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BIENNIAL REPORT

OF THE

FOREST COMMISSIONER

OF THE

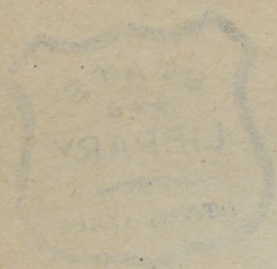
STATE OF COLORADO

FOR THE

YEARS 1889 AND 1890.



DENVER, COLORADO:  
THE COLLIER & CLEVELAND LITH. CO., PRINTERS.  
1891.



THE STATE OF COLORADO

FOREST COMMISSIONER

STATE OF COLORADO

DEPT. OF AGRICULTURE



STATE OF COLORADO,  
*Office of the FOREST COMMISSIONER,* }  
DENVER, November 15, 1890.

*To his Excellency,*

JOB A. COOPER,

*Governor of the State of Colorado:*

SIR:—In accordance with law, I have the honor to submit a statement of my official action for the years 1889 and 1890, together with such information and suggestions as may be useful in preserving the forests of the State, and maintaining the supply of water.

My annual report for 1889 having been submitted in condensed form, and no copies of the same printed by the State, I have deemed it expedient to include in this a statement covering the two years.

I remain, sir,

Very respectfully yours,

EDGAR T. ENSIGN,  
*Forest Commissioner of the State of Colorado.*

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## Colorado Forest Land

— 1900 —

THE FOREST LAND OF COLORADO, AS REPORTED BY THE

FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE.

BY THE FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE.

REPORT OF THE FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE.

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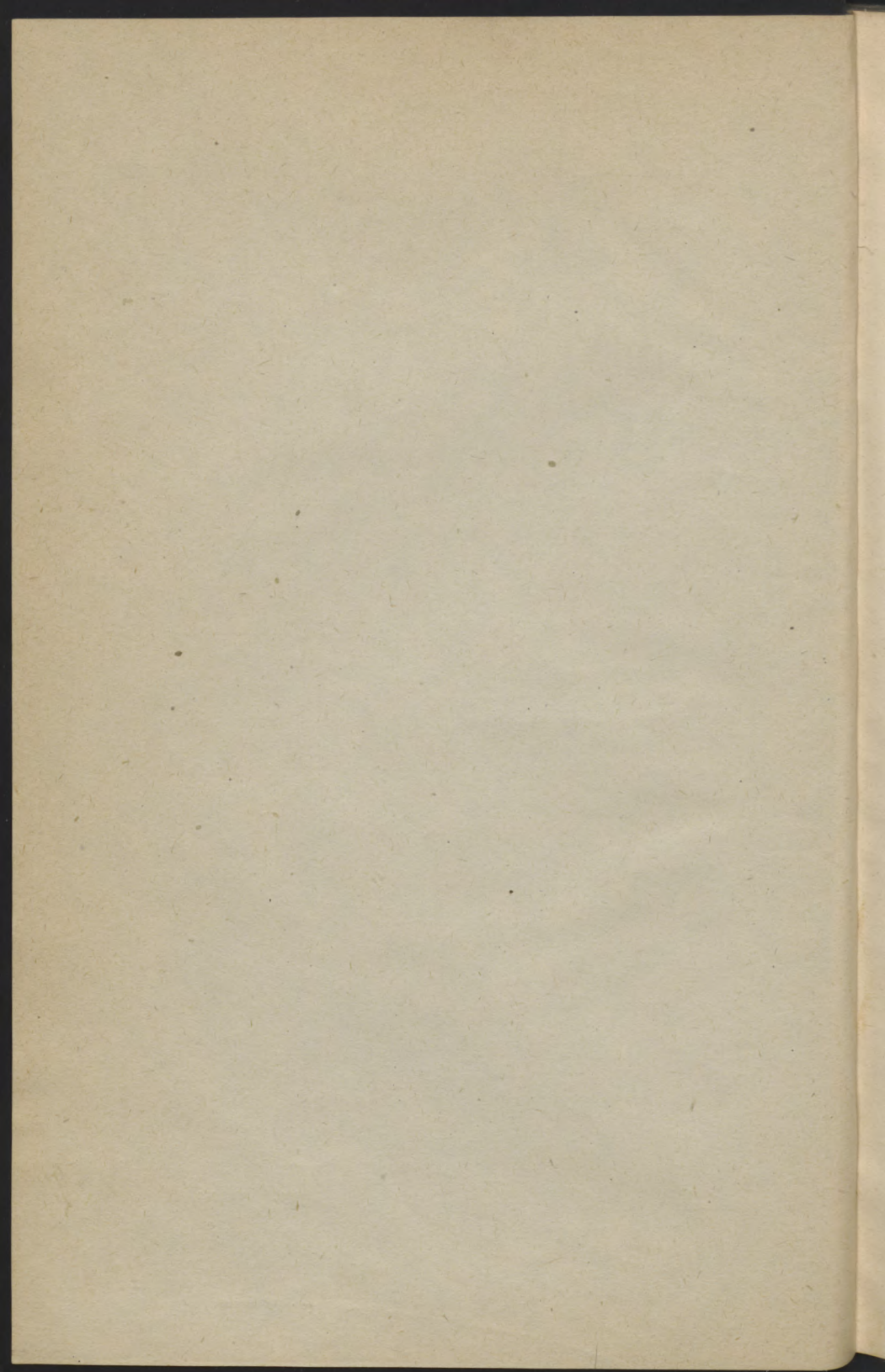
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## Colorado Forest Laws.

### ACT CREATING A FOREST COMMISSION.

[As originally enacted April 4, 1885, and amended March 3, 1887.]

AN ACT RELATING TO WOODLANDS AND FORESTRY IN COLORADO,  
AND TO CREATE A FOREST COMMISSION FOR SAID STATE.

*Be it enacted by the General Assembly of the State of Colorado:*

SECTION 1. All lands now owned or controlled, or which may be hereafter owned or controlled by the State of Colorado, and which are now, or shall hereafter be, covered with forest growth, or devoted to forest uses, are, for the purposes of this act, declared to be woodlands.

SEC. 2. By and with the advice and consent of the Senate, the Governor shall appoint one Forest Commissioner, a suitable person, skilled in matters relating to forestry, who shall be a resident and citizen of this State, and who shall be known as the Forest Commissioner of the State of Colorado; the said Commissioner shall hold his office for the term of two years, or until his successor shall be duly appointed and confirmed, unless sooner removed by the Governor, for cause.

SEC. 3. The Forest Commissioner shall, at the expense of the State, be provided with an office at the capital, where his official records shall be kept. He shall be paid a salary of fifteen hundred dollars (\$1,500) per annum, and his reasonable and necessary traveling expenses, not to exceed five hundred (500) dollars in any one year. Such salary and traveling expenses shall be payable in monthly installments, by the State Treasurer, on warrants drawn by the State Auditor. Before entering upon the duties of his office, he shall take and subscribe the oath required by the Constitution, and give a bond to the State of Colorado in the sum of two thousand dollars, conditioned for the faithful discharge of the duties of his office. Said bond shall be approved by the Governor and Attorney-General, and be deposited in the office of the Secretary of State.

SEC. 4. Said Forest Commissioner shall have the care of all woodlands now owned, or controlled, or which may be hereafter owned or controlled by the State. He shall cause all such lands to



be located and duly recorded, and shall make and publish reasonable rules and regulations for the prevention of trespass upon said lands, for the prevention and extinguishment of fires thereon, and for the conservation of forest growth. He shall also, as far as possible, promote the gradual extension of the forest area, encourage the planting of trees, and preserve the sources of water supply; but nothing in this act shall be so construed as to permit any Forest officer, hereby constituted, to interfere with the use of timber for domestic, mining, or agricultural uses. On or before the fifteenth day of December, in each year, he shall report to the Governor his official action during the preceding year, and such information as may be useful in preserving the forests of the State, and maintaining the supply of water.

SEC. 5. In addition to the powers and duties attaching to the offices of County Commissioners and Road Overseers in the counties of this State, such Commissioners and Overseers shall act as conservators of woodlands in their respective localities, and shall enforce the laws and regulations made for the protection and preservation of such woodlands. Said County Commissioners shall, also, to the extent of their power, encourage the planting of trees along water-courses and irrigating ditches, and in other proper places. Except in cases of emergency, no expenses under this act shall be incurred by the said County Commissioners, or Road Overseers, unless by direction of the State Forest Commissioner.

SEC. 6. It is made the special duty of all Forest officers of the State to exercise the utmost care and vigilance in the prevention and extinguishment of fires within the State likely to endanger or destroy forest growth, and to apprehend any person who may be guilty of causing such fires; and in the performance of their duties such officers may call to their aid such person or persons, within the State, as they may deem necessary. Any person who, without good cause, shall fail or refuse to give aid as aforesaid, when requested so to do by any duly authorized Forest officer, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in a sum not less than twenty-five dollars, nor more than one hundred dollars. All Forest officers and all peace officers within the State are empowered and required to arrest any and all persons found trespassing upon the woodlands of the State, or unlawfully cutting or destroying timber thereon, or setting fire in a manner to endanger such woodlands, and shall cause actions to be instituted in Courts of proper jurisdiction to punish violators of the Forestry laws of the State. In all matters pertaining to woodlands and forests the District officers shall be subject to the County Forest officers of their respective counties; and all shall be subordinate to the Forest Commissioner of the State. The County and District Forest officers shall make reports of their official action to the State Forest Commissioner, and furnish that



officer with such information relative to their respective counties and districts as he may, from time to time require.

SEC. 7. For the time actually occupied in the performance of duties imposed by this act, the said County Commissioners shall receive additional pay at the same rate per diem as is allowed them by existing laws. The said Road Overseers, for services rendered under this act, shall be paid at the rate of three dollars per day. All bills for such services shall be approved by the State Forest Commissioner, and shall be paid by the county wherein such services were rendered; *Provided*, That the entire sum which may be paid under the provisions of this act in any county shall not exceed the sum of one hundred dollars (\$100) in any one year.

SEC. 8. No person who is directly, or indirectly, engaged in the manufacture of lumber, or railroad ties, or telegraph poles, or any business which requires a large consumption of growing timber or wood, shall be qualified to serve as a Forest Commissioner under this act.

SEC. 9. All acts and parts of acts inconsistent with the provisions of this act are hereby repealed.

SEC. 10. It is the opinion of the General Assembly that an emergency exists; therefore, this act shall take effect and be in force from and after its passage.

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#### FOREST FIRES.

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AN ACT TO PREVENT THE SPREADING OF FIRES IN THIS STATE, AND PROVIDING FOR THE PUNISHMENT OF WILLFUL OR NEGLIGENT USE THEREOF.

---

*Be it enacted by the General Assembly of the State of Colorado:*

SECTION 1. If any person shall wilfully and maliciously set on fire, or cause to be set on fire, any woods or prairie, or grounds of any description other than his own, or shall intentionally, or by gross neglect, permit a fire, set or caused to be set by him, to pass from his own grounds to the injury of any other person or persons, such person shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by fine not exceeding three hundred dollars, or by imprisonment in the county jail not exceeding six months, or by both such fine and imprisonment.

SEC. 2. Any person who shall build a camp-fire in any woods or prairie, or on other grounds in this State, shall, before or at the time of breaking or leaving such camp, totally extinguish such camp-fire; and, upon a failure to do so, such person shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished



by a fine not exceeding one hundred dollars, or by imprisonment in the county jail not exceeding one month, or by both such fine and imprisonment.

Approved March 27, 1885.

*Further enactments upon this subject may also be found in the General Statutes of Colorado, sections 905, 906, 1036 and 1037.*

*Penalties, for injuries to trees, are prescribed in sections 2468, 2469, 3427 and 3428 of the General Statutes of Colorado.*

#### POSTING OF FIRE NOTICES.

AN ACT DIRECTING THE ERECTION OF NOTICES TO EXTINGUISH CAMP FIRES.

*Be it enacted by the General Assembly of the State of Colorado:*

SECTION 1. It shall be the duty of the Board of County Commissioners of each county in this State, within thirty days after this act shall take effect, to cause to be erected in a conspicuous place, at the side of each and every traveled highway, and at such places as they may deem proper, at suitable distances alongside the main traveled highways of their respective counties, a notice in large letters, substantially in the following form, to wit:

"Camp fires must be totally extinguished before breaking camp, under penalty of not to exceed one month's imprisonment, or one hundred dollars fine, or both, as provided by law."

..... } County  
..... } Commissioners.  
..... }

The erection and maintenance of such notices shall be at the expense of the respective counties, and at least ten in number of such notices shall be posted in each and every county in this State.

SEC. 2. Whoever shall wilfully destroy, remove, injure or deface any such notice, erected on any highway as aforesaid, or shall wilfully injure or deface any inscription or device comprising such notice, shall be deemed guilty of a misdemeanor, and on conviction thereof, before any justice of the peace or court of competent jurisdiction, shall be fined not exceeding one hundred dollars, or imprisonment in the county jail not exceeding three months, or both, in the discretion of the court.

Approved March 27, 1885.



## AN ACT TO ESTABLISH ARBOR DAY.

*Be it enacted by the General Assembly of the State of Colorado:*

SECTION 1. The third Friday of April of each year shall be set apart and known as "Arbor Day," to be observed by the people of this State in the planting of forest trees, for the benefit and adornment of public and private grounds, places and ways, and in such other efforts and undertakings as shall be in harmony with the general character of the day so established; *Provided*, That the actual planting of trees may be done on the day designated, or at such other most convenient time as may best conform to local climatic conditions; such other time to be designated and due notice thereof given by the several County Superintendents of Schools for their respective counties.

SEC. 2. The day, as above designated, shall be a holiday in all Public Schools in the State, and school officers and teachers are required to have the schools under their respective charge observe the day by the planting of trees or other appropriate exercises.

SEC. 3. Annually, at the proper season, the Governor shall issue a proclamation, calling the attention of the people to the provisions of this act, and recommending and enjoining its due observance. The Superintendent of Public Instruction and the respective County Superintendents of Schools shall also promote by all proper means the observance of the day, and the said County Superintendents of Schools shall make annual reports to the State Forest Commissioner of the action taken in this behalf in their respective counties.

Approved March 22, 1889.

FOREST COMMISSIONER

STATE OF TEXAS

IN ALL TO EXAMINE

...

Section 1. The third Valley of April of each year shall be set apart and known as "Arbor Day," to be observed by the people of this State in the planting of forest trees for the benefit and pleasure of people and private grounds places and ways and in such other places and undertakings as shall be determined by the local authorities of the day as established. The purpose of this act is to encourage the planting of trees and shrubs on the land belonging to it and other land owned at that time as may best conduce to the benefit of the State and the people thereof and to be designated and the money derived therefrom to be used for the purpose of planting trees and shrubs on the land belonging to it and other land owned at that time as may best conduce to the benefit of the State and the people thereof.

Sec. 2. The day as above designated shall be a holiday in all public schools in the State and in all churches and societies and in all places where the people gather for religious or social purposes and in all places where the people gather for religious or social purposes.

Sec. 3. The purpose of this act is to encourage the planting of trees and shrubs on the land belonging to it and other land owned at that time as may best conduce to the benefit of the State and the people thereof and to be designated and the money derived therefrom to be used for the purpose of planting trees and shrubs on the land belonging to it and other land owned at that time as may best conduce to the benefit of the State and the people thereof.

Approved March 22, 1907.

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# REPORT

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## Forestry in Colorado—A Review.

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Although a clause in our State Constitution provides that laws shall be enacted to prevent the destruction of and to keep in good preservation the public forests of this State, it was not until the year 1884 that active steps were taken in that behalf. In the summer and fall of that year a series of articles, published in the Colorado Springs *Gazette*, called attention to the urgent need of adopting measures for the protection of our native forests and to promote the growing of forest trees.

In November, of the same year, the Colorado State Forestry Association was formed, for the purpose of furthering the objects named.

At the instance of this Association, the efforts of which were seconded by many prominent citizens, the General Assembly of 1884-85 passed an act establishing the office of State Forest Commissioner, and constituting the County Commissioners and Road Overseers throughout the State Forest officers in their respective localities. These officers were charged with the protection of the forests, to the extent of their power and ability, and directed to promote, by all proper means, the planting of forest trees. At the Legislative Session of 1886-7 this act was strengthened somewhat by amendment, and provision made for the appropriation of funds necessary to carry on the work of the State Forest Commission.

Theoretically, the law has much to commend it; practically, it is somewhat lame, for the reason that the great body of forest land in this State is still



owned and controlled by the General Government, and the State authorities have no jurisdiction thereof. Consequently, protective measures on the part of the State Forest officers have been mainly confined to efforts in aid of the Federal officials. This is true, at least in so far as it relates to depredations. In the matter of the prevention or suppression of forest fires, the local officers have felt at liberty to take such action in any particular case as might seem necessary, without having special regard to questions of jurisdiction.

Furthermore, the law is inoperative to an extent, because many of the Boards of County Commissioners exhibit so much indifference in relation to its due enforcement. It seems difficult for them to appreciate the fact that they are legally constituted forest officers and have a duty to perform in connection with the conservation of the forests of the State. At the time of the passage of our forestry acts, public opinion did not warrant anything beyond the most conservative action; nor has it since been practicable to enforce, literally, the law as then established. It is to be hoped that the next General Assembly will make some needed changes in the law, and that provision will be made to insure a more strict and uniform enforcement of the same.

The Arbor Day custom has gradually gained ground in this State. The Chief Executive, by the timely issue of proclamations enjoining the observance of the day, has done much to promote the cultivation of trees and to establish a just public sentiment in that behalf. In this work the State Forest Commissioner, Superintendent of Public Instruction and County Superintendents of Schools have actively co-operated. Owing to these efforts many more trees have been planted than would otherwise have been the case, and valuable lessons in practical forestry have been given to many of our school children.



At the last session of the General Assembly an act was passed setting apart the third Friday of April in each year as Arbor Day, constituting it a holiday in the public schools, and requiring the issue of Executive proclamations enjoining a due observance of the day.

Although forestry proper concerns itself principally with the forming and managing of forests, other and different elements have necessarily entered into the work here. In the first place it was requisite to create and foster a public sentiment which would justify the enactment of forestry laws—at least conservative ones. This has been effected by the publication of forestry articles in the local press, by the formation of a State Forestry Association, etc., and it would seem also that the enforcement and operation (more or less imperfect) of the Forestry laws have done something toward their popularization, and to aid in giving right direction to public opinion.

During the early part of forestry agitation in this State it was thought by the friends of the movement that if the local government should establish a reasonably complete and effective Forest administration it would then be proper and expedient to ask for the transfer to the State of all the public timber lands within her borders. This opinion has been modified or changed in a large measure, for the reason that the difficulty of securing legislation of that character in favor of a single State seems very great; and it is also thought that the burden of protection and managing so large an area of woodlands would be heavier than the State, in its present condition, could well bear.

Having thus abandoned, at least for the present, the idea of acquiring for the State control over the public timber lands, it then seemed wise to secure in Congress some general legislation which would include the forest land of our own State, as well as those in other parts of the public domain. To that end, I have sought to

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establish quite intimate relations with, and to secure the co-operation of, the several State Forest Commissions, the United States Forestry Division and various Forestry Associations and individuals throughout the country. The Forestry Division of the Department of Agriculture is a strong power in the direction of forest reform. Its work, however, is limited to advisory and educational measures. It has no executive authority. Various State and local associations have been formed, and exert a good influence in their respective localities. The American Forestry Congress (now called the American Forestry Association) has been in existence about eight years. Its annual sessions have been held successively, in the principal cities of the United States and Canada. The meeting for 1886 took place at Denver. This is the leading and representative body of the kind in the country. Its influence even at this early period can hardly be measured.

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### Forestry Day at Glen Park.

---

Tuesday, July 16, 1889, was set apart for a Forestry Day at Glen Park, our Colorado Chautauqua. The exercises on that occasion were participated in by some of the leading men in the West, interested in forest reform.

Louis R. Ehrich, Esq., delivered an eloquent and instructive address upon the need and prospective advantages of the proposed Colorado National Park, on the White River plateau.

The methods and importance of forest tree culture were treated by ex-Governor J. Sterling Morton, of Nebraska, originator of the beneficent "Arbor Day" custom.

Mr. A. E. Gipson, well known in the West as a practical tree culturist, read an interesting and instructive paper upon "The Tree and the State." He spoke of



the need of forests for the conservation of moisture, and the importance of forest tree culture; that judicious tree growing could be made a source of gain to the individual, and, if conducted on a liberal scale, would add much to the general welfare of the people.

An address by Geo. H. Parsons, Esq., of Colorado Springs, was entitled "The Influence of Forests upon Water Supply." It was alleged that all the water in this region used for irrigation or domestic purposes, comes from the streams which have their origin in the forests; that destruction of the forests would inevitably be followed by a greatly lessened and irregular flow of water in the streams.

Mr. Ensign, the State Forest Commissioner, presented a carefully prepared paper upon Rocky Mountain forests, illustrated with maps.

The several addresses were listened to with earnest attention by all present.

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### Mountain Forests.

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[Extract from the fifth biennial report of the State Engineer of Colorado for 1889-90.]

The destruction of our mountain forests is the occasion of repeated complaints on the part of people living in the South Park and in other localities along the base of the main range, and its effect upon the water supply for irrigation, is a question that has received some attention in the former reports from this department. While it is not the intention here, with the limited space at our command, to enter into general discussion of the subject, it may not be amiss to make some remarks as the result of observations made along the base of the main range.

It is well known that our heaviest bodies of timber and that of the largest growth are to be found in the valleys and on the adjacent hill-sides of our principal streams and their tributaries, but a short distance below timber line, and that this section of the mountains is comparatively free from deep, narrow cañons and precipitous ledges. It is further well known that the most broken and rugged portions of the range are to be found on the very head waters of these streams,



and very close to the summit of the Great Divide. The snows precipitated on the crest of the range and even on the gentle slopes adjacent thereto, on the western side, are carried by the prevailing west winds over the bold points on the eastern slope, and in close proximity to the summit, and there deposited to great depths. And here let it be observed, that such banks are not formed to any great extent on the western slope, and hence as a rule, it is not practicable to secure water in quantity above timber line on that water-shed at such seasons of the year as would make it possible to divert it. It is from these banks that the late water supply is supposed to be derived, but I apprehend that no inconsiderable amount of that supply is traceable to other sources.

Between the heads of the various streams bearing eastward, are to be found prominent spurs or divides putting out from the main range, and but a little below it in elevation, being above timber-line. These divides are frequently elevated plateaus, with considerable extent of surface, with smooth, grassy slopes, and are sometimes known as bald mountains. The snow fall on these spurs is as great as on the main range, and the wind there has as keen an edge and as great a sweep. At the bases of these spurs, on either side, are to be found the dense forests, to which reference is made, and in them much of the snow drifted from the heights above finds a resting place. Early spring will find hundreds of acres of this timber-belt covered with drifts five, ten, and in some places twenty and twenty-five feet deep. In these forests the fallen timber is frequently so thick as to render passage through it with a horse impracticable. Much of it in an advanced stage of decomposition. Decayed vegetation covers the ground, absorbing and holding the moisture from the melting snow. The soil underneath it, and protected by it, is porous and spongy, and holds water to such an extent as to render it marshy well up on the hill-sides. Springs abound, and every ravine carries a running brook well into the summer months. It would be difficult to convince an old mountaineer, who is familiar with these forests, that the valley irrigator should not thank their protecting shades for much of the moisture that matures his crops.

Destroy these forests by fire and with them will burn the vegetable mold that covers the earth. Destroy them by the woodman's axe, and fire will soon follow among the tops, with a similar effect. The snows that were wont to find lodgement there will then be carried on by the wind, evaporating them to such an extent as to far overbalance any consumption of moisture in the support of forest life. Under the action of the wind, the earth is soon divested of its light soil, and the exposed gravel and sand becomes compact, hard and dry, shedding the spring rains like the roof of a house. The springs cease to flow and the ravines become dry. The results are sudden and unusual floods, sending immense volumes of water into the val-



ley, without notice, and beyond all possibility of control, with existing facilities.

The laws for the protection of these forests from the ravages of fire cannot be too stringent, and more efficacious methods should be devised for their execution.

J. P. MAXWELL, *State Engineer.*

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It is not necessary to repeat the many convincing facts and arguments that have been so often advanced in connection with the matter of the preservation of our forests. But it appears to me that upon every consideration of climatic effects, economy of use and reproduction, of the conservation of the snow-fall for gradual melting for the use of the cities, towns and villages, and of the farmers depending on the water coming from the melting snow for household purposes, for their live stock, and for irrigating their farms in these arid regions, that the National Government should take immediate and decided action for the conservation of our remaining forests. And for this purpose I am of the opinion that all the heaviest bodies of timber now remaining on the mountains, and yet forming part of the public domain, should be made reservations; and the other portion of public timber lands should be placed under the care and charge of a proper governmental bureau, and timber to be removed under stringent regulations. I hope that the association will be able to accomplish something definite toward this end.

JOHN S. TITCOMB, *Deputy State Engineer.*

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### Forests and Irrigation.

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It has become plainly apparent that one of the chief functions of our mountain forests, if not, indeed their most important one, is the conservation of water. As preventing the premature and rapid melting of snow, affording protection to the sources of streams, and securing their uniform and continuous flow, the forests are invaluable. The forest cover on mountain slopes acts as a sponge, retaining moisture and yielding the excess gradually, thus preventing floods and other disastrous consequences. In fact, the Western forests are most important adjuncts to our great irrigation system, and in time will so be recognized.



## NATURAL AND ARTIFICIAL WATER STORAGE.

An article from the *Denver Republican*, entitled "Powell and the Forests," reads as follows:

Major Powell is right in urging Congress to appropriate money with which to carry on the survey for irrigation reservoir sites. But he is wrong in saying that it would be a good thing for the arid region if all the forests near the heads of streams were cut down.

His theory about the beneficial effects of forest destruction can find no justification except upon the supposition that reservoirs would be constructed in which to hold the water.

But the correct way in which to consider the reservoirs is to look upon them as merely supplementary to the forests. If none of the water which flows through a stream were wasted—if none of it passed on down to the sea without being utilized—there would be no occasion to build reservoirs. The reservoirs should be for the purpose of retaining the water, so that it might not be wasted.

The forests, with their matting of leaves upon the ground, are natural reservoirs, in that they prevent the rapid escape of the water, and hold it back, so that it flows off gradually. The water which is thus retained comes down the mountain during the irrigating season, and is conducted on to the land to be irrigated. Nothing more than this can be done by any artificial reservoir.

The answer which Major Powell would make to this is, that much of the water that is held by the undergrowth and dead leaves of the forests is, after all, lost through evaporation. This is true. But it is also true that much of the water placed in artificial reservoirs would be lost in the same way.

The conclusion to be drawn from a consideration of the whole matter appears to be this: That the reservoirs should be treated as supplementary to the forests, which are the reservoirs that Nature has provided. We want the reservoirs, but we also want the forests.

The *New York Tribune*, treating of the dangerous features of artificial water storage, in an editorial entitled "Proposed Mountain Reservoirs," has the following:

The rapidity with which in this age of occupation and excitement even the deepest impressions are effaced is strikingly exemplified in the fact that though scores of bodies are still mouldering beneath the unexplored ruins of Johnstown, the great disaster has faded out of public attention. While the horror was still fresh there was an eager desire to learn if other dams were ready to give way before an extra pressure, and the demand for investigation and prompt precautions against similar catastrophes was universal. But



already the search and the discussion have been practically abandoned.

These observations are suggested by an article in the current number of *Garden and Forest*, upon the vast scheme of mountain reservoirs proposed by the Director of the Geological Survey as a means of irrigating the dry plains beneath them. There is little doubt that engineering skill is competent to carry out the plans of Major Powell, and that a great territory can be rendered fruitful through the accumulation and distribution of water which otherwise would be largely wasted; but there are serious objections which ought at least to be considered far more attentively than they yet have been before the government goes further in the direction of committing itself to this project. As *Garden and Forest* suggests, there is something to be said in favor of the decrees and processes of nature as opposed to the impatient purposes of man, but we are not desirous now to dispute the immediate utility of the plan for making the desert blossom. The question of safety is of the first importance. As *The Tribune* remarked directly after the Conemaugh disaster, and as *Garden and Forest* now urges, the chief element of danger in an elevated lake artificially formed lies in the difficulty of maintenance, not of original construction. Secret and obscure agents of destruction are constantly endeavoring to undermine the strongest fabric, and the obstacles to an adequate determination of their success or failure are practically insuperable. But aside from this constant menace, sudden and irresistible forces may be developed at any moment. Our contemporary points out that an earthquake so slight as to be otherwise harmless might make a breach in one of these dams, through which the sea of water behind it would pour in an instant, and it furthermore supplies this most suggestive illustration of what might follow the proposed cutting away of the mountain forests: 'The Ardeche is a small mountain stream in France, and yet the sudden melting of the snows in the deep valleys at its sources so swelled its current that it once delivered 1,305,000,000 cubic yards of water into the Rhone in three days. For this short period it flowed with a volume like the Nile, and what reservoir could be trusted to restrain an outpouring of this sort?'

These are considerations which ought not to be lightly dismissed. We are far from failing to appreciate the beneficent transformation which might reasonably be expected to result from an artificial distribution of moisture on the arid land which Major Powell designs to fructify, but we do insist that several momentous arguments against his plan ought to be satisfactorily answered before the first step is taken toward putting it into practical operation.



### Forest Destruction and Floods.

The subjoined letter from Capt. Edward L. Berthoud should be carefully read and considered. He is the present mayor of Golden. He has been long and favorably known throughout the West as a civil engineer and explorer of ability and unusually wide experience.

MAYOR'S OFFICE, CITY OF GOLDEN, COLO., }  
October 1, 1890. }

COL. EDGAR T. ENSIGN,

*Forest Commissioner of Colorado:*

DEAR SIR:—Your circular with reference to the destruction of our mountain forests demands immediate attention, ere it is too late to remedy the havoc so industriously and continually kept up. The senseless manner in which the present greed of gain most scandalously and wastefully destroys what nature created as a receptacle and generous store-house for water can not be too strongly condemned.

Our General Government claims the ownership and control of vast areas of land, worthless except for the tree-growth upon them. Yet no care—nothing is done to preserve them except the isolated and sporadic efforts of so-called officials, whose duty seems to be not to preserve the forests, but to gather in a few dollars for "stumpage," after the havoc is completed.

Your efforts some two years ago, joined to those of the American Forestry Association, to have Congress enact some law to protect the mountain forests, were without apparent result. It would seem as useless as ever to try and curb the destruction done by itinerant saw-mills, and still more itinerant fraudulent filers on timber lands, whose filings are abandoned when the wood is destroyed—to recommence again in some other locality the same destructive process.

Concerted action by the residents of Colorado, Wyoming, Montana, Idaho, Utah, New Mexico and Arizona might do some good. One half the money expended in the last two years in the Utopian schemes of Powell and others to survey and examine the whole arid region for storage reservoirs that will never be built by the General Government, would have patrolled and guarded the entire area of Rocky Mountain forests, and done more for the conservation of water supplies than the untenable theories of artificial storage by means of reservoirs. Given any area stripped of the timber growth, no human power or system of storage can prevent the two-fold ravage—first, of the want of protection to the bare soil from rapid evaporation in our high altitude, and, second, the sudden and immediate drainage of mountain slopes when heavy rains occur.



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FOREST COMMISSIONER.



We have recently had, here in Golden, a forcible lesson, an object-lesson of most extraordinary results. Our village is bisected by the north side of Clear creek by what is called Tucker's gulch. Prior to 1877-78 never had the water of this gulch been over two and a half feet deep, even after the heaviest rains and snows. In fact, it was a tiny, unpretentious, meek little rivulet, fed continuously by the slow oozing and percolating waters of its head in the mountains north-west of town. Since 1887, numerous small farms and their concomitants, cattle and sheep, have caused the gradual clearing off of the heavy timber and destroyed the smaller thick undergrowth of bushes and young trees. And all the available ground on mountain or in valley has been cultivated. Mark the result:

The high mountains, in which the six principal gulches head, are yearly visited by heavy rains and fabulous cloud-bursts. These waters were formerly retained by plant, tree and under growth, and slowly distilled in harmless rills. In July last, a cloud-burst, a "water-spout" rather, we might say, fell on the mountains of the north branches. The water, mixed with debris, boulders of one and two tons, logs, trees, bushes, mud, rich soil, all came down together, tumultuously, from ten to thirteen feet deep, swept through town, overran the railway and ditches, took off a bridge eight feet above the gulch, hurled stones of one-half tons weight like chips, and cleared out a channel fully six feet wider than before the flood. Its force, beggars description, weighted as it was by the rich soil of the upper mountain farms. Five thousand dollars' worth of property was destroyed, with the not cheerful prospect of other similar visitations during the summer.

Such is the effect of forest denudation, and thirty years' residence here proves that such must be the result universally when our mountain store-houses of water are leveled by the "dendrophagi."

I believe that concerted action by the States and Territories mentioned before might result in some good; some law proposed and enacted that would compel the General Government, the principal owner of the forest lands in the Rocky Mountains, to do what it seems futile or impossible for the State government to do.

A plan should be formulated between the respective State governments and the General Government, by which itinerant saw mills, their waste, and the destruction they industriously foment to hide their theft of Government timber, should be put under full control, as to place and method of working. As it is now, Government inspectors never are seen until the wood is cut and the mischief completed; a convenient fire hides all proof of contiguous cutting as a trespass on lands of the public domain.

From past experience, unless the matter is watched and controlled, the entire forest between Bear and Clear creeks, up to timber-line,



will be purposely ravaged by fire before five years have passed, and our Clear creek water-shed will be swept by sudden floods.

Respectfully yours,

EDWARD L. BERTHOUD.

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### Interest of Adjacent States and Territories.

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The relations of forests to irrigation are quite similar in the several Rocky Mountain States and Territories, differing only in degree. When neighboring communities shall have made the same progress in agriculture that Colorado has, similar problems in connection with water supplies will confront them. Recognizing this mutuality of interest between ourselves and our neighbors, and believing that our cause is also theirs, I have sought to bring to their attention the subject of forest preservation, and to secure their assistance in obtaining legislation for our common good. With that object in view, I have, by personal interviews and correspondence, established kindly relations with many of the leading citizens of the region in question, especially those concerned in the subject of forest preservation and irrigation. Also, during the last two years, by special arrangement, I have published a series of forestry articles in the newspapers of the region, including, of course, a number of those of our own State.

It will be seen that, with respect to forestry in the Rocky Mountain region, we are still in a formative period. There yet remains to be done a large amount of what might be called educational work. In other words, our people have yet to reach that point from whence they will demand and sustain an effective and comprehensive forest administration—national in its scope; a system not following blindly the methods of



foreign countries, but one founded on models of our own, and adapted, as nearly as may be, to our peculiar requirements.

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### **Publication of Forestry Matter**

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As previously indicated, I have, during the last two years, published in some of the leading newspapers of the Rocky Mountain region a series of forestry articles, adapted, so far as practicable, to local conditions. I am happy to state that, so far as known to me, the public press of the entire region earnestly favors forest reform, and the institution of an effective system of forest administration. Early recognizing the great influence of the press in shaping public opinion and promoting reform, I have sought, by all proper means, to enlist it in aid of the forestry cause. This work has been extended to our sister States and Territories, for the reason that nearly similar forest conditions exist in all, and that the cause of one is that of the others. If a general forest administration shall ever be instituted here, it is likely to be in response to the united efforts and appeals of the people of the region.

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### **Forest Conditions of Certain Counties.**

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In September of the present year, circular letters of inquiry were forwarded to the boards of commissioners of each county in the State. The letters sent to the mountain, or timbered, counties, embraced the following questions:

1. To what cause, or causes, may be ascribed the principal injury to the forests of your county?
2. Have any forest fires occurred in your county during the present year? If so, please give date, of

their occurrence, location, approximate extent, estimated value of timber destroyed, origin of fire, if known; arrests, if any made for setting fire, and such other useful facts in this connection as may occur to you.

3. Has the law, requiring the posting of notices warning persons of the penalties for failure to extinguish camp-fires, been observed in your county? If so, has the effect been beneficial, or otherwise?

4. What expense, if any, under the forest acts, has been incurred in your county during the present year; stating for what particular purposes money may have been so expended?

5. In what manner can our State forest laws be so amended as to render them more effectual in preventing the destruction of forests?

6. In your opinion, what objections, if any, exist to the present policy of the General Government respecting the public timber lands?

7. What changes in such policy, if any, are desirable, in order to secure better protection and utilization of the forests on the public domain?

8. To what extent have shade and forest trees been planted in your county? Can you suggest any measures in that connection, the adoption of which might encourage or promote such action?

In letters sent to counties of the plains region, questions marked 1 and 2 were omitted.

The responses to these letters were so few, and meager in character, that on the twenty-first day of October following, I wrote to the clerks of each of the delinquent counties, asking them to further, in any way possible, the transmittal of the desired information. As a result of these efforts, reports from the following named counties only were obtained. A summary of their respective statements is here given:\*

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\*Suggestions relative to change in the Federal or State Forest Laws are given in the chapter entitled "Forest Policy."



*Archuleta.*—No injury to the forests; no fires, and no arrests. Fire notices posted, with good effect. No expenses incurred under the Forest acts. Unable to suggest measures to encourage or promote the culture of forest trees. Have in the county a number one pine forest, forty-five miles square; trying to keep it. No county in the State has so much, nor so good a quality of pine timber. Fires sometimes started there by the Indians.

*Baca.*—No forests in the county. Some timber along the creeks and some scrubby cedar in the west part. Notices to extinguish camp-fires duly posted. No expense incurred under the forest acts. No objection to the present policy of the General Government respecting the public timber lands. Almost every farmer in the county has planted from one hundred to five thousand trees, principally Cottonwood, Locust, Box Elder and Catalpa, all of which varieties do well.

*Chaffee.*—No forest fires and no posting of fire notices. No expense incurred in that behalf. Would abolish all laws to prevent the destruction of forests. No knowledge of the extent to which forest trees have been planted in the county.

*Cheyenne.*—County destitute of forests; scattering clusters of trees along Big Sandy creek. Notices, warning persons to extinguish camp-fires, posted, with good effect. Shade trees have been planted with quite good success, but not extensively. Forest-tree planting (on timber-culture claims, etc.,) has been a failure in most cases, caused principally by insufficient moisture and improper planting and cultivation. Success has usually accompanied careful planting and cultivation. The frauds perpetrated in connection with the timber-culture act are too well known to require mention here.

*Costilla.*—No injury to the forests within the last year, except such as produced by natural causes—high winds, etc. No fire notices posted, for the reason that the population of the county is made up almost entirely of Mexicans, more than two-thirds of whom are unable to read or write. No expenses incurred under the Forestry acts. No forest-tree planting, except for ornamental purposes around a few houses.

*Douglas.*—To camp-fires, causing conflagrations, and cutting of timber may be ascribed the principal injury to the forests.\* Bills, amounting to \$50, for the extinguishment of forest fires rendered, but not yet paid. Several thousand forest trees have been planted, with fair success; thousands of others have failed.

*Elbert.*—The principal injuries to the forests have occurred through carelessness. No arrests for setting fires. Fire notices posted, with beneficial effect. No expense incurred under the

\* For statements relative to forest fires, see a subsequent chapter of this report entitled "Forest Fires."



forestry acts. No objections to the present forest policy of the General Government. Shade and forest trees have been planted to a considerable extent.

*Gilpin.*—No forest fires the present year. Notices have been posted, with beneficial effect, warning persons to extinguish camp-fires. No expense incurred under the Forest acts. No planting of forest trees.

*Huerfano.*—Principal injury to forest caused by carelessness. No fires and no arrests during the present year. Notices requiring the extinguishment of camp fires have been posted, with good effect. Unable to state whether or not any expense has been incurred under the Forestry acts.

*Lincoln.*—No forests in the county. No expenses have been incurred under the Forestry acts. Very few forest trees have been planted. Unable to suggest measures to encourage or promote such action.

*Pitkin.*—Fire causes the principal injury to the forests. Fire notices duly posted; effect beneficial. No money expended under the Forestry acts.

*Pueblo.*—Principal injury to forests caused by saw-mills. No fires have occurred during the present year. Notices requiring the extinguishing of camp-fires, have been duly posted, with good effect. No expense incurred under the Forestry acts. Estimated number of forest and shade trees planted, 229,500. Forest land extends along the western boundary of county in townships 21, 22, 23, 24 and part of 25, range 68, with a width of two to six miles east and west.

*Rio Blanco.*—Fire is the main cause of forest destruction. Have had one fire the present year (1890); not extensive, and but little damage done. Fire notices have been posted everywhere, with beneficial effect. No expense incurred, except for posting notices. Very few forest trees planted.

*Rio Grande.*—Principal injuries to forests caused by fire, and the extensive cutting of timber at high altitudes for railway purposes. Disastrous fires occurred in 1889. Notices, requiring the extinguishment of camp-fires, have been posted to a limited extent. On one road leading to the nearest mining camp, two or three notices were posted some five years ago. On an extended trip in the mountains, in July, 1890, no notices were seen on a frequented road and among favorite camping-grounds. I think the law requiring the posting of such notices has proved beneficial, as many camping-places were seen where the remaining fire brands had been saturated with water. Years ago nobody thought of putting out camp-fires.

No expenditure whatever has been incurred under the Forest laws. Our commissioners flatly refuse to expend any money, while



scores of people, under contract from the railroad company, are constantly destroying our timber and filling the forests with immense quantities of inflammable material, which, upon the occasion of the first fire, will sweep the remaining forest to destruction.—*Alonzo Hubbard, Monte Vista.*

*Routt.*—Carelessness in leaving camp-fires unextinguished and fires by Indians are the principal causes of forest destruction. One large fire on Park range; origin, unknown; damage, considerable. Fire notices posted, with good effect; expense, about \$10. Shade and forest trees have been planted to some extent, with fair prospects of success.

*Summit.*—The principal causes of injury to forests is the failure to extinguish camp-fires, from which forest fires originate. Have had no disastrous fires the present season (1890). Notices requiring the extinguishment of camp-fires have been posted, with good effect, judging from the small number and extent of forest fires. No money expended, under the Forest laws, the present year (1890). No planting of forest trees—nature has supplied them in abundance.

*Weld.*—No forests in the county. No money expended under the Forest laws, except in payment of bounties for tree planting. Shade and forest trees have been planted to some extent.

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### Timber Depredations.

The State authorities, having no direct jurisdiction over the public timber lands, can only co-operate with and aid the Federal officers in preventing depredations upon such lands. Acting on the policy that spoliation and destruction of the mountain forests is an injury *per se*, irrespective of the question of ownership, I have at all times sought to furnish all the aid and information within my power to prevent such spoliation, or to bring to justice any violators of the law. I have, also, endeavored to impress upon the local Forest officers the need of their active co-operation in this behalf.

Not infrequently, persons having some knowledge of the commission of offenses of this character, or in anticipation of such violation of the law, have communicated



directly with this office, requesting that action be taken. In a majority of cases, the information furnished is quite indefinite; and if sufficient facts are adduced to constitute a cause of action, the names of witnesses, dates, locality, etc., may be lacking. I then advise the complainant to correspond directly with the United States Attorney, at Denver, and to send him a precise and complete statement of all the facts within his knowledge. In some instances letters of this nature, addressed to me, have been referred at once to the officer above named.

During the last two years, numerous complaints of this character have been made to me, nearly all of which have been placed in the hands of the Federal authorities. As to the action taken by them I have not been advised. Both the general laws and the means for their enforcement are entirely inadequate for the protection of the public timber.

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### Forest Fires.

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If it be true that fire is the great scourge of American forests, it is especially true of those of the Rocky Mountain region. There, both natural conditions and human agencies invite the coming of that dread element, and prepare the way for its most destructive effects.

The Rocky Mountain forests are composed almost entirely of coniferous trees, highly resinous and inflammable. Since the first settlement of the country these forests have been subject, without let or hindrance, to the attacks of man and the ravages of fire. Lumbermen, tie-cutters, charcoal-burners, wood-choppers and others have invaded them, each taking that which best suited their purposes, and leaving the ground strewn with combustible material. This, in time of drought, becomes ignited by a spark, or a match carelessly dropped, and a



conflagration ensues. Whatever had been spared by the axe is now consumed by fire. Even the soil is so burned and impoverished that it can no longer produce the nobler plants. Ignoble species, if any, succeed.

Where mountain slopes of this region, having a southern or eastern exposure, have been denuded of their forest cover, it is rarely the case that reforestation occurs. Nature's laws are inexorable; when violated, the penalty surely follows.

Upon slopes having a northern or western exposure, and therefore favored with maximum degrees of shade and moisture, a new growth more frequently appears than in the cases cited above. At some of the greater altitudes, burned surfaces are often covered with Aspen, and under the protection of this inferior growth a superior one slowly gains footing.

Nearly all now admit the many and unmitigated evils which result from forest fires. No one has yet suggested a feasible and adequate remedy applicable to the region under consideration. It is needless to say that our own system is imperfect and inadequate. Whether, with the means at command, it can be improved and made effective, remains to be seen.\*

In my biennial report for 1887-'88 occur the following passages:

So far as has been reported, or become known to me, but few extensive forest fires have occurred in the State during the last three years. There is, however, abundant cause for anxiety as to the future. Railway tie-choppers, lumbermen and others have never been more numerous and active than during the last two years. They have invaded the forests from all sides, leaving behind them a mass of combustible material which, sooner or later, will cause great loss and destruction. Prior to recent snows in the mountains (October, 1888,) fire was imminent in many localities.

\* This subject is further discussed in a subsequent chapter, entitled "Forest Policy."



Although Colorado has for a brief period escaped very disastrous forest fires, there is no reason to expect the good fortune to continue. Our forests are full of inflammable material, and slight causes may at any time precipitate a catastrophe.

The foregoing prediction was soon verified. During the late spring and summer months of 1889 the rain-fall was unusually light in the mountains. A long dry period ensued, somewhat similar in character to the drought of 1879. Material for combustion had been abundantly provided. The conditions being favorable, slight extrinsic causes produced frightful conflagrations in many portions of Colorado and other parts of the Rocky Mountain region.

In July, August and September of last year extensive forest fires occurred in Idaho, Montana and Wyoming. Not only were wide areas of valuable timber destroyed, but buildings, fences, bridges and even whole towns were swept out of existence. A number of human lives were also lost. For a period of six days in the latter part of July the smoke from the Montana fires, carried by air-currents, covered large portions of Colorado and New Mexico.

The *Denver Republican* commented upon the Montana fires as follows:

It is to be hoped that the terrible forest fires that are now raging in Montana will have the effect of making the people more careful to prevent the starting of such fires. The forests are nature's reservoirs, in which in the form of snow the water is stored, which during the spring and summer is used to irrigate fields and meadows. The disastrous effects of forest destruction have been shown so clearly and so often that the public needs no information on the subject. What the public needs is to suffer from these effects in order that men may be taught to guard the mountain forests with the utmost care. It seems that nothing less than the schooling of adversity will teach the people what their duty is in this particular.

In our own State the most extensive and disastrous forest fires that occurred in 1889, were in Grand, Garfield, Rio Blanco and Mesa counties.



The experience of the present year has been quite similar to the last. Long continued droughts have prevailed, crops have suffered, or perished, from lack of moisture, and forest fires have been numerous and destructive, although, perhaps, not covering so large an area as in 1889.

Both this year and last, circular letters were sent out from this office warning the County Commissioners and others to have notices posted and take other precautions to prevent the outbreak and spread of forest fires. No doubt these and other like measures were to a degree beneficial. It would appear, however, that in extremely dry seasons ordinary precautions are of little avail. What, if any, effective remedy for the evil can be devised, time alone will determine. I am of the opinion that in case a general forest administration were instituted the public forest lands might be divided into districts, and a system of protection organized in which a free use would be made of rangers or patrols. This, if coupled with power to call out a *posse comitatus* in case of emergency, and further strengthened by the co-operation of local authorities, would, I believe, be reasonably effective.

#### FOREST FIRES IN THE SEVERAL COUNTIES.

The following statements cover a majority of the forest fires that have occurred in the State during the last two years. The accounts are necessarily quite meager, most of them being derived from unofficial sources. The several counties are given in order:

**BOULDER.**—About the middle of June last, an extensive and disastrous forest fire occurred at Ward, an important mining town in the western part of Boulder county. The fire lasted for eight or ten days, extending from Ward to Bald Mountain and Four-Mile creek. It is estimated that some 5,000 acres of timber was consumed, besides large quantities of cord-wood. Only by



the most strenuous exertions on the part of the inhabitants were the town and neighboring mining plants saved from the flames. The origin of the fire was not definitely ascertained. It is supposed to have occurred through the carelessness of wood-choppers. No action was taken by the County Commissioners. It has been further reported to me that in the early part of the present month (November) a forest fire was burning in the foot-hills near Boulder. No particulars were given, except that it was of moderate extent, and was quenched by a timely fall of snow.

CLEAR CREEK.—The following was clipped from the *Denver Republican*:

SILVER PLUME, COLO., Sept. 12, 1889.—[Special.]—For several days a heavy fire has been raging in the timber just across the range from Graymont, near the head-waters of William's fork, which has filled the atmosphere in this section with smoke. The County Commissioners have taken the matter in hand and propose to prosecute the guilty parties for setting the timber on fire, in case they can be found out. Commissioner Rowe left here on Wednesday afternoon, with a party of men to locate the fire and bring in the guilty parties in case they can be captured.

A letter from myself to the Commissioners of Clear Creek county elicited the following reply:

The forest fires in this county were on the mountains above Graymont, and were confined to the west side of the wagon road which leads over Loveland pass. I went there with some men, and attempted to stay the progress of the fire, which was done to a certain extent. The next two days being rainy, the fire was totally extinguished. A considerable amount of good timber was destroyed, covering an area, say, two or three miles square.

THOMAS ROWE,  
*County Commissioner, Second District.*

Under date of August 15, 1890, the following note was received from Hon. Wm. N. Byers, of Denver:

I have just returned from Middle Park. There has recently been a bad fire in Clear Creek county, on both sides of Clear creek, five-miles west of Empire. It burned up to timber line on both sides of the valley.



I at once communicated with the commissioners of that county. Mr. Ernest Le Neve Foster, the chairman of the board, stated in reply:

There was a forest fire on Cascade creek, which destroyed about a square mile of timber. It was partially put out and driven back several times. We know nothing about a fire in the timber west of Empire; it has not been reported to us. There was a small fire near Georgetown, which may have burned an acre. We do not know the cause of any of the fires; the large one is said to have started from a prospector's camp fire.

It was also reported to me, in June last, that a forest fire had occurred on the south side of Clear creek, near Lawson. Mr. Foster stated that if there had been such a fire, the County Commissioners had no knowledge of it.

On the twenty-first of November last, Mr. G. R. Arnold, of Cresswell, Jefferson county, informed me that a forest fire, caused by the carelessness of a party of railroad surveyors, and destroying quite a quantity of green timber, had recently occurred about three miles west of his place, in Clear Creek county. He thought the fire might have been easily extinguished by those who set it, and before much damage had resulted, had proper effort been made.

DOUGLAS.—In October, 1889, Mr. Charles Hayden, of Woodland Park, informed me that about mid-summer of that year a heavy forest fire had taken place on the south fork of the Platte river, near the mouth of Turkey creek. Said the fire burned some ten days. Presumed to be in Douglas or Jefferson counties. Subsequent efforts to learn more in relation to the fire proved fruitless.

A destructive forest fire, said to have started from a logger's camp, occurred near Palmer Lake about the middle of last June. The fire swept over a tract of several hundred acres, the principal damage being done on the lands of Wm. B. Daniels and Chas. F. Wilson, of Denver. A fine body of timber was burned, and the



natural beauty of the locality greatly marred. A volunteer force, organized at Palmer Lake, did much toward the suppression of the fire. The county authorities also rendered some aid in that connection.

Another forest fire was said to have occurred in the same month (June) in township 9, range 68 west. Reported by Mr. Jones, the county clerk, but no particulars given.

In the first part of July, of the present year, a forest fire, of considerable extent, prevailed for several days at Devil's Head, a few miles north-west of Castle Rock. To the best of my knowledge, no steps were taken by the board of County Commissioners to suppress the fire, or to apprehend the parties guilty of causing it. The chairman of the board, Mr. J. P. Adams, strongly urged that body to take necessary action, but the appeal was ineffectual. No detailed report of the matter was sent to this office.

EAGLE.—Hon Wm. N. Byers, in a letter dated at Denver, November 3, 1889, reported a great forest fire on Piney river, in Eagle county. No date given, but presume it occurred in July or August. No further particulars concerning it were obtained.

EL PASO.—On August 2, 1889, near the summer residence of Mr. Orlando Metcalf, in Manitou Park, a fire was started in the pine timber, and before it could be suppressed, several acres were burned over. Its origin was ascribed to the careless leaving of a camp-fire by a party of tourists, although a subsequent investigation failed to fix the responsibility upon any one. The extinguishment of the fire before it had caused great damage, was due to the prompt and energetic action of Mr. Metcalf, who secured the aid of a large number of men from the Manitou Park hotel. These, equipped with axes and wet sacks, were enabled to soon subdue the flames. Had the progress of the fire not been arrested, the injury to the fine timber and to the beauty of the Park would



have been incalculable. Cinders from the fire, borne by the high wind, started other fires at long distances from the original one. Fortunately, however, these were early discovered and extinguished.

One of the most notable forest fires in El Paso county, during the present year, was that which occurred in the latter part of January, on Cheyenne mountain. It continued for about two days, and burned over an area of several hundred acres on the north-eastern slope of the mountain. A strong wind blowing from the west prevented the spread of the flames over the crest, and to the timber on the western side. The County Commissioners, although strongly urged to authorize the employment of men to subdue the fire, took no action in the premises. The city authorities of Colorado Springs, believing that the property of the city at Cheyenne Cañon was in jeopardy, sent out a posse to fight the fire. Count Portales, Judge Colburn, Mr. John Curr and others having landed interests in the vicinity, also made strenuous efforts to limit or suppress the fire. Through the endeavors of the parties named, facilitated by the favorable direction of the wind, the flames were finally checked. Only a small amount of large timber was destroyed. A ranch house and other improvements valued at \$200, owned by Wm. Bush, were burned.

Information was filed charging certain persons with carelessly setting the fire while burning brush, but on preliminary examination sufficient evidence of guilt not being produced, the accused were discharged. Afterwards, with the object of securing information which might lead to the apprehension of the parties guilty of causing either the forest fire at Glen Eyrie, in July, 1888, or the fire on Cheyenne Mountain, the following rewards were offered:

By Gen. Wm. J. Palmer . . . . .	\$500 00
By Wm. Bush . . . . .	25 00
By the county of El Paso . . . . .	25 00
By the Cheyenne Lake and Broodmoor Co's . . . . .	25 00
By the City of Colorado Springs . . . . .	25 00



Notices of the offering of these rewards were printed upon cloth and posted in public places. Copies of the same were also published in the local press, and the matter brought to the attention of one or more detective agencies; but no adequate result followed, and it is unlikely that the guilty parties will ever be brought to justice.

By letter, dated the 21st of June last, and forwarded to me in northern Colorado, I was informed by Mr. T. S. Nicholson, road overseer at Florissant, of the existence of an extensive forest fire in the north-west corner of the county. He stated that the fire started on the premises of one Andrew Nelson, near Buckman's saw-mill.

It being impossible for me to then visit that part of the State, I telegraphed to the County Commissioners, informing them of the facts, and asking that needed action be taken on their part. I doubt, however, whether any steps were taken by them in that behalf. None were reported to me. In a subsequent letter, Mr. Nicholson advised me that rain had extinguished the fire, but not before it had destroyed public timber over an area of several square miles.

In reply to a letter from me, Mr. H. S. Buckman, owner of the saw-mill in that vicinity, wrote me, under date of July 14, that the fire started at a distance of two or two and a half miles from his mill, and that he thought it was in the timber near Florissant. Upon investigation, found it was in another gulch from that in which his mill was located; that it was impracticable, the country being so dry, to do anything to check the fire. After a few days, a heavy shower occurred, and the flames were quenched—as he was advised. A week later, he discovered another fire in the same neighborhood, but that was soon extinguished by the July rains. Could form no ideas as to how the fires originated. Some one might have been riding through the timber and, in



lighting his pipe, dropped a match. Many hunting and fishing parties were in the region, and the fire might have been caused by them. From the best information obtainable, the fire spread over an area two by three miles square. The timber burned was mostly dwarf pine; one small strip of large trees. Loss estimated at about \$1,000.

The *Crystal Park Beacon*, published at Florissant, made the following comments in connection with the fire:

There would be a degree of satisfaction to the ranchmen unspeakable if those "Commissioners" who have so many theories about the making and keeping of forests could take a day's drive over the hills and up the gulches in this community. There is hardly a hundred feet square in all this region where, if a match were dropped, a destructive fire would not sweep over miles and miles of country, killing the timber and devastating the ranches. A fire has raged in Crystal Peak range of hills this week, and the result is perfectly dreadful. What remedy can be applied? To advise people to be careful, effects nothing. There should be a law requiring loggers and tie-makers to clean the ground and pile the brush; for the laps of trees cut are the principal source of danger.

At nearly the same time of the Florissant fire, word was sent to me concerning another near Lake Moraine and Seven Lakes, in the Pike's Peak region. I also sent telegram to the County Commissioners in relation to this. No details were reported to me, and I was unable to learn more concerning it. Have the impression the fire was inconsiderable in extent, causing but little damage.

On the 30th of October last, Mr. C. B. Burton, road overseer at Edgerton, informed me that the Santa Fé and Denver and Rio Grande railway companies, whose lines passed through his district, had failed to extend freshly plowed furrows, at suitable distances, along their tracks, to prevent the spread of fire from their trains, and that the grass and brush in that vicinity had been frequently fired in that manner. I immediately communicated with the general managers of these roads



upon the subject, who assured me that the matter would have early attention. Also advised Mr. Burton of this action, and requested him to write me again, if necessary. Nothing more was heard from him in that behalf.

GARFIELD.—The subjoined item was taken from a Denver paper of July 30, 1889:

GLENWOOD SPRINGS, COLO., July 29.—[Special.]—The fire started over a week ago by sportsmen in No Name cañon, whereby Mr. J. Brown, his family and a party of ladies, narrowly escaped death, only escaping by wading through the creek for nearly two miles on their hands and knees, and by which Mr. Brown lost two valuable horses, has now spread and covers an immense area of over ten miles square.

The entire air on the western slope is filled with smoke from the burning mountains. Reports from Red Cliff, Leadville, Aspen and New Castle report the sun completely obscured. The sight from Glenwood in the evening is magnificent but awful. The entire extent of No Name and Grizzly mountains is one mass of fire.

The miscreants, if caught, should be severely punished for setting the fire, which also endangers the water supply of Glenwood and several saw-mills and ranches.

On the same day (July 30) I sent both telegraphic and written communications to the Commissioners of Garfield county, urging them to do everything in their power to prevent further devastation and to bring offenders to justice. Also requested them to give me early information as to the extent and location of the fires, how caused, if known to them, approximate amount of loss, action taken by them, etc.

No reply to the above being received, I subsequently wrote to Jas. L. Clark, Esq., of Glenwood Springs, asking for further information concerning the fires. Under date of August 29, Mr. C. advised me that my letter had been referred, for reply, to Mr. Philip M. Brashear, acting manager of the *Glenwood Springs Republican*. He also said that he had recently been at the head of No Name gulch, and the fire was then burning, although not to a sufficient extent to do much harm; that if the rain, which had since fallen, had reached that locality, the fire was doubtless extinguished.



Mr. Brashear wrote me that the fire was started in No Name gulch, about six miles north-east of Glenwood Springs; probably by boys or campers—exact origin unknown. A person who had passed through the burned area, estimated that not less than 10,000 acres were burned over near the place of beginning, and that the fire had extended many miles to the westward. A great deal of timber was destroyed, and much of it of good quality; the fire did not sweep the entire country clean, but jumped in some places; thought the site of proposed national park was much injured; wild game disturbed and driven from its accustomed haunts. Said it was impossible to make even an approximate estimate of loss without incurring considerable expense. In a note Mr. B. further stated that the fire had burned fiercely for two weeks, and might still be smouldering in spots, notwithstanding the late rains.

GRAND.—In a letter from Hon. Wm. N. Byers, dated at Hot Sulphur Springs, August 8, 1889, he said:

We have had two bad fires in this (Middle) park. One, about three miles east of here, started last Friday from a camp-fire; the other, about fifteen miles east; I do not know the origin of. The country is dry as tinder; Gunnison river the lowest I ever saw it at any season of the year. Hay crop about one-fourth what it should be, taking the average of fairly good seasons. I fear that a large portion of the proposed White River park is burned over.

In a subsequent letter from Mr. Byers, written at Denver, November 3, 1889, the following statements were made:

There have been several forest fires in Grand county this season. One between Pole and Crooked creeks, started in the latter part of July on Pole creek, and yet showed life last Monday when I came out. It burned in spots and streaks over the north-east face of the mountain spur between Fraser and William's Fork rivers, apparently destroying about half the timber, reaching to the summit (perhaps over) for many miles right and left.

Another, on South Fork of Grand river, started about the same time from a cigarette thrown down by a boy in a meadow, destroyed all the hay and much of the peaty soil, and thence extended to the timber and up the face of the main range, apparently to timber-line.



It burned between two and three months. Another, three miles east of Hot Sulphur Springs, started from a camper's fire, burned two or three weeks, but did not destroy much timber of value. Another, in northern part of the county, between Troublesome and Muddy rivers, destroyed a great deal of timber, and was yet burning fiercely October 20. Another, on the North Fork of Grand river, destroyed a great deal of hay, and extended into the timber.

In October, of the same year (1889), Mr. A. N. Hoag, of Fort Collins, wrote to me in relation to forest fires, in July or August preceding, on the Gore range, at the north-west side of Middle Park. He was unable to give particulars.

At about the same time, Mr. Hammond, a ranch owner in the county, seen at Denver, mentioned the existence, at some time previous, of a heavy forest fire near the head of Fraser river, in Middle Park. Did not give date or other details. I presumed it might have been one of the fires observed by Mr. Byers.

Whenever information of fires of this character reached me no time was lost in communicating with the County Commissioners, urging them to take prompt and necessary action, and to advise me fully as to all the facts. In case of the supposed fire on Gore range, I wrote to the Commissioners of both Grand and Routt counties. No reply was received from the Commissioners of the last named county. In a letter from Henry Lehman, Esq., chairman of the Board of Commissioners of Grand county, dated at Hot Sulphur Springs, October 7, 1889, the following statements were made:

We have had in our county three big timber fires, which have been burning from four to six weeks each, and have and are destroying a large quantity of green timber. It is impossible to estimate the extent of loss, but it will reach thousands of acres. In every instance these fires were set by tourists, who, long since, left the country. I have endeavored to find out the parties who set the fires, but can learn nothing of importance. One thing is certain: If provision is not soon made for protecting our timber from fire it will in a short time be like the wild game—all gone. The same men who have



destroyed the game are destroying the timber. If persons could be appointed whose duty it would be to guard the forests and put out fires when first started, it would save much.

In the latter part of June, of the present year, from a high point in the vicinity of Golden, Capt. Edw. L. Berthoud, of that place, observed the smoke of a heavy forest fire, which he presumed to be in the timber adjacent to Middle Park. Reporting the fact to me, I immediately forwarded a communication upon the subject to the Commissioners of Grand county, directing them to make every effort to limit or suppress the fire, and, if possible, to apprehend the person who caused it. Mr. Lehman, still acting as chairman of the Board, replied as follows:

HOT SULPHUR SPRINGS, COLO., Aug. 10, 1890.

DEAR SIR:—There are at present two timber fires in this county. We are not able to make an appropriation for the purpose of suppressing such fires. One of them is close to my place, and it has spread over miles of country already. We have a slight clue to one party that let a fire get out. It has been very dry this season, until last night, when a heavy rain-fall occurred in the vicinity of the fire, and it seems to be almost out; but of course it will blow up again.

No further information, in this connection, was forwarded to me.

GUNNISON.—The following item was clipped from one of the State papers:

GUNNISON, COLO., July 29, 1889.—For two or three days the mountains in this vicinity have been ablaze with burning timber. The timber is afire below Shawnee. It is supposed to have been started from sparks from passing locomotives.

In response to a letter of inquiry to the Commissioners of Gunnison county, Mr. D. C. Scribner, the county clerk, wrote me as follows:

There has been quite a fire in the northern part of the county, but we have been unable to get any particulars. We had posted, in all parts of the county, notices to extinguish camp-fires. I do not think there are now any forest fires in this vicinity.

In a few days thereafter, being at Gunnison, I made further inquiries relative to forest fires in that county.



Was told that fires had occurred on Curicantii Mesa, near the border of and mostly in Montrose county; also, one in, or near, Lost Cañon, about twelve miles north-east of Gunnison; and one at head of Steuben creek, running thence to Bear creek. Was advised that information relating to these fires could be obtained from J. J. Carpenter, of Sapinero; John Outcalt, of Gunnison, and John N. Hall, of Kezar. From the first two no particulars were learned. Mr. Hall, under date of August 25, 1889, wrote me as follows:

Yours in regard to forest fires on Steuben and Bear creeks, was duly received. I went to-day to the head of Steuben creek and across the divide. No fire has ever been there. I saw from the top of range a small smoke down near its mouth, but nothing of any account, as there is but little timber there. Could see a large smoke on the hills between Six-Mile creek (six miles from Sapinero) and Elk creek (two miles from Sapinero). Thought from the size of the smoke, a good deal of ground was being burned over. As near as I can learn, the fire commenced last week. I also saw a smoke cloud toward Lake Fork. Could see in different directions thirty to forty miles, and observed no other fires. With so many hunting and fishing parties out, and everything so dry, it is a wonder that forest fires do not occur more frequently than they do. Neglected camp-fires have been the source of more willful and careless destruction of timber in this region than all other causes combined.

On the thirteenth of September, 1889, Mr. Edward Croke, road overseer at Irwin, wrote me as follows:

I have been fighting forest fires for the last ten days, and have succeeded in putting them out. I discovered a fire on the tenth inst. and it looked as if it might burn the whole country. With the aid of two men I finally extinguished it. Do not know how it was started, although I have tried hard to find out.

A letter to Mr. Croke, asking for further particulars, elicited the following reply:

The fires I wrote to you about were a half-mile from town (Irwin), close to the county road leading to the Bullion King mine. No standing timber of any considerable value was burned—it was mostly fallen timber. This district has been very fortunate in the past in regard to forest fires, but I am always on the lookout for them in dry weather, and try to keep a close watch all the time.



In a News "special" dated Ouray, Colo., July 30, 1889, it was stated that "extensive mountain fires on the Cimarron are reported, and fires are raging in other parts of the mountains." The Cimarron river rises in the extreme south-western portion of Gunnison county, and flows thence into the south-eastern part of Montrose county, where it unites with the Gunnison river. I was unable to gain further information relative to the fire or fires in this section.

In the early part of July, 1890, Mr. Lew Wait, of Gothic, informed me that a forest fire had recently occurred on Rock creek, near Crystal. Letters of inquiry were at once sent to the County Commissioners and to A. A. Johnson, editor of the *Crystal River Current*, at Crystal. My letter to the County Commissioners was referred to Mr. J. for reply. Under date of July 16th he wrote me as follows:

The fire, which was accidental, occurred on the 18th of last June. It started from the sparks of a fire that had been placed on a dead animal which lay beside the wagon road. It crossed the river and got into some dead fallen timber; could not be extinguished at the time, as very few men were in camp. It occurred while I was in Denver, but every effort was made on the part of those present to subdue the fire and save the town. There was but little loss of live timber, and no buildings burned. On my return a number of men and myself went up to where there were some logs still burning, and we extinguished all that was possible, and dug up the loose debris, making a trench to confine the fire within a small area of ground, and the fire went out. I have always been cautious to suppress any fires that might possibly do any damage, and have found others here willing to assist in the matter. This fire probably spread over twenty-five acres of fallen, burnt timber, and really did no harm of consequence.

LARIMER.—In the early part of November, 1889, Hon. Wm. N. Byers informed me that some time prior thereto, he had observed the smoke of an immense forest fire in North Park. Was unable to more definitely locate the fire or give any particulars. To a letter upon the subject, addressed to the commissioners of Larimer county, no reply was received. No further information,



in this connection, was obtained by me. Heavy forest fires were then prevailing in many portions of the mountain region, and more than likely a fire of that nature occurred in the section named.

The following correspondence relates to a forest fire in Larimer county the present season. It may be stated that Chambers' Lake is on the Medicine Bow range, some fifty miles west of Fort Collins. The lake is utilized in connection with a large irrigation system. During the irrigating season last past, Mr. Van Dolat had charge of the lake, or reservoir.

(Extract from a letter from Prof. C. S. Crandall, of the State Agricultural College):

FORT COLLINS, COLO., Oct. 20, 1890.

In September I went over Cameron Pass, passing through the district burned over in July in the neighborhood of Chambers' Lake. I was much struck by the extent of burned timber, and the desolate appearance of the region—not a green thing to be seen for several miles. The importance of the preservation of the timber in the mountains cannot be overestimated, and I hope your efforts to prevent forest devastation may meet with a good measure of success.

In response to an inquiry addressed to J. T. Budrow, the clerk of Larimer county, he informed me that J. P. Van Dolat, of Home P. O., could give all needed information relating to the fire. A letter (of date Oct. 25) was forwarded to the latter from this office, in substance as follows:

Will you be so good as to give me the facts in relation to the forest fire which occurred in the vicinity of Chambers' Lake in July last. I would be glad to know as to the date and origin of the fire, its extent, location, amount of damage done, measures taken to suppress it, steps taken to arrest guilty parties, if any, etc. In fact, *any* information you can furnish me respecting the matter, will be thankfully received.

To the above, Mr. Van Dolat sent the following reply, dated Home, Colo., October 29, 1890:



The fire started June 28 from a camp-fire carelessly left. About 5,000 acres were burned over, the timber being mostly heavy, green Spruce. To my knowledge, no measures were taken to arrest the parties. A number of cabins were burned, one team of horses and a number of bridges. The timber was on fire for about two weeks.

I then wrote the County Commissioners as follows:

I have been informed, from an apparently creditable source, that in the latter part of June last, by the careless leaving of a camp-fire at or near Chamber's Lake, in your county, an extensive forest fire occurred, burning over some 5,000 acres of heavy timber, and destroying also a number of cabins and bridges and a team of horses; and that no measures were taken to arrest the guilty parties. Will you be so good as to give me the facts in the case? Your early attention will oblige.

No reply to the above was received by me.

On the 18th of November last I met Mr. Van Dolat in Fort Collins. He stated that the Chamber's Lake fire was in a large body of timber (say, 25x30 miles in extent) covering the tributaries of the Cache la Poudre river; that a much-traveled wagon road extended through the timber, along which passed many tourists, hunters and others, who frequently left camp-fires unextinguished. Believed the forest fires of this season originated in this way, but that no sufficient evidence of the fact was obtainable to definitely fix the responsibility.\*

MESA.—In the latter part of July, 1889, the following newspaper item was noticed by me:

FRUITA, COLO., July 29 (SPECIAL).

Forest fires, covering thousands of acres on the Grand Mesa, are reported here. The atmosphere of Grand Valley during the day has been so full of smoke as to obscure the sun.

In response to a letter and telegram, which were immediately sent to the Commissioners of Mesa county, Mr. A. J. McCune, the County Clerk, under date of August 3, wrote me as follows:

\* In a subsequent chapter, on "Forest Policy," is given certain suggestions made by Mr. Van Dolat with respect to the employment of mounted patrols or rangers to prevent the outbreak of forest fires.



The fire was located where no damage to speak of could be done, and nothing could be done to stop it. There would be great damage done, however, to the water supply of Kannah creek, one of our irrigating streams, if the timber on Grand Mesa was destroyed. Have you any suggestions as to what can be done to prevent such an occurrence, except the ordinary warning to campers? I write this at the request of a member of our Board, who lives in town.

Replying to the above, I asked for further particulars. Also sent letters of inquiry to W. E. Pabor, Esq., Fruita, and Mrs. S. B. Pickett, at Whitewater. Mr. Pabor wrote me as follows:

There are extensive fires on the Grand Mesa at the head waters of Kannah and Whitewater creeks. They are in the vicinity of the lakes, and great destruction of trees will be the result.

Mrs. Pickett's reply was dated at Whitewater, August 13, 1889. The main portions of it read as follows:

I was on Grand Mesa when the fire started there on the morning of July 26. I rode out to the edge—or "rimrock"—eastward, with some friends, and as we looked *down*, and toward Mesa creek, we noticed a little smoke as though some one had a small camp-fire in the forest along the creek, possibly two or three miles away. The next day (Saturday), about two o'clock, I noticed from our cabin a great volume of smoke arising from that same region. It had the appearance of having already spread over quite a tract. I saddled my pony, and rode over to the edge again. Saw the fire leaping from tree to tree and spreading rapidly, but it was still below our part of the mesa—on the "bench," so called—but coming up grade as fast as possible, bearing south-west from point of starting, while we were north-west. Saturday evening, when the boys returned, we rode over again. The fire had almost reached the top. Sunday morning it had subsided to a considerable degree; in the afternoon rising again, as the wind rose. By Monday it had burned over more or less of the valley of Mesa creek, from near its source to a considerable distance down the creek, and from a quarter to a half mile wide. It burned only a comparatively small space on top, an acre or so, perhaps. The fire changed its course, and spread to the eastward and not far from Mesa lakes, about five miles or more, in a direct line from where we were. So it must have gone over a good deal of land, and burned a considerable amount of timber. On Monday, August 5, the boys rode over that way, and said it was about out, but the valley looked desolate.



MONTROSE.—When in Gunnison, in August, 1889, I was told of a forest fire said to have occurred on Curicantii Mesa, on the border of and mostly in Montrose county. Was advised to correspond, in relation to the matter, with Mr. J. J. Carpenter, Sapinero, which I did. Have misplaced his reply. My recollection is that he was unable to furnish any definite information relating to the fire. On examination of the map, it appears that Curicantii Mesa is, for the most part if not wholly, in Gunnison county.

OURAY.—The following news item was clipped from a Denver paper:

OURAY, COLO., July 30, 1889.—[Special.]—For the past three or four days the mountains have been enveloped in a dense volume of smoke. It gives the country an Indian summer appearance. Extensive mountain fires on the Cimarron are reported, and fires are raging in other parts of the mountains. Some men seem to have no regard for the fine bodies of timber that clothe the mountains in many places, but must set them on fire and destroy them. We have not timber enough, and the wretch who willfully or through carelessness starts a conflagration that denudes large areas of the mountains of their forests, should be severely punished.

To a telegram and letters of inquiry to the Commissioners of Ouray county, Mr. T. H. Moore, the clerk of the board, replied as follows:

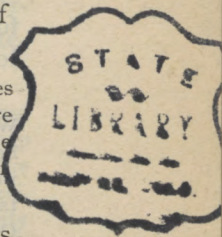
It seems that you are misled in regard to the locality of forest fires in this county. The forests in the Red Mountain district were on fire some weeks ago, but were promptly extinguished by action of the Commissioners. The Cimarron fires do not reach the boundaries of Ouray county.

Replying to the above, I requested further particulars as to the Red Mountain fires.\*

PITKIN.—In a report forwarded to me from Aspen, September 24, 1890, Frank A. Shepard, Esq., Chairman of the Board of County Commissioners, made the following statement:

On the 27th of last June there was a forest fire in Hunter's Park, about six miles from Aspen, which destroyed about ten acres of good

\* See report from San Juan county, on a subsequent page.





timber, worth, I presume, about \$1,000; supposed to have started from some camp-fire. Another occurred July 25, which did no particular damage. It was said to have been set on fire, but as we did not think it could be proven, the ranchmen being at outs, nothing was done about it. The effect of posting notices, warning people to extinguish camp-fires, has been beneficial.

RIO BLANCO.—Extract from letter of Hon. Wm. N. Byers, dated Denver, Colo., Nov. 3, 1889:

\* \* \* In Rio Blanco county, east, north-east and north of Meeker, it was reported, in August last, that forest fires had burned over 800 square miles of territory, and were still burning in the middle of October. Much of the area of the proposed National Park was devastated. Seven saw-mills said to have been destroyed.

No report was received by me from the County Commissioners relative to these forest fires; therefore, no authoritative statement can be made relative to their extent, etc. Doubtless they were very extensive and disastrous, though perhaps not covering so wide an area as named in the report to Mr. Byers.

One fire, of small extent, and causing but little damage, occurred this year. Circumstances not reported.

RIO GRANDE.—The following paragraphs relating to forest fires in Rio Grande county, were clipped from the local press in the latter part of June, 1890:

Tie-choppers have allowed fire to get into the timber above Wagon-Wheel Gap, and some of the finest bodies of timber in that vicinity have been destroyed. The guilty parties should be hunted out and punished. The fire has burned from Deep Creek to the Gap—a distance of seven miles—and about 10,000 ties have been lost in the fire. Other fires have been raging lately—one on Old Woman's creek and one on "Old Baldy." Everything is as dry as a powder-house, and burns readily. A heavy rain is probably the only thing that will stop the fires.

LATER.—Since the above was put in type, Mr. L. B. Shaw has informed this paper that he knows positively that the Deep creek fire did not originate with tie men, and that the tie men have spent many dollars in trying to stop the fire. There certainly has been criminal carelessness on the part of somebody, and the guilty ones deserve whatever punishment the law provides in such cases.

WAGON-WHEEL GAP, Colo., June 28.—[Special]—A forest fire has been raging up Deep creek, and great destruction has been done



to the timber. Messrs. Brandt & Turner, tie contractors, will lose heavily. They have a gang of men employed in cutting ties on Deep Creek Mountain. The fire surrounded their camps, and it was with great difficulty the men saved their lives. At one time three Mexicans were hemmed in by the fire, and it took a superhuman effort to save them. Over 9,000 ties have already been burned. Messrs. Brandt & Turner have 60,000 ties cut and strewn along the river from twelve miles above the Gap to South Fork.

On the twenty-ninth of June I telegraphed to the County Commissioners, asking them for a statement of facts, and what action had been taken by them.

Replying to the above (under date of July eight), Mr. W. D. Zook, the County Clerk, said:

There is a forest fire up the Rio Grande river. Cannot say how large it is, as no reliable reports have come in. The Commissioners think it started from the Rio Grande railroad tie-camps in that vicinity. No action has yet been taken in the matter by the County Commissioners. The Board is now in session.

I then sent a second message to the commissioners, urging them to take immediate action in the premises. Whether anything was done by them in this behalf I am unable to say.

In response to letters of inquiry sent to Richard Irwin, Esq., of Sunnyside, he made the following statement.

The railroad tie contractors have (by accident, it is claimed) burned a body of fine timber, a mile long by half a mile in width, on Deep creek, across the Rio Grande, and about four miles from here. Fire still burning, but apparently dying out. During my five years residence here not a fire has got out into the forest, nearer than twenty miles to us, until this last one at the tie camp.

Deep creek is on the main road from Wagon-Wheel Gap to Antelope Springs and Lake City. Mr. Turner, of the firm of Turner & Brandt, tie contractors, informed me that the fire got out, as supposed, by some accident in one of their tie-choppers' cabins, while the occupants were gone, and burning the cabin and contents. The fire started on the 19th of June, and, driven by the wind, raged for two weeks, burning east and south, back from the Rio Grande river south and south-east, toward Wagon-Wheel Gap, and continued until the heavy rains of the 8th and 9th of July put it out. Mr. Turner said they (the tie-cutters and haulers) had been fighting the fire for two days. All the fire and loss was in Rio Grande county.



ROUTT.—In the early part of November, 1889, Hon. Wm. N. Byers informed me that an immense forest fire had occurred that season on the west flank of the Gore range in Routt county. He stated that the burned timber had covered, in whole or in part, the drainage area of Morrison creek (a branch of the Yampa river), Rock creek (a branch of Grand river), and many other small streams. I was unable to obtain any further information concerning the fire. So far as known no action was taken in the matter by the commissioners.

In a letter from Hon. J. H. Crawford, of Steamboat Springs, dated October 22, 1890, it was stated that a forest fire had occurred on the Park range during the present season; origin unknown; damage considerable. On the contrary, in a report, on behalf of the county commissioners, from Mr. C. E. Baker, county clerk, statement was made that no forest fire had occurred in the county during the year 1890. The time at my command did not permit an attempted reconciliation, by correspondence, of the conflicting reports.

SAGUACHE.—A BURNING RANCHE.—In July, 1889, a fire starting in a meadow owned by the Saguache Land and Cattle Company, in Saguache county, became uncontrollable, and burned for several weeks before it could be extinguished. Over fifteen hundred acres of land were burned over, both crops and soil being consumed—the latter being burned to a depth of one and a half to thirty inches. The loss was ten thousand dollars and upwards.

SAN JUAN.—In response to a letter of inquiry to the commissioners of San Juan county, concerning certain forest fires said to have occurred in July 1889, in the Red Mountain district, Mr. M. W. Emery, county clerk, under date of November 7, wrote me as follows:

The fire caught from an engine on the Silverton Railroad, and I was told at the time that it was largely burning brush where railroad ties had been cut, but was doing no great damage. The spread of the fire was checked by the efforts of the miners in that district. I have never heard that any damage was done by it.



### **Consumption of Timber by Railway Companies and Others.**

No substantial check has been given to the comparatively free use of Government timber in railway, lumbering, charcoal, mining operations, etc. Our general laws are wholly inadequate to prevent abuses in that connection. The federal authorities, with very scanty means at their disposal, and having no duly organized system of protection, make vain attempts to prevent waste and despoilation. The territory is vast, and the few scattered officials make but little impression. Where one is seeking to enforce the law, there are hundreds engaged in its violation. Under a proper system of forest administration, all legitimate wants would be supplied at a minimum cost, the continued existence of the forests would be assured, and at least a moderate revenue accrue to the Government.

The several classes named above, with hardly an exception, not only make such use of the public timber as best suits their interests and convenience, but conduct their operations in such a reckless manner as to cause unlimited waste and destruction of the forests.

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### **Forest Tree Culture.**

The planting of forest trees in Colorado is second only in importance to the preservation of her native forests. Trees and groves on the plains cannot perform the office of forests in the mountains. The former, however, occupy an important place in the economy of nature, and their extensive planting and cultivation should be promoted in every legitimate way.

In some parts of the State the rain-fall is sufficient in amount, and the climatic condition such that a few



varieties of hardy trees may be grown without the aid of irrigation, provided they receive careful and thorough cultivation. In most cases, however, irrigation is necessary to the successful growing of trees.

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#### PLANTATION AT ROTHERWOOD.

An interesting experiment in forest tree culture has been in progress for several years at a country-place near Denver, called "Rotherwood." Hon. S. Allen Long, the proprietor, and under whose personal direction the work has been done, has, in this enterprise, shown remarkable courage and intelligence. He has acted on the theory that even in the semi-arid region of the plains, by the thorough preparation of the soil, rendering it fully receptive to the little moisture afforded, both farm crops and forest trees could be successfully grown. Both in theory and practice he has emphasized the necessity of extensive and deep cultivation of the soil, until every farmer and tree-grower should have his own reservoir on his own land. And he has sought to encourage the more rapid and universal breaking of the sod throughout the State, so that it might no longer be said that the almost water-proof sod of Colorado was like the roof of a house, shedding the rain-fall into the highways.

But Mr. Long's experience in tree culture can best be given in his own language:

On my ranch, "Rotherwood," about eleven miles due south of Denver, on the line of Broadway, I commenced in 1885 the preparation of the land on my timber culture entry, lying high above the present possibilities of irrigation. I enclosed about fifteen acres of light, sandy loam, so situated on sloping ground as to receive the snow melt and rain-fall from the adjacent land. I broke the sod in the summer of that year, and the spring of 1886. I then immediately plowed five acres and planted it in corn. In the spring of 1887, I plowed deeply another five acres, planting it in corn, potatoes and rye, and at the same time planted the first five acres with walnut and



other seeds. From defects in the seed and prevalence of weeds only a very small proportion of these seeds germinated. Of the walnuts, out of four bushels planted, not more than a hundred appeared above ground at all, and they had a sickly growth of not more than four or six inches high. They died during the succeeding winter. The spring of 1888 opened with the ground in good condition. I had it thoroughly plowed and harrowed, and early in May purchased 15,000 seedlings from a leading nursery in Denver, and had them planted by their own men. They consisted of Black and Honey Locusts, Elms, Maple, White Ash, Catalpa, Speciosa and Black Walnut. In addition to these, I planted 30,000 tree seeds, embracing about the same as the above list. The summer of 1888, as is well known, was unusually dry, and at Rotherwood we had none of our customary July and August showers. We cleared the ground of weeds by hand and with the hoe, and kept the cultivators going. At the end of the season, the black locusts had made a growth during the dry year varying from one foot to three feet in height, the honey locusts from six to eighteen inches, and the remainder of the list from eight to twelve inches, all wearing the appearance of health and strength. These figures refer to the seedlings only. The 30,000 tree seeds spoken of above were planted later—toward autumn, and do not figure in the results of 1888. In November, 1888, we simply threw up the ground around the trees, so as to protect the roots, and in this way they entered upon the winter.

In the spring of the year 1889, the trees were found, upon the whole, to have wintered well. A small proportion of the tops were winter killed, but they subsequently grew up fresh from the root, and all started out with fine promise for the year. At about this time, I planted some thousands of tree seeds additional, mainly of Black Locusts and White Ash, with a few Apricots and Peaches. The seeds planted in the preceeding autumn did not come up in as large proportion as those planted in the spring, but those of them that did appear have grown higher and more thrifty, and with less attention. In my judgment, they will be in better condition to withstand the winter. The results of 1889 surpassed the most sanguine expectations. We have continued to cultivate thoroughly with the double cultivator, as long as this could be done without breaking the tree tops; afterwards with the plow, single cultivator and hoe. At this date (November, 1889) we have several thousand more growing, thrifty trees than are necessary to fulfill the requirements of the government. Our Black Locusts range from five to nine feet in height; the Honey Locust from two to five feet; White Ash, Elms, Maples and Catalpas ranging two, four and five feet. All of these are still growing rapidly, and it is my firm belief that had we been able to complete the process of trimming a little earlier and more thoroughly than was possible, the end of this season would have shown Locust trees twelve feet high.



This is the result of two seasons' growth from seedlings one foot high and less, without irrigation.

Though not strictly in the line of forestry, yet it may be of general interest and encouragement to state that I have in both years raised good crops, comprising corn, rye, barley, potatoes, with sufficient for my own table of lettuce, onions, cucumbers, summer squash and other vegetables. Watermelons have done well. Several varieties of sorghum grew very satisfactorily, especially white milo maize.

Further communications upon the subject were received from Mr. Long, as follows:

*March 25, 1890.*—We have just concluded the transplanting of our trees eight feet apart, and I was *myself* surprised to see the size and strength of the roots of *all* the trees.

*May 20, 1890.*—Our trees appear to have survived the ordeal of transplanting, and are putting forth their leaves in a most promising style.

*Oct. 25, 1890.*—I have to-day made a somewhat careful examination of the trees in my timber culture tract, as you requested, and am greatly pleased with the result. I estimate that 20 per cent. or at most 25 per cent. will cover the apparent loss on the trees, from the excessive and long continued drought of the past summer. The *real* loss may prove to be much less, as many of those apparently dead in the tops, may be found to have sufficient life in the roots to produce a new growth. Indeed, there are already many illustrations of this second growth resulting from the showers of early September.

The evil result of the drought are confined almost exclusively to the trees which were *transplanted* last Spring (1890), from the close furrows into rows eight feet apart each way. Those which were left untouched were entirely free from blight, and retain their full complement of leaves, though they have not grown as much as in the previous two years. They look healthy, strong and well. I am very hopeful, indeed confident, that the Spring of 1891 will see a large proportion of those which have suffered, restored to healthy growth. If so, the memorable drought of 1890 will not have been destitute of value in the experimental opportunity it has afforded.

My observations, this season, has led me to several conclusions:

1. I would advise the planting of Black Locusts and Black Walnuts in all localities deficient in water. I regard the Black Locust as the tree of most certain growth, the Black Walnut next. The Honey Locust is the only tree in my experience attacked by cut worms, and they have destroyed a great many of that variety. I would strongly advise against their use,

2. In setting out trees under the Timber Culture Act, I would advise that they be placed the required distance—say eight feet—



apart each way. Then I would plant two or three trees on each of the four sides of this stationary one, near it, and not more than six or eight inches apart. These will grow up in bushy style around the main tree, thereby shading the soil, and forming as well a windbreak. At proper time these auxiliaries can be removed, and planted elsewhere.

In conclusion, I wish to say to owners of dry lands: If my trees continue another year to grow as they have done, I shall, as an investment, plant 200,000 at Rotherwood, instead of the Government requirement, already fulfilled, fully convinced that the trees, with all their chances, are worth more than the land which the Government gives for their culture and the constant cultivation required for success.

#### FOREST TREE PLANTING AT LOOKOUT MOUNTAIN.

In the early part of May, of the present year, under the direction of the Denver and Lookout Mountain Reserve Company, I planted a small nursery, mainly of forest trees, on the grounds of the company, at Lookout Mountain, near Golden. The tract used for this purpose consisted of about one and a half acres of gulch land, situated at an approximate elevation of 7,600 feet. The direction of the gulch, at the point in question is a little north of east. Most of the land on which the planting was done has a southern exposure; the soil is mainly a vegetable mold, dark and rich in the lower part of the gulch; the south side moistened by a few springs. The transplanted deciduous trees, about 4,700 in number, consisted of maple, elm, cottonwood, box elder, ash, wild black cherry, black and honey locust, Carolina poplar, Lombardy poplar, Russian mulberry, balm of Gilead, catalpa speciosa, linden, black walnut, and a few each of crab apple, plum and pear. The trees when obtained had a growth of from two to four years, were from the Gipson nursery at Greeley, and were transplanted in the first week of May. The ground had been previously cultivated, and was mellow and moist. The trees were placed one foot apart in rows four feet apart; great care was exercised in planting them, and after



they had been cultivated once, the entire surface of the ground was mulched with refuse straw. Thereafter, before the cultivator was run between the rows, the straw was raked to either side, to be replaced when the work was done.

Rain and snow-fall ceased about the 13th of May, and a drought ensued which lasted throughout the season. Resort was had to irrigation; water from one of the springs being conducted to a tank on the west side of the gulch, and thence, by means of force pump and hose, conveyed to the rows of trees. Shallow wells were also sunk in several places, and more or less water obtained from them. All of this involved much labor, and the results were not entirely satisfactory. On the nights of June 4th, 5th and 7th heavy frosts occurred, depriving many of the trees of their leaves and tender shoots. With the shock of transplanting, the drought and frost, it is not surprising that by the end of June one-fourth or more of the trees had died. The elm and ash trees suffered less than the others, for the reason that they were late in producing foliage. The heaviest loss seemed to be among the black locusts. Possibly they were in less vigorous condition than the others at time of transplanting.

In the latter part of May about 1,000 native Pines and Spruces, of small size, were transplanted from a point some two miles distant to the nursery rows. These were shielded from the direct rays of the sun by screens made of laths, and were cultivated, mulched and irrigated the same as the deciduous trees. The loss among these was probably greater than among the latter.

My work at Lookout ceased on the 4th of July. I was afterward advised that the dry weather continued, that the trees had suffered greatly, but that the Elms and wild Black Cherry trees had done better than the other kinds.



The unusual dryness of the season and exceptionally late frosts at Lookout might not occur again for a long period; but in the light of this experience, I would recommend that in similar cases younger nursery stock be planted (seedlings perhaps), and that an adequate supply of irrigating water be provided. The argument that inasmuch as in favorable seasons certain crops are grown in a given region without irrigation, forest trees can be so grown, is not conclusive. A farm crop is the product of a single season; to produce trees, a continuous growth of many successive seasons, is required.

#### CULTURE OF CONIFERS AT BEULAH.

At Beulah in Pueblo county, near the head-waters of the St. Charles river, is located the mountain nursery of Rev. C. S. Harrison, who makes a specialty of growing Rocky Mountain Conifers. He transfers the small plants from the mountain slopes to his nursery rows, cultivates them for a period, and then sells for ornamental planting. Some of the trees he ships to Franklin, Neb., where he maintains a larger nursery, containing a more varied collection of trees. Mr. Harrison's methods seem to be very successful. He plants large spaces, and shades them with brush roofs, keeping the young plants under this shelter until they become sufficiently hardy to endure exposure in the open ground. For the germination of seeds of conifers, he uses wooden boxes, four feet square and a foot high; prepares the seed bed in these, and shields from the sun with screens made of laths. After sowing the seed, it is covered with a fine, rich loam, that will not crust; the ground is then kept moist till the young seedlings appear. The principal species grown by Mr. H. are the Yellow Pine (*Pinus Ponderosa*), Silver Fir (*Abies Concolor*), Douglas Spruce (*Pseudotsuga Douglasii*), White Spruce (*Picea Engelmanni*), Silver Spruce (*P. Pungens*) and Juniper (*Juniperus Virginiana*).



**THE DENVER PUBLIC PARKS.**

The following letter from Mr. Richard Sopris, Commissioner of Public Parks at Denver, will be of interest in this connection:

During the past nine years I have planted in the parks of this city some 13,000 trees, selecting such varieties as I thought would make quick growth and good shade. I began in 1882 by setting out 1,200 Cottonwoods on forty acres. The trees were three inches in diameter and ten feet high. They are to-day twelve inches in diameter and thirty to forty feet high. In 1883 I set out 1,200 more Cottonwoods, and they have done equally as well as the first lot. Since 1883 I have used nothing but hard wood trees, principally Soft Maple, Ash and Elm. Of those varieties, my preference is for Soft Maple, with Ash next. But for rapid growth and adaptability to the climate of Colorado, I have found nothing to equal the Cottonwood. While all other varieties are infested with insects, and require great care, the Cottonwood is free from them, and is of more sure and rapid growth. As to irrigation of trees, I have never discovered that it was possible to get the ground too wet. In our parks the largest and healthiest trees are to be found where the most water was used.

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**FOREST TREE CULTURE AT THE STATE AGRICULTURAL EXPERIMENT STATIONS.**

In response to inquiries sent to President C. L. Ingersoll, of the State Agricultural College, concerning forest tree culture at the several Experiment Stations in charge of the college authorities, he kindly forwarded the data embraced in the subjoined table, to which special attention is called. In an accompanying note, President Ingersoll remarked that "the subject of forest tree culture, where no water can be applied, is a delicate one. I fear that in ordinary seasons but few can be made to live, except in draws and other favorable localities. With water, however, the case is different, and if the Cottonwood gets well rooted for two or three years, it may, after that, live with no more water than the rain-fall."

The Black Walnut trees upon the College land at Fort Collins are twelve years old, and in bearing.



At the Experiment Station at Del Norte (H. H. Griffin, Superintendent,) the Honey Locust is being grown for a hedge. The forest tree growth there has been healthy, but not rapid, because the soil is not conducive to extensive growth. The Ash is perfectly hardy, but the Black Walnut died down last Winter, and made a new growth from the roots this Spring. The ground in which the trees are set had been plowed two seasons. The trees have been cultivated and hoed during the growing season, and irrigated once a week on an average. In the latter part of August cultivation was stopped and water withdrawn until the last of October, at which time they were given a final irrigation.

At the Rocky Ford Station (F. L. Watrous, Superintendent,) the trees have had a slow but sturdy growth, except the Sycamore and European Alder, which have grown rapidly. The Sycamores were killed back a little last winter, but their vitality seems unimpaired. The trees stand in nursery rows, are cultivated to keep clear of weeds, and irrigated often enough to keep the soil at a growing moisture. Irrigation stopped from September 5 to October 25.



LIST OF FOREST TREES AND SHRUBS GROWING AT THE SEVERAL STATE  
EXPERIMENT STATIONS IN COLORADO, NOV. 1, 1890.

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TREES.	NUMBER AND WHERE GROWN			REMARKS.
	Ft Collins	Del Norte	Rocky Ford	
White Elm ( <i>Ulmus Americana</i> ) . . . . .	.....	5	24	Fast grower; three to ten years old
Red Elm ( <i>U. Fulva</i> ) . . . . .	1,285	.....	.....	
Camperdown Elm ( <i>U. Campastris</i> ) . . . . .	.....	.....	45	
European Elm ( <i>U. Latifolia</i> ) . . . . .	.....	.....	42	Good grower; three years old
Rock Elm ( <i>U. Racemosa</i> ) . . . . .	200	.....	.....	Fair grower; hardy
Soft Maple ( <i>Acer Dasyarpum</i> ) . . . . .	271	5	.....	Rapid grower; hardy, but easily broken by the winds
Norway Maple ( <i>A. Platanoides</i> ) . . . . .	100	.....	.....	Slow grower; not hardy
Box Elder ( <i>A. Negundo</i> ) . . . . .	240	5	.....	Good grower; hardy
Beech ( <i>Fagus ferruginea</i> ) . . . . .	50	.....	.....	Slow grower; not hardy
Black Walnut ( <i>Juglans nigra</i> ) . . . . .	500	15	45	Valuable for the plains
Butternut ( <i>J. cinera</i> ) . . . . .	10	.....	.....	Fair grower
English Walnut ( <i>Juglans</i> ) . . . . .	50	.....	.....	Slow grower; not hardy
Black Ash ( <i>Fraxinus sambucifolia</i> ) . . . . .	.....	.....	125	Fair grower; very desirable
White Ash ( <i>F. Americana</i> ) . . . . .	2,400	.....	.....	Good grower; hardy; valuable for the west
Green Ash ( <i>F. viridis</i> ) . . . . .	.....	.....	100	Good grower
Mountain Ash ( <i>Pyrus ancuparia</i> ) . . . . .	2	.....	.....	Small tree; hardy
Chestnut ( <i>Castanea vesca</i> ) . . . . .	50	.....	.....	Hardy; fair grower

BIENNIAL REPORT OF THE



Sycamore Maple ( <i>Acer pseudo-platanus</i> ) . . . . .	50	25	Not hardy
Catalpa ( <i>Catalpa speciosa</i> ) . . . . .	60	5	Fast grower; fairly hardy
Coffee Tree ( <i>Gymnocladus Canadensis</i> ) . . . . .	50	5	Slow grower; not desirable
White Mulberry ( <i>Morus alba</i> ) . . . . .	50		Hardy; good grower
Black Locust ( <i>Robinia Pseudacia</i> ) . . . . .	500	4	Rapid grower and hardy; valuable timber and shade tree
Honey Locust ( <i>Glenditschia triacanthos</i> ) . . . . .	170	5	Desirable for hedges; rapid grower, hardy
Dogwood ( <i>Cornus Siberica</i> ) . . . . .	35		Hardy; good
White Birch ( <i>Betula alba</i> ) . . . . .	40	3	10 Slow grower; not hardy
Yellow Birch ( <i>Betula Lutea</i> ) . . . . .	25	70	Slow grower; not hardy
Alder ( <i>Alnus glutinosa</i> ) . . . . .	50		Slow growth
European Alder . . . . .	50	24	Fair grower; hardy
Cottonwood ( <i>Populus angustifolia</i> and <i>P. angulata</i> ) . .	1,223		Desirable for wind-breaks
Lombardy Poplar ( <i>P. dilatata</i> ) . . . . .	10		Not hardy
Russian Poplar ( <i>P. Bolena</i> ) . . . . .	30		Symmetrical; hardy; good grower and free from rust
Russian Poplar ( <i>P. pyramidalis</i> ) . . . . .	25		
Russian Poplar ( <i>P. Riga</i> ) . . . . .	175		
Russian Willow ( <i>Salix aurea</i> ) . . . . .	50		Hardy and vigorous, but ungainly and foliage rusts badly
Russian Willow ( <i>S. fragilis</i> ) . . . . .	50		
Russian Willow ( <i>S. laurifolia</i> ) . . . . .	75		
Red Cedar ( <i>Juniperus Virginiana</i> ) . . . . .	25		Hardy; fair grower
White Cedar ( <i>Cupressus thyoides</i> ) . . . . .	25		Hardy; fair grower
White Pine ( <i>Pinos Strobus</i> ) . . . . .	50		Slow grower; hardy



# LIST OF TREES AND SHRUBS—*Concluded.*

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BIENNIAL REPORT OF THE

TREES.	NUMBER AND WHERE GROWN.			REMARKS.
	Ft. Collins	Del Norte	Rocky Ford	
Yellow Pine ( <i>P. mitis</i> ) . . . . .	50	.....	.....	Slow grower; hardy
Norway Pine ( <i>P. resinosa</i> ) . . . . .	50	.....	.....	Slow grower; hardy
White Spruce ( <i>Abies alba</i> ) . . . . .	100	.....	.....	Slow grower; hardy
Spruce ( <i>A. Canadensis</i> ) . . . . .	100	.....	.....	Slow grower; hardy
SHRUBS.				
Snowball ( <i>Viburnum opulus</i> ) . . . . .	50	.....	.....	Good grower
Lilac ( <i>Syringa vulgaris</i> ) . . . . .	50	.....	.....	Hardy; desirable
Mock Orange ( <i>Philadelphus coronarius</i> ) . . . . .	5	.....	.....	Vigorous
Honeysuckle ( <i>Lonicera</i> ) . . . . .	50	.....	.....	Not hardy
Trumpet Honeysuckle ( <i>L. Sempervirens</i> ) . . . . .	50	.....	.....	Hardy; a desirable climber
Snowberry ( <i>Symphoricarpus occidentalis</i> ) . . . . .	25	.....	.....	Occasionally kills back
Hydrangea ( <i>Symphoricarpus arborescens</i> ) . . . . .	50	.....	.....	Not hardy
Spiraea ( <i>S. opulifolia</i> ) . . . . .	50	.....	.....	Hardy and vigorous
Pea Tree ( <i>Caragana arborescens</i> ) . . . . .	5	.....	.....	Hardy and vigorous
Buckthorn ( <i>Rhamnus catharticus</i> ) . . . . .	.....	.....	.....	Good grower and hardy
Barberry ( <i>Berberis vulgaris</i> ) . . . . .	.....	.....	.....	Hardy and desirable
Privet ( <i>Ligustrum amureuse</i> ) . . . . .	200	.....	.....	Valuable hedge plant; hardy and vigorous

### Arbor Day Observance and Tree Planting in the Several Counties.

On a previous page of this report I have spoken of the Arbor Day custom here, the issue of Executive proclamations enjoining it, and the fact that it has been legally established by legislative enactment. This observance has had an excellent effect, and, if not allowed to fall into disuse, will continue to exert a good influence in connection with the cultivation of trees. Although the act designates as Arbor Day the third Friday of April of each year, it provides that the actual planting of trees may be done at such time as may best conform to local, climatic conditions.

From the Arbor Day proclamation issued by Governor Cooper in the years 1889 and 1890, I extract a few paragraphs:

\* \* \* I hope to see all citizens of Colorado participate in a custom at once so useful and so beautiful. \* \* \* I earnestly advise that the people regard it by planting trees, shrubs and vines in and about public grounds and private property. It is hoped that special attention will be given in our schools to the dissemination of knowledge respecting tree culture as affecting our climate, health and future prosperity; also, that interest be awakened not only in the planting of trees, but in the care and preservation of our forests by preventing their wanton and careless destruction.

The following editorial note was taken from the *Denver Republican* of March 27, 1890:

The Governor has designated the 18th of April as Arbor Day. It is to be hoped that the day will be fittingly observed by all the public schools, as well as by the people in general. Too much encouragement could not be given to tree planting and forest culture in this State, which is almost treeless outside of the mountains. The benefit of the observance of Arbor Day comes not so much from the actual planting of trees on that day as from the fact that it directs public attention to the subject of forestry and to the needs of our State in that respect. The celebration ought therefore to be made as much of as possible. It should be a general holiday and a time of rejoicing.

The Superintendent of Public Instruction, Hon. Fred. Dick, has issued, at appropriate seasons, circular



letters, addressed to the County Superintendents of Schools and school officers, requiring a general observance of the day by the public schools of the State. In March, of the present year, this officer also had printed and widely circulated a carefully prepared pamphlet, containing the Arbor Day act, the Governor's proclamation, his own official circular, an Arbor Day program for the use of the schools and a choice selection of reading upon forestry subjects.

From the office of the Forest Commissioner, also, in the early spring of each year, circular letters and printed forestry matter of various kinds, have been sent to the County Superintendents of Schools, County Commissioners and others throughout the State. Timely articles upon the subject of forest tree culture and forest conservation have also been furnished for publication to the principal papers of the State.

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#### ARBOR DAY TREE PLANTING.

CIRCULAR No. 9.

STATE OF COLORADO, }  
OFFICE OF FOREST COMMISSIONER, }  
DENYER, March 28, 1890. }

For the information of school authorities, and others, interested in Arbor Day tree planting, I have appended hereto a copy of the act instituting "Arbor Day" in this State, together with a few suggestions relating to the transplanting and culture of trees.\*

The educational features of Arbor Day are not here dwelt upon. It is trusted that the annual observance of the day, by appropriate exercises, and practical lessons in tree planting and culture, will eventually lead to a greater and more general interest in the science of forestry.

EDGAR T. ENSIGN,  
*Commissioner.*

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\* The act being printed elsewhere in this report, it is omitted here.



## DIRECTIONS FOR PLANTING.

*When to plant.*—The coming of spring varies so greatly in different parts of the State that no single day could be chosen that would be seasonable for all localities. The transplanting should be done after the ground is entirely clear of frost, and at about the time of the commencement of the spring rains, if such rains can be anticipated with reasonable certainty. A cloudy day rather than a sunny one, should be selected for the work.

*Where to plant.*—It is worse than useless to plant trees in a situation where they cannot be properly protected and watered, and made to thrive. I assume that in this State, all trees, even the most hardy, will, after transplanting, require irrigating for a longer or a shorter period. Therefore, let that consideration influence the choice of site.

In planting adjacent to school buildings, the boundaries of the walk along the street or road are suitable places for rows of trees. Within the grounds trees should be planted in groups (disposed naturally), rather than placed singly or in formal "clumps"; and to preserve in the ground, a lawn-like appearance, the planting should mainly be near the boundaries, or corners, or at the rear. Generally, it is not well to plant trees in close proximity to the school building. Make it a point to plant so as to screen the out-buildings, or cut off any objectionable view. In determining the situation of groups or individual trees, make due allowance for the space they will occupy when grown.

*Choice of trees.*—It may be said at the outset that trees from well-managed nurseries are preferable to those grown in the forest, because their root-system is better prepared for transplanting.

As a rule, young and small trees, when transplanted, make a more vigorous, thrifty growth than do trees of larger size and greater age. In school grounds it is usually better to plant hardy *deciduous* trees than *conifers*. To insure success with the latter, more skillful treatment is demanded than they would be likely to receive in the instance under consideration.



Among the hardier forest trees suitable for planting in this State, especially in the plains region, are the Cottonwood (broad leaved), Balm of Gilead, Russian Mulberry, American White Ash, Black Locust, Honey Locust, Western Gray Willow and Wild Black Cherry. In localities south of the Arkansas-Platte divide the Osage Orange and *Catalpa speciosa* might be tried.

The Cottonwood, of which there are several varieties, is the pioneer tree of the plains. It is hardier and has a more vigorous growth in this region than other species of which we have knowledge. The broad leaved variety is superior to others. It is exceedingly useful for street and road-side planting, where speedy results are sought. Where irrigation is freely practiced, the Hickory, Butternut, Black Walnut, White Elm, Linden, Box Elder and other varieties of Maple are likely to do well.

Several species of trees, native to the State, if carefully transplanted, would be likely to thrive in altitudes as great as 9,000 to 11,000 feet. Among those worthy of trial in such situations may be named the Cottonwood, Aspen ("quaking asp"), Box Elder, Dwarf Maple, Alder and Wild Cherry.

Evergreens, when healthful and perfect, with drooping branches sweeping the ground, are beautiful objects. To successfully transplant and grow them is a work of skill, but the extra labor and difficulty in such cases often secures the most gratifying results. Though not recommended for Arbor Day planting by schools, they might be freely used under other and more favorable circumstances.

*Method of transplanting.*—Where schools or other organizations engage in the work, experienced tree-planters should do the actual planting, heaps of earth being left for those to fill in who perform the more ceremonious parts.

Before bringing the trees on the ground, dig large holes and procure plenty of rich, fine soil to fill in around the roots of the trees. If manure of any kind is used do not place it in contact with the roots. In taking up the trees be careful to save, with each, all the roots possible, especially the fine or fibrous ones, and remove the trees at once to the place where they are to stand. Do not allow them to be long exposed to the



sun or wind. If it seems necessary, shorten the side branches (never the leader) to correspond with loss of root which the trees may have sustained. Cut off smoothly the rough or broken ends of roots, spread them out at length in the hole—for good “anchorage” and further nutrition of the trees. Set the trees about the depth they naturally grew, wet the roots thoroughly and sift in around them good, fine soil. Press the earth down firmly, leave no spaces, water (though not too freely) while filling in, and avoid heaping the earth around the trunks. *A close contact of the soil with the rootlets, is the secret of success in planting.* Mulch the surface around the trees with leaves, straw or litter of some kind.

A well-known authority has summarized the elements of success in tree planting as follows:

1. Trees suitable to soil and surrounding conditions;
2. A well developed root-system, kept in living condition;
3. Wide holes and mellow soil;
4. Firm packing of soil around roots.

*After Care*—After the trees are transplanted, secure them from harm in some effective way. Those along the street or roadside should be protected by strong posts or rails, placed at such a distance outside of the trees that the latter may be beyond the reach of horses. The barbarism of hitching horses to young and growing trees should be suppressed. School children should also be taught to respect the trees and the importance of letting them alone. Each tree planted in school grounds might be placed in charge of, and named for, some meritorious pupil; the child so honored to be held responsible for the care and growth of the tree. It is cruel and wasteful to remove a thrifty tree from its home and let it perish for want of care. Treat it as a friend; nourish and protect it, and in after years it will amply reward you with its shade and beauty.

Statements have been forwarded to me from nearly all of the County Superintendents of Schools concerning the Arbor Day observance in their respective counties for the last two years. In a large number of counties the day was duly observed and considerable tree planting done. In some of the newly-formed counties their



organization occurred at too late a period to secure action in this behalf in 1889, on the part of the school authorities. In a few of the mountain counties the high altitude, rigorous climate, scanty population and other adverse conditions preclude tree planting, except on the most limited scale.

Notwithstanding the extremely dry seasons for the two years last past, I believe that in the improvement of farms, homes, and city residences, streets and parks, more tree planting has been done in Colorado than in any other and similar period. Quite a large number of trees have been planted under the timber culture act. In all such cases, where the claimant is acting in good faith and honestly trying to comply with the requirements of the law, he should receive great consideration from the authorities.

The following are the reports received, from County Superintendents of Schools and others, relative to Arbor Day observance and forest tree planting in the different counties of the State during the years 1889 and 1890:

*Arapahoe.*—As near as I can ascertain, very few districts do much in the line of tree planting. Most of them would be glad to set out trees, but have no water to keep them alive, and therefore consider it useless to do so. Nearly all the schools have special exercises, on Arbor Day, relating to the subject of tree planting.—*A. D. Shepard, Co. Supt. of Schools, Denver, June 12, 1889.*

Arbor Day was duly observed here by planting four Box Elders, with appropriate exercises, on our school grounds. We have observed the day, by tree-planting, for the last three years.—*J. A. Fowler, Littleton, April 24, 1889.*

I have five acres of land along the road, and on one side an irrigating ditch. Have planted and kept in fine order 600 shade trees; they are four years old this spring. Can I obtain the \$10 premium, per hundred, according to the act of 1881? My trees are the finest in the country.—*S. M. Carlzan, Montclair, April 3, 1889.*

To show the genuine interest manifested, the certain faith our homesteaders have in the early prosperity of and the manner in which they are rapidly developing the Arickaree Valley, we give the names and number of trees, seeds and nuts that have been planted this spring, but we feel confident of being unable to secure all of the names of the persons who have enlisted in this good cause. The



report we give does not mention the ornamental trees, vines and shrubbery, which will count up into the thousands. (Then follows list of names, number of trees, etc.) The result gives as a total 267,750 trees, 688,600 seeds and 9,000 nuts. Suppose two-thirds of these trees, seeds and nuts grow, which is making a low enough estimate of those that will live, then we will have more than one-half million trees adorning our handsome prairies from this year's planting, to say nothing about what was planted last year, and the thousands that will be put in the ground each year for the next decade. Several thousand of the whole number are fruit trees of the select and various kinds.—*Arickaree Tribune, May, 1889.*

Prior to the last Arbor Day (1890), Mr. A. D. Shepard, the Superintendent of Schools in this county, sent circular letters to the boards of directors in the several school districts, calling attention to the Arbor Day Act, and directing observance of the same; also, that reports thereof be duly forwarded to his office. A summary of the reports so obtained is embraced in the following table:

FOREST TREE PLANTING BY THE PUBLIC SCHOOLS OF ARAPAHOE COUNTY, ON ARBOR DAY, 1890.

SPECIES OF TREES.	SCHOOL DISTRICTS AND TREES PLANTED.																							Total.
	NO. OF DISTRICT.																							
	1	2	4	6	12	14	17	19	24	27	37	38	41	44	47	57	16	61	75	80	81			
	NO. OF TREES.																							
Cottonwood . . . . .				8	10	4	5		5	23	1	20	12	8			15		5		20	50	186	
Elm . . . . .	1						3																4	
Box Elder . . . . .						5	3				14		8		7	10		5		10			62	
Willow . . . . .						2	3				10												15	
Maple . . . . .						2	3							4									9	
Ash . . . . .															5	10	24		6	8			53	
Plum . . . . .																7							7	
Catalpa . . . . .																7							7	
Cherry . . . . .						3																	3	
Locust . . . . .											10										5		15	
Poplar . . . . .																10							10	
Evergreen . . . . .		23													5				12				40	
Twenty-one districts. Grand total . . . . .																								411



School districts 23 and 63 planted a quantity of Apple and Box Elder trees.

Four districts reported no water, and nothing done.  
Eight districts held literary exercises.

In thirteen districts there is no permanent school house.

Eighteen districts reported no school in session on Arbor Day.

Twenty-seven districts made no report.

Total number of districts in the county, 93.

Extract from the *Rocky Mountain News*, of April 19, 1890:

Arbor Day was celebrated with enthusiasm. It was not confined, either, to the younger folks. In a tour around the city, a *News* reporter had no difficulty in fixing his journalistic optics on many children of larger growth, spade in hand, paying their tribute, first to the adornment of the city, and secondly to their own homes. Denver's glory, as she now is, is derived in no small degree from the luxurious growth of trees along her highways and byways, and too much importance cannot be attached to the continued acquisition of arboreal wealth.

Under date of October 10, 1890, D. S. Grimes, Esq., of Denver, wrote me as follows:

The past season in Arapahoe county, which is a fair index of all that part of the State lying east of the Rocky Mountains, has been, to a great degree, unfavorable to tree culture. The atmosphere, naturally arid, has been intensely dry through the summer. This, coupled with unusual shortage of water for irrigation, caused heavy losses, especially with newly planted trees. Although Arapahoe county is situated wholly in the plains region, there is a connecting link, governing cause and effect, that makes the mountains master of every industry connected with our soil products. This climatic influence and shortage of water we trace direct to the deforesting of the mountains. The injurious effect is not felt only on the plains but on the mountains as well. The scattering pine trees, refused by the lumbermen and spared by camp-fires, show no vigor or increase of growth, but are gradually dying from lack of moisture in the soil. The failing water supply, and the results that must follow, we look upon with apprehension.

Aside from lack of moisture in the soil, man is the principal factor in tree growing. Much depends upon the manner of tree cultivation. A late number of the *Iowa Homestead* states that three-fourths of all



the trees planted in that State fail to reach mature growth. One-half of this loss is placed to the fault of defective planting and cultivation, and the balance divided between climatic influence, want of adaptation and bad condition of trees when received. According to this, Iowa, notwithstanding her conditions of soil and climate favorable to timber growth, suffers a loss perhaps greater than occurs here, where the conditions essential to success depend upon artificial methods. But there are no good reasons for heavy loss, either there or here. Success in this, as in other things, depends upon the tree planter and his application of methods.

Laws for the encouragement of tree culture seem to have but little effect. Whether this arises from defective laws, or indifference of the people and public press, it is difficult to say; all may contribute to the result. While Colorado keeps abreast with other classes of scientific and educational progress, the most valuable and beautiful part of our common interests is sadly neglected. It would seem that the great and increasing value trees give to real property, and the refining influences and protection they afford to all classes, would, without other encouragement, lead to their unlimited cultivation in this State.

*Archuleta.*—Arbor Day was not observed by any of our schools. We have some good school buildings, but the arrangement of the grounds has not yet progressed sufficiently to warrant the planting of trees.—*C. H. Harper, Co. Supt. of Schools, 1889.*

Arbor Day was observed with appropriate exercises by such of our schools as were at the time in session. A few trees were planted on the school grounds, numbering in all 17 Spruces, 3 Pines and 12 Willows. This county being heavily timbered, tree culture has not seemed necessary, except to ornament public or private grounds, and as our county is new, but little attention has as yet been paid to that.—*W. P. Underwood, Co. Supt. of Schools, Pagosa Springs, 1890.*

*Bent.*—Arbor Day was not very well observed; will undoubtedly make a better showing next year. Seven thousand acres have been planted to Cottonwood, and previous to this season 5,000 acres of forest trees have been transplanted. Twenty thousand trees have been transplanted this season.—*Fred. C. Ford, Co. Supt. of Schools, Las Animas, 1890.*

*Boulder.*—The school children of this county observed Arbor Day by tree planting, music and recitations. I think greater interest was exhibited in the observance of the day through the county than heretofore. The number of trees planted is as follows: Soft Maple, 208; Box Elder, 94; Elm, 56.—*F. A. Shute, M. D., Co. Supt. of Schools, Boulder, 1889.*

Our school planted 31 trees. Five of these were Ash, 9 Maple, 8 Cottonwood, and the remainder of different kinds. Twenty-five rods more ditch were dug and the trees planted by the side of it. We



think the trees will all live. Aside from this, 25 Rose bushes and other shrubbery was planted. All of the work was done by the children in school. We are more than pleased with the results of Arbor Day. A great interest has been created on the subject among pupils and parents. I hope other schools have been as much benefited as ours.—*Florence Cornell, teacher, Hygiene, 1889.*

Prior to April 18, I addressed a circular letter to the different secretaries throughout this county, directing their attention to the act to establish Arbor Day, and recommended its observance by appropriate exercises wherever practicable. In addition to this notice to the district secretaries, I also addressed a letter through one of our county papers, to the citizens of Boulder county, recommending that they make special effort to observe Arbor Day by planting shade trees and shrubbery to beautify their homes. Reports from the several school districts show that the recommendation was generally complied with, wherever the school grounds were supplied with water. The slips enclosed are samples of reports received. The district report is especially significant in that it suggests that much may be done in fraternizing the people of a district upon such an occasion. The Boulder Public Schools celebrated by appropriate exercises and tree planting, the pupils themselves taking part in the planting. Some of the school premises in this county are so situated that it is a difficult matter to irrigate them properly; but where water can be brought upon the school grounds, I have induced the Boards to take steps in that direction for the coming year. So far as I have been able to ascertain, not less than 1,500 trees were planted in this county on Arbor Day this year, the principal varieties being Maple, Box Elder, Cottonwood and Elm.—*W. V. Casey, Co. Supt. Schools, Boulder, 1890.*

*Chaffee.*—None of the schools took any action as regards planting of trees. There must have been 4,000 trees planted in the county, mostly Cottonwood and a few Maple and Ash.—*Jacob Kagey, Co. Supt. of Schools, Buena Vista, 1889.*

Arbor Day was observed with appropriate exercises in many schools throughout the county. Owing to the fact that some school houses are surrounded by native groves, and others too remote from the necessary water supply to keep trees alive, there were no trees set out in those districts. The interest in the day was maintained by programs having a direct bearing on the intention of the day. At Salida the public schools held exercise in one of the churches, and 25 Aspen trees were planted. At Buena Vista the principal in charge arranged a beautiful literary program after outlines prepared by Superintendent Dick. After the conclusion of the literary program 30 trees were planted, mainly Box Elder and Cottonwood. These were grouped about the school grounds with a view to naturalness of effect, as well as utility. In the county generally a large number of



fruit and shade trees have been planted during the past year. It would be quite impossible to state the exact number, but the number will not fall below 4,000. As far as tried, Box Elder and Cottonwood are preferred for shade trees, being the most rapid growers and not requiring as much water as other varieties.—*Lee Champion, Co. Supt., Buena Vista, 1890.*

Three thousand trees, from Four Mile, near Cañon City, were planted at Salida, under direction of the Mayor.—*Exchange, 1890.*

*Cheyenne.*—There was no observance of Arbor Day in this county, it being too dry in this locality for planting trees.—*S. C. Perry, Co. Supt. Cheyenne Wells, 1890.*

A great deal of tree planting has been done in Cheyenne county this Spring. L. N. McLane has planted 40,000 trees, A. B. McKinley 25,000, and L. Gudgel 25,000.—*Exchange, 1890.*

*Clear Creek*—A large number of trees were planted this year by the pupils of our public schools; and in addition the citizens of this county have planted very generally. The number will, I think, exceed 1,500, consisting of the Cottonwood and Aspen varieties.—*Henry Bowman, Co. Supt. Idaho Springs, 1889.*

There were no formal Arbor Day exercises held in Clear Creek county this year, and yet about seven hundred (700) trees of different varieties have been planted during the season.—*Ibid., 1890.*

The people, notwithstanding the pleasant weather, failed to observe the rule set down for Arbor Day. The only trees planted were those put in around the public school building. In extenuation of their seeming neglect in observing the Governor's proclamation, is the fact that Spring weather still lingers in the lap of Winter. Trees planted in cold weather will not thrive in this high altitude.—*Rocky Mountain News, April 18, 1890.*

*Conejos.*—So far as I know, including Arbor Day, there have been about eight hundred trees planted in this county this year. As to varieties, I can give you no definite information.—*C. H. Prickenstein, Co. Supt., Alamosa, 1889.*

Arbor Day was observed in ten districts out of twenty-four in Conejos county. In the fourteen where the day was not observed, school was not in session on the day appointed. The exercises consisted in following out the plans proposed in the excellent circular sent out by State Superintendent Dick, after which trees were set out on and near the school grounds.—*S. A. Norland, Co. Supt., La Jara, 1890.*

Let me add a line in regard to my own experience with forest trees in Colorado. Since coming to the San Luis valley, five years ago last spring, I have set out several thousand trees of different varieties, but have not been as successful as I had hoped for. Have planted



hardy Catalpa, Russian Mulberry, Black Locust, American Elm, Soft, Hard and Norway Maple, Box Elder, White Ash, Black Walnut, Laurel-Leafed and Gray Willow, and Broad-Leafed Cottonwood. Of all these, I have had the greatest success with the White Ash. Though slow of growth, this beautiful tree is least affected by the extremes of heat and cold during the winter months. The Box Elder does very well, though in the Spring I often find the north side of the main trunk alive and the south side dead—scorched by the hot mid-day sun of winter, and then chilled by the cold nights; especially so in the most exposed rows. Cottonwoods do well, but, in my opinion, are but little better than nothing. All the other varieties tried (except the ones named and the willows) have died down to the ground during the winter, but most of them have come up again the following spring.—*Ibid.*

*Costilla.*—The schools of this county have planted—say 400 shade trees, and private parties about 2,000 more.—*Fred Etter, Co. Supt. Fort Garland, 1889.*

During the month of May about 10,000 shade trees were planted in this county.—*Ibid.*, 1890.

*Custer.*—There was no observance of Arbor Day in this county. No water facilities; and the day comes at a time of year when our heaviest snow storms occur. Snow from 18 inches to 2 feet deep at that time.—*J. P. Wright, Co. Supt., Westcliffe, 1889.*

In April, 1890, Mr. Price Walters, the present county superintendent of schools, made a report similar to the foregoing. I then informed him that the presence of snow, or other local climatic disturbance, though preventing the planting of trees, was not sufficient cause for the non-observance of Arbor Day, by appropriate exercises, as an examination of the law would disclose. That the act was mandatory, and that its observance, or non-observance, was not left to the discretion of school officers.

Under date of October 13, 1890, Mr. Walters wrote me as follows:

Very little has ever been done in the way of planting forest trees in this county, and what little has been done has not been a success. Only the hardier kinds of trees will grow here, such as Aspen, Pines, etc. Maple, Walnut, Ash and others have been tried, but invariably winter-kill. Some varieties, as Oak, Willow and Birch, which grow to trees in lower altitudes, here merely form shrubs. In the eastern part of the county the Cottonwood does fairly well, but grows exceedingly



slow and never makes timber of any size. Arbor Day exercises were held in more schools in this county this year than ever before.

*Delta.*—But four of our school grounds are fenced as yet, but I think that by next spring we can give a good report. This being a newly opened country, my first object has been to get the schools in shape. The number of trees planted is about as follows: Cottonwood, 200; Box Elder, 75; Evergreen, 60.—*J. B. McGinty, Co. Supt., Hotchkiss, 1889.*

Arbor Day exercises were generally observed in the schools of the county. To the best of my knowledge, there has been planted in the county since last January, forest trees as follows: 3,550 Black Walnut; 350 White Ash; 600 Hard Maple; 1,450 Box Elder; 150 White Elm; 250 Wild Black Cherry; 1,000 Catalpa; 2,500 Russian Mulberry; 50 Gray (green) Ash; 4,200 Cottonwood—different kinds; 300 Black and Honey Locust; and 12,000 fruit trees, mostly apple. Mr. Jas. W. Still states that "the Honey Locust grew six feet last year; the Box Elder made the next best growth; White Ash and Catalpa next. The Black Walnut and Wild Cherry made the poorest growth of any. Lost seven per cent. of all I planted." The soil varies from sandy clay loam to the roughest adobe. The trees upon the mesas seem to do best, owing, perhaps, to freedom from frosts in spring and autumn, as compared with the valleys.—*P. M. Condit, Co. Supt., Delta, 1890.*

*Dolores.*—No trees were planted in this county, to my knowledge, nor was there any observance of Arbor Day. The county is heavily timbered, and has no ranches or agricultural land under improvement.—*J. O. Campbell, Co. Supt., Rico, 1889.*

We did not observe Arbor Day, as we are surrounded by forests, and are here only for a day.—*F. Roys, Co. Supt., Rico, 1890.*

*Douglas.*—About 400 trees were planted in Castle Rock this spring. No other extensive planting; 1,000 would be a fair estimate for the county. Arbor Day not generally observed. Trees hard to get, and mostly planted a few days later.—*P. H. Hammond, Co. Supt., Castle Rock, 1889.*

Arbor Day was generally observed where irrigation was possible. Unfortunately, but few of our schools are so situated that water can be obtained. Most schools observed Arbor Day exercises without tree planting. At Castle Rock, the present year, about 250 Cottonwoods, 50 Box Elders, and 100 Evergreens were planted. Other parts of the county did not plant extensively, except on timber-culture claims. Not less than 40,000 trees and cuttings have been planted on claims, of which Black Locust predominates, followed by Cottonwood, Pine, Box Elder, Walnut, etc. I believe that Locust does the best without irrigation.—*Ibid, 1890.*

*Eagle.*—No observance of Arbor Day was had in Eagle county and no trees planted. The only part of Eagle that is not very new



is the mining district, and in it there are more trees than there is demand for. In the near future we hope to do something in this line.—*James Dilts, Co. Supt. Schools, Red Cliff, 1889.*

In Eagle county no observance of Arbor Day was had. Eagle lies on the west slope, and reaches the summit. It abounds everywhere with trees. Only small strips of land along the streams are available for agriculture, and these narrow belts are too precious to grow trees on when on all sides the mountains are covered with the natural growth. In a few places trees might be planted, with profit, for shade or ornament about buildings, and a very few persons have planted fruit trees as an experiment. What Eagle county most needs is protection for the natural growth of trees. Forests are being destroyed very rapidly.—*Ibid., 1890.*

*Elbert.*—Forest-tree seedlings, including Catalpa, Elm, Ash, Box Elder, Locust, Mulberry and Maple, have been planted in this county the present year, to the number of 100,500. This does not include any that were raised from seed last year and transplanted, nor shrubs, vines, etc.—*B. C. Killin, Co. Supt., Kiowa, 1889.*

Arbor Day was observed generally by the schools of the county. Most of them planted some trees; some planted shrubbery and some seeds. None of the school grounds are under irrigation. Forest trees were planted in the county as follows: Maple, 3,500; Ash, 7,000; Walnut, 200; Elm, 600; Locust, 500; Russian Mulberry (seedlings), 10,000.—*Ibid., 1890.*

*El Paso.*—Arbor Day was generally observed by the public schools of the county. Appropriate literary exercises and addresses were had. But few trees were planted, except in the Colorado Springs district (No. 11), owing to the fact that provisions for irrigation had not been made. At the Colorado Springs schools, 13 White Maple and 18 Elms were planted. The trees were each dedicated to some eminent person. Many citizens participated in the exercises. At Colorado College a few trees were planted, with appropriate exercises.—*R. Berrey, Co. Supt., Colorado Springs, 1889.*

It is said 200,000 trees will be planted in the vicinity of Falcon, El Paso county, this spring, several ranchmen planting as high as 16,000 to 20,000 on timber claims. The nurserymen who furnish these trees say that where corn will grow without irrigation trees of several varieties, such as the Catalpa, Locust, Maple and small fruits, will grow. It has been proved beyond a doubt that corn will grow and ripen at Falcon if planted early, therefore we expect to see quite a number of groves there in the course of a year or two.—*Colorado Springs Gazette, 1889.*

Arbor Day was observed in El Paso county, both as a holiday and for its more specific objects—that of tree planting and of creating and fostering a just public sentiment in this behalf. The following



is a condensed statement of the observance of the day at the Colorado Springs public schools:

At the High School no trees were planted, as the school is not occupying a building of its own. The exercises here consisted of readings, recitations and music.

At the Garfield school, the indoor exercise consisted of songs, selections, essays and papers. Four Elms, four Box Elders and two Soft Maples were planted, with the usual ceremonies. The exercises of the various grades were combined, and a large flag was hoisted for the first time. Many visitors were present.

The Arbor Day exercises at the Liller school were of a varied and interesting character, consisting of songs, recitations, declamations and quotations indoors, and tree planting in the school grounds. A number of Elm and Maple trees were planted, and dedicated to particular persons.

The exercises at the Lincoln school consisted of recitations, songs and devotional exercises, and the planting of three trees—two Elms and one Maple.

At the Colorado City public school the program included literary exercises, music and tree planting. Twelve trees in all were planted, consisting of Elm, Ash, Cottonwood and Catalpa.

At Manitou the day was appropriately observed, and twenty-five Elm and Maple trees planted.

At Monument the Arbor Day exercises consisted of readings, recitations and addresses indoors, and tree planting in the school grounds. Sixteen trees were planted, consisting of Cottonwood, Spruce and Cherry.

The exercises at Fountain included music, recitations, quotations, a flag presentation and tree planting. Thirty-eight trees were planted, consisting of Cottonwood, Mulberry, Cherry, Plum and Apple; also a quantity of shrubbery.

Arbor Day exercises were held in many of the other schools of the county, and trees would have been planted if proper facilities for irrigation and protection had been provided. The main purposes of Arbor Day—that of promoting public sentiment for the protection of forests and an increase of tree planting—have made a most praiseworthy advance this year.—*R. Berry, Co. Supt., Colorado Springs, 1890.*

*Fremont.*—Arbor Day was observed in Cañon City by general tree planting. In the public school grounds at Florence thirty-two Cottonwood and fifteen Hard Maple trees were planted. They have ample means for irrigation. No reports have been made to me from the different sections of the country.—*B. G. Woodford, Co. Supt., Canon City, 1889.*



No reports have been made to me concerning Arbor Day observances in this county, although notices were published and circulars sent out requesting the same. The schools in Cañon City followed the program that was sent out, which proved interesting, and was doubtless profitable. Mr. Dall De Weese gives the number of trees planted in this county, the present season, as follows: Fruit trees, 9,000; forest trees, 5,600.—*Ibid.*, 1890.

*Garfield.*—Arbor Day was generally observed throughout the valley. Among the schools, where the districts owned the land, and water was convenient, trees were planted with appropriate ceremonies. In the years 1889 and 1890, more trees were planted here than during all the time previous in the history of the county.—*Sam. M. White, Co. Supt., Glenwood Springs, 1890.*

*Gilpin.*—No tree planting on Arbor Day. We have no school grounds. The mountains here are so abrupt that if space enough is gained on which to build a school-house, we are fortunate. Another drawback is the lack of water for irrigation. Literary exercises, music, etc., were had in the various schools, and efforts made to enlighten the pupils as to the objects of Arbor Day.—*E. F. Lake, M. D., Co. Supt., Central City, 1889.*

No enthusiasm felt, and little hope of arousing any in tree planting here. Nobody cared to have any exercises on Arbor Day. The schools gave it public recognition by exercises and a half-holiday, and some trees were planted. I planted three Aspen and one Pine in my yard on Arbor Day. A neighbor planted six Pines the next day, and yesterday a team came in with a load of young Cottonwoods. There is not soil enough on our school yard to support trees, even if there were provisions made for proper care and watering. Shall endeavor to do more on next Arbor Day.—*F. B. McLeod, Co. Supt., Central City, 1890.*

*Hinsdale.*—Arbor Day was observed at the Lake City school, with appropriate exercises. Afterward, tree planting was done by the different classes, and a large number planted. The people of the town have planted many trees in front of their residences. Our town presents a very beautiful appearance, as most of the streets are nearly lined with the beautiful Cottonwood trees. More trees have been planted this year than ever before.—*W. S. Elmendorf, Co. Supt., Lake City, 1890.*

*Huerfano.*—Little has been done in forest tree planting, save my nursery at Beulah of 50,000 Evergreens. At Pueblo and Beulah the Ash, Soft Maple, Elm, Cottonwood and Poplar have been planted considerably for shade and ornament. Lack of water will prevent extensive planting.—*C. S. Harrison, Beulah, 1890.*

*Jefferson.*—No general observance of Arbor Day in this county. Weather disagreeable. No reports made to me.—*J. S. Eagleton, Co. Supt., Golden, 1889.*



Out of forty-two districts I have received reports from twenty. More than one-half of our districts are in the mountains, and the school-houses are surrounded by Pine and Evergreen trees. In the valley, where they can obtain water, most of the districts have planted trees. Appropriate exercises were held where the schools were in session on Arbor Day. About fifty trees were planted in the city park by the citizens of Golden. Many of the citizens observed the day by planting fruit and forest trees. The districts reporting, report eighty-six trees planted, all forest trees.—*Ibid*, 1890.

*Golden, Colo., April 18.*—Arbor Day was observed by the public schools and citizens of this city by planting a large number of shade trees in the public park and on private grounds. At the tree-planting exercises held in the park this afternoon, under the auspices of the city council, Lieutenant-Governor Smith made a very appropriate address, replete with good advice to the growing generations of the young commonwealth.—*Rocky Mountain News*, 1890.

*Kiowa.*—In the spring of 1890, Mr. F. E. Torbit, the County Superintendent, addressed a circular to the school officers and teachers of Kiowa county, requesting a due observance of Arbor Day. What the result was, I have no means of knowing, as no report was received by me.

*Kit Carson.*—Parties here allege that Cottonwood trees are a failure, except upon low lands; they say there is a good growth for a few years, and then the trees die. Box Elder promises to be one of the hardiest species for the plains. A person near this place set out 100 Box Elder seedlings last spring on newly broken sod, and but few of them died, although they had but little cultivation during the summer. He also had good success with *Catalpa speciosa*, under similar conditions. I think it would be well to raise a crop of sod-corn on the ground the first year it is plowed, and let the stalks stand during the winter to catch the snow; this, melting, would leave the soil in good condition for spring planting. It does not, however, seem probable to me that a large or permanent growth of forest trees can be had without more moisture in the subsoil.—*D. S. Harris, Burlington*, 1888.

Our county was not organized until after Arbor Day had passed, hence I have been unable to get but little information as to its observance by the schools.

As nearly as I can determine, there were about two thousand acres of land in this county set to forest trees last spring. Most of these were set on timber claims. Many claims were planted to tree seeds also. Box Elder, Ash, Black Locust, Black Walnut are the species of tree seeds planted. Ash, Box Elder, Black Locust, *Catalpa*, Black



Walnut, Ailanthus, Russian Mulberry, Willow, Soft Maple, Lombardy Poplar and Cottonwood are the species of forest trees set out. The number of each being about in the order named. Where the ground was properly prepared and the trees carefully set out and cultivated during the season, the trees have made a very fair growth. I have seen Black Locust grown from seed planted last spring which measured 4 feet 6 inches, Box Elder, two years old, measuring 7 feet, Lombardy Poplar and Cottonwood cuttings making a growth of 3 to 4 feet the first season. It must be remembered that Kit Carson county is situated in the "Rain-Belt," and these trees are entirely dependent upon the rain-fall for moisture. The hot winds seem to have little effect upon them, except where the ground is weedy and poorly cultivated. Black Locust, Ash, Lombardy Poplar and Cottonwood seem to be the hardiest species, as shown by the test last winter. It is proposed by some to set out alternate rows of Cottonwood and Ash, the Cottonwood making a rapid growth and giving protection to the ground. When they begin to crowd the other trees cut out the Cottonwood.—*D. S. Harris, Co. Supt., Burlington, 1889.*

The enclosed statement shows the tree planting in Kit Carson county during the spring of 1890. I sent out blank forms for reports to each of the forty-seven school district secretaries of the county, and have received reports from twenty-eight of them. From this I feel safe in saying that the statement does not represent more than one-half of the trees set out in the county this season. Where the ground was properly prepared and the trees were carefully set, they are growing well. Trees set last year are making a vigorous growth this season. I am still further convinced that it is not profitable to plant tree seeds on timber claims with the idea of making a permanent stand. They are so difficult to cultivate that, in most cases, a complete failure is the result.

Quite a number of the schools observed Arbor Day, using the order of exercises furnished by the State Superintendent of Public Instruction. Trees were planted and grounds fenced, etc. A beginning was made and an interest awakened in the subject. More work will be done in this line another season.—*Ibid, 1890.*

In addition to the tree planting shown in following table, a large number of tree seeds were planted in Kit Carson county the present year; the principal variety being White Ash, Box Elder, Black Walnut, Honey and Black Locust.



*Showing the Number of Trees Planted in Kit Carson County during the Spring of 1890. From the Report of D. S. Harris, Co. Supt. of Schools.*

[illegible]



*Lake.*—LEADVILLE, Colo., April 18, 1890.—Arbor Day was appropriately observed to-day at the Central school and the Ninth street. Interesting exercises were held, and a large number of evergreen trees were planted. There were nearly 2,000 people present to witness the exercises, which were in charge of the pupils of the two schools. The program had been carefully prepared, and the pupils of the schools deserve great credit for the manner in which the affair passed off.—*Rocky Mountain News*, 1890.

*La Plata.*—An estimate of the number and kinds of forest trees planted in La Plata county this season, is as follows: Cottonwood, 350; Box Elder, 300; Elm, 25; Maple, 100; Aspen, Spruce, etc., 25; total, 800.

I advertised Arbor Day as widely as possible, and much interest was manifested. It was celebrated at Animas City school by the planting of 50 trees, and in the city schools of Durango by appropriate and very interesting exercises; but no trees were planted at the latter place for lack of water. But the grounds are now placed under hydrant service from the city waterworks, and many trees will be planted in the school grounds next Arbor Day. The trees planted last year and theretofore, are doing exceedingly well, and already add much to the appearance of the city. The Broad-leaf Cottonwood has decidedly the most rapid growth, and is the handsomest tree of any yet planted here.—*T. J. Jackson, Co. Supt., Durango*, 1889.

About 3,500 trees were planted in this county in the month of April. Arbor Day was quite generally observed in the public schools of the county, and considerable interest was manifested by our citizens.—*C. A. Pike, Co. Supt., Durango*, 1890.

*Larimer.*—745 trees are growing upon our school grounds, of which about 300 were planted this year. There are fifty-five districts in the county, thirty of which are in the valley. Those in the mountains have a natural growth of timber, and are not embraced in this report.—*S. T. Hamilton, Co. Supt., Fort Collins*, 1889.

Nothing was done this year further than the replacing of trees that died during the winter.—*Ibid.*, 1890.

*Las Animas.*—Arbor Day was duly observed as a holy day, but no shrub or shade trees were planted on school grounds, nor by pupils at their homes, to the best of my knowledge.—*M. Beshoar, Co. Supt., Trinidad*, 1889.

Up to the present time there has been planted some 3,000 Apple and Crab-Apple trees in Las Animas county. Probably not over fifteen tree claims have been planted in the county, the past two seasons being so dry as to discourage that kind of planting. In this city no school was held on Arbor Day. Some 4,000 trees were planted—Box Elder, Locust and several varieties of Maple. The west half of



the county is well supplied with native timber. The Maxwell grant company is making havoc with timber on the grant. Enclosed is copy of a circular addressed by me to all directors of school districts.—*Geo. C. Shiels, Co. Supt., Trinidad, 1890.*

*Lincoln.*—Arbor Day was not observed here this year. Several timber claims were taken in this county the past year, but no forest trees planted yet that I know of, except in this town (Hugo). Last spring young Cottonwood trees were planted along the sides of streets, perhaps 500 in all. Our county is new (created April, 1889). It has heretofore been a great grazing region, but settlers are coming in and breaking land fast.—*H. A. Lowell, Co. Supt., Hugo, 1889.*

No Arbor Day tree planting. The schools had a holiday, but owing to the situation of the school houses, on the dry prairie, it was deemed useless to plant trees.—*Ibid., 1890.*

*Logan.*—Nothing done on Arbor Day in this county, so far as I know.—*W. B. Wheeler, Co. Supt., Sterling, 1890.*

*Mesa.*—On Arbor Day public exercises were held by the children of the schools. 200 trees were planted on the school grounds of Grand Junction, prior to the regular day, the season being early here. No other tree planting, to my knowledge.—*D. T. Stone, Co. Supt., Grand Junction, 1889.*

Mesa county has planted something like 1,000 acres in fruit this year. Arbor Day was observed in the Fruita district, where the afternoon was devoted to suitable exercises and the planting of 24 shade trees, Maple, Cottonwood, Catalpa, etc.—*E. T. Fisher, Co. Supt., Grand Junction, 1890.*

*Montezuma.*—Most of the schools were not in session on Arbor Day. Cannot inform you as to trees planted. There are probably ten timber-culture claims in this county.—*J. O. Miller, Co. Supt., Cortez, 1889.*

*Montrose.*—Arbor Day was observed by eight districts, and 40 Box Elders, 10 Ash, 20 Lombardy Poplars, 14 Maples and about 100 Cottonwoods were planted.—*John J. Tobin, Co. Supt., Montrose, 1889.*

During the spring and upon Arbor Day there has been about 12,000 trees planted in Montrose county, including fruit and shade trees. Among the latter, about one-half are Cottonwood, and the remainder consist of Catalpa, Soft Maple, Box Elder, Ash and Lombardy Poplar. Seven school districts held Arbor Day exercises.—*Ibid., 1890.*

*Morgan.*—The schools of Morgan county were active in tree planting, on Arbor Day, and the citizens were also interested. The town of Fort Morgan planted 2,000 trees—250 of which were planted on the school ground. The Brush school planted forty trees on their school grounds, and a number of the citizens planted on their private



grounds. Cottonwood, Box Elder, Catalpa, Carolina Poplar and Elm were the principal varieties.—*Wm. E. Garver, Co. Supt., Fort Morgan, 1890.*

*Otero.*—Mr. S. R. Lyon, the superintendent of schools for Otero county, in the spring of 1890, addressed a circular-letter to the school boards, parents and guardians in that county, urging the importance of observing Arbor Day; the result of which was not reported to me.

In a recent letter from J. H. Crowley, a nurseryman at Rocky Ford, it is stated that but little was being done in the way of forest tree planting, except on timber-culture claims. That about 400 acres had been thus planted, and that a much greater area would be used for the same purpose. The writer further stated that Soft Maple, Ash, Ailanthus, Elm, Cottonwood and Box Elder were growing finely; that Black Locust had grown to a height of five feet from seed planted last spring; Ailanthus, eight feet; Box Elder and Honey Locust, fire feet; Soft Maple, three; Ash, two and one-half; Cottonwood, seven to ten.

*Ouray.*—Not many of the schools were in session on Arbor Day. At Ouray there was an elaborate and appropriate observance of the day by the schools and city. A number of trees were planted on the school grounds, but not many, the space being limited. In the school grounds of Districts Nos. 1 and 3 there were planted twelve Box Elders, eight Cottonwoods and two Spruces. The county is plentifully supplied with natural groves of Pine, Cottonwood and Box Elder.—*P. H. Shue, Co. Supt., Ouray, 1890.*

*Park.*—Owing to the great altitude of this county, and the severe storms prevailing at that time, tree-planting on Arbor Day was generally disregarded. An interest has, however, been awakened that may hereafter produce desirable results.—*T. W. Duff, Co. Supt., Alma, 1889.*

The weather was very cold in this county on, and for sometime after, Arbor Day—hence nothing in the way of forest or tree-planting was done.—*Ibid., 1890.*

*Phillips.*—But few school districts observed Arbor Day in this county. Some did, however, planting Catalpa and Cottonwood mostly. It is estimated that at least 500 timber-culture claims in



this county are receiving attention, and that an average of five acres have been planted to each claim, making, say, 2,500 acres in all. Trees grow much better than seeds, when planted, and Cottonwood take the lead. Honey Locust, probably, grows better from the seed than any other kind. The kinds named above, and Catalpa, Box Elder and Ash, are the leading varieties.—*Oscar Trego, Co. Supt., Holyoke, 1889.*

The schools of the county, that were in session at the time, observed Arbor Day in some way. At many of them, where the ground had been prepared, trees were planted. At other schools, where the grounds were not in suitable condition for the planting, appropriate exercises were had. The program, as prepared by Superintendent Dick, was carried out, and a decided interest in the work was manifested throughout the county. This will, I believe, do much to encourage tree planting in the future. Probably three hundred trees were planted by school children on Arbor Day.—*Chas. B. Timberlake, Co. Supt., Holyoke, 1890.*

*Pitkin.*—Mr. J. W. Deane, County Superintendent, under date of May 31, 1889, reported that inclement weather had prevailed on Arbor Day, that the intention was to set apart a day in June for the purpose, but that the sudden closing of the schools prevented. He asked if the observance of a day in the fall would not be advisable; to which I replied in the negative.

Frank A. Shepard, Esq., chairman of the Board of County Commissioners, advised me that in the spring of the present year (1890), about one thousand trees—principally Cottonwood—were planted in Aspen.

*Prowers.*—The schools of only four districts were in session upon Arbor Day. Those observed the day by planting about 200 Cottonwood trees in connection with other appropriate exercises. The county being new and the school districts not owning grounds, the day was not observed as it would have been otherwise. Circular letters upon the subject were sent by me to the various school officers and teachers in the county. An elaborate program, including tree planting, was carried out by the city schools at Lamar. To the best of my knowledge, there has been planted in the county this spring about 150 acres to Black Locust, 350 acres to Cottonwood, and 60 acres to Catalpa.—*G. T. Feast, Co. Supt., Lamar, 1890.*

*Pueblo.*—I do not think any trees have been planted here on Arbor Day this year, owing to the lack of water to irrigate them.—*C. F. Taylor, Co. Supt., Pueblo, 1889.*



About twelve districts observed Arbor Day by appropriate exercises, but having no water for irrigation did not plant trees. This is the first year any interest has been taken on the subject here. Quite a number of districts are making arrangements to secure water another season. Trees were planted this year as follows: 50 Catalpas, 50 Box Elders, and 4 Cottonwoods.—*J. P. Thurman, Co. Supt., Pueblo, 1890.*

*Rio Blanco.*—Arbor Day was not publicly observed in this new county, and our public schools were mostly closed at that time. Some private citizens planted forest trees on that day, mostly Cottonwood, but to what number I can not state. I know of two who put out about 200.—*G. S. Allsdrook, Co. Supt., Meeker, 1889.*

I have not previously made report to you of our Arbor Day work, because we accomplished so little, as schools; all our school-houses being beyond the reach of irrigation. We called the school and citizens together in the town of Meeker, and conducted appropriate indoor exercises, but planted no trees. A committee was appointed to request the town council to plant more trees in the public park, which resulted in the planting of about five hundred broad-leaf Cottonwoods and Box Elders; and a few of the ranchmen in the country planted trees along the roads. We are advising that all new school-houses be built where trees will grow. No trees have yet been planted for timber. Our forests have been well cared for, no more timber having been cut than is absolutely necessary for domestic use. Before next Arbor Day, we hope to be in shape to accomplish something.—*C. W. Foreman, Co. Supt., Meeker, 1890.*

*Rio Grande.*—Three hundred trees were planted in this county on Arbor Day. Monte Vista was the only place that observed the day by planting trees.—*Seigel Heitman, Co. Supt., Monte Vista, 1889.*

Little interest is taken in forestry matters in our county, and what surprises me most, is that those whose interests may be most deeply affected by circumstances growing out of forest conditions, show the least interest in forestry matters. Our School Superintendent says one-half of the schools in the county have observed Arbor Day in planting trees around their school-houses. Shade and ornamental trees are generally planted around the houses of the people. Forest trees for wind-breaks and general protection are very scarce, and I am unable to learn of any trees being planted for forest purposes, except on a few timber-culture claims. Forest trees are of slow growth in our valley, it being 7,500 feet altitude, and extremely dry during a greater portion of the growing season. People are very slow in engaging in any business where the question of profit does not enter. Exemption from taxation on tracts of ten and twenty acres, or more, might prompt a few people to plant trees; the influence of example might reach others. If it were possible to



make the growing of forests a source of profit, our experimental stations might determine the soils suitable, the better kinds of trees to plant, and the cultivation and care necessary.—*Alonzo Hubbard, Monte Vista, 1890.*

*Routt.*—Shade and forest trees have been planted in this county to a considerable extent; the Cottonwood more than any other. Maple, Box Elder, Locust, etc., have been set out in small quantities. The prospects are fairly encouraging.—*J. H. Crawford, Steamboat Springs, 1890.*

*Saguache.*—Arbor Day was observed in this county by the closing of the principal schools; but so far as I am able to learn, no trees were planted by any of the schools, owing to the fact that but few of the country schools are so situated as to preserve or protect them. Several hundred trees were planted in the town by individuals, and quite a number of our farmers set out Cottonwoods. In the matter of timber-culture in this county, Chas. P. Phillips planted 10,000 Cottonwoods this spring, and already had about the same number of other varieties planted. Michael White has five acres of fine Cottonwoods growing on his timber claim, it being the only one in this land district upon which proof could be made. From both of these persons I learn the hard and soft Maple, Black Walnut, Locust and Mulberry will grow during the summer, but freeze off at the ground in winter, thus preventing any material growth. After the native Cottonwood, the Broad-leaf Cottonwood seems to thrive best in this county.—*T. M. Lyons, Co. Supt., Saguache, 1890.*

*San Miguel.*—A reference to your letter files would have shown you, without writing to me, that I had already informed you last year that the conditions here are such that trees are a disadvantage. In that same letter I informed you of my sincere interest in the cause of tree culture in general.—*H. C. Lay, Co. Supt., Telluride, 1889.*

There has been no tree planting in the part of the county where I was located, and I presume very little in any part of the county. The timber in the mountains is being rapidly destroyed by lumbering operations and fire. Entire mountains are now bare which a few years ago were green with trees, principally Spruce. I suspect that what is true of any mountain mining camp where the people care for nothing but the mineral, and are not making permanent homes, is true of San Miguel county.—*Rev. J. Spencer Voorhees, Pueblo, 1890.*

*Sedgwick.*—I have no report of the observance of Arbor Day in this county. There has been a large number of trees planted here, as near as I can tell about as follows: Ash, 500,000; Box Elder, 200,000; Cottonwood, 75,000; Honey Locust, 100,000; Mulberry, 50,000; Catalpa Speciosa, 75,000; other varieties, say, 200,000.—*E. H. Stevens, Co. Supt., Julesburg, 1890.*



*Summit.*—We observed Arbor Day, with appropriate exercises, in our only school in session, and think we accomplished a great deal of good by making it a holiday. While the snow prevented us from even attempting to plant any trees, we have impressed the necessity of protecting our native forests upon all our people.—*B. A. Arbogast, Co. Supt., Breckenridge, 1889.*

The report for 1890 was similar to the above.

*Washington.*—There was only one school district in the county that practically observed Arbor Day, though most of the schools then in session had suitable exercises. The reasons why the day was not otherwise observed, were that the school-house grounds were not in a suitable condition, being unbroken, and not fenced. In school districts Nos. 2 and 3, the grounds were set with trees last year. A large percentage of them survived the winter, and at present are growing nicely. The species planted are mostly Box Elder and Ash. The people of the "rain belt" realize fully the importance of growing trees in the development of their country, and I must say that their efforts in that line are truly commendable, considering the difficulties under which they labor.—*E. M. Forbes, Co. Supt., Akron, 1890.*

*Weld.*—On Arbor Day our people after appropriate exercises planted 7 Lombardy Poplars, 4 Cottonwood and 6 Plum trees.—*S. W. Mellotte, Principal, Evans, 1889.*

No other report than the above was received from Weld county in 1889.

I have been unable to obtain reports from more than two or three districts in the county. Eight or ten class-trees were planted by the High School in Greeley, and a similar number by the school in District No. 52. In and around Erie, more than 1,600 trees were planted.—*W. C. Thomas, Co. Supt., Greeley, 1890.*

*Yuma.*—As our country is new and has but few school-houses, not many trees were set out. Hundred of thousands, however, were planted on timber-culture claims, consisting mostly of White Ash, Box Elder, Honey Locust, Russian Mulberry and Walnut.—*W. Curtiss, Co. Supt., Yuma, 1889.*

Arbor Day was observed by a good part of the schools of this county, which were in session at the time. Exercises were held in ten schools, and the pupils entered into the work with interest. In many of the schools the exercises were instructive. About 200 trees were planted. Ash, Box Elder and Cottonwood being the chief varieties. In some of the schools each pupil was allowed to plant, name and care for one tree. The interest taken in tree planting is increasing in this county.—*M. W. Haver, Co. Supt., Yuma, 1890.*



### Trees for the Plains.

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The problem of finding, or developing, a tree, or trees adapted to the ordinary conditions of our semi-arid plains is, as yet, an unsolved one, although the experiment of Mr. Long, at Rotherwood, referred to on a previous page, may throw much light on the question.

In the spring of 1888, I procured from Professor J. L. Budd, of the State Agricultural College of Iowa, about three thousand cuttings of certain varieties of Russian Willow and Poplar, recommended by him as hardy, and eminently adapted to the Western plains. The cuttings were distributed to one hundred or more of our citizens, in different sections of the State. Request was made that they carefully plant and cultivate them, giving them enough water to insure their growth. It was hoped that a good supply of material might thus be provided for future experiments. From recent reports concerning them, I regret to say that a large proportion of the cuttings were lost through neglect and lack of sufficient water. A few persons, however, have by the due exercise of care and attention, given the plants a good start, and their further progress will be noted with interest. I have on my own grounds some of the plants well established, and likely to make thrifty trees.\*

The following is a summary of the reports received from those who have been more or less successful in growing the Russian trees:

Full notes have been taken on the stock during the season, an account of which will be rendered as soon as I can complete another report.—*James Cassidy, Botanist and Horticulturist, State Agricultural College, Fort Collins, Colo., Oct. 17, 1889.* †

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\* The young trees, last mentioned, were transplanted to the grounds of the Denver and Lookout Mountain Resort Company, near Golden.

† The death of Professor Cassidy occurring soon after the above was written, no further report was received from him.



I have never come into possession of any manuscript notes left by Professor Cassidy, and have but the record of yearly reports. I enclose such notes as appear in the Station report of 1888-89. I found standing in nursery rows, when I came here last spring, only three of the species mentioned in your list. These are *Salix fragilis*, *S. laurifolia* and *S. aurea*. They had made some growth, but were too much crowded. I had them transplanted, giving them more room, and though the transplanting was done late, some of the trees have made a fair growth. *S. aurea* was somewhat killed back during the winter; it does not appear to be hardy; but *fragilis* and *laurifolia* seem perfectly hardy. *S. fragilis* has produced shoots from four to five feet long this season. *S. laurifolia* has grown two to three feet, and *S. aurea*, three to four feet. There are a few trees labeled "Russian Poplar," but I understand they have been here several years; they are about four inches in diameter. I am unable to learn where they came from.—C. S. Crandall, *Botanist and Horticulturist, State Agricultural College, Fort Collins, Colo., Oct. 20, 1890.*

The following are the notes taken from the Station reports:

	Leaves formed.	Leaves matured.	1888	1889	
				Per cent. alive.	Growth inches.
<i>Salix fragilis</i> . . . .	May 5	Nov. 5	{ Desirable species; rapid growth; wood tough and durable . . }	95	42
<i>S. laurifolia</i> . . . .	May 5	Nov. 1	{ Desirable for ornamental plant- ing . . . . . }	92	54
<i>S. aurea</i> . . . . .	May 8	Nov. 7	Rapid grower; valuable for screens	. . .	
<i>S. acutifolia</i> . . . .	May 5	Nov. 5	{ Hardy and free grower; foliage rusted some . . . . . }	90	36
<i>Populus pyramidalis</i>	May 3	Nov. 1	Upright; of doubtful value . . . .	. . .	
<i>P. Bolleana</i> . . . . .	May 5	Nov. 1	{ Handsome, and valuable for the west . . . . . }	. . .	

We have had no rain to amount to anything since you left (July 4th.) Have had two light snows lately. The Willows are all alive and doing well.\* The stakes with labels are gone. The Elms and Wild Black Cherry (nursery stock) have done the best of any.—Geo. Wasson, *Lookout Mountain, near Golden, Colo., Nov. 12, 1890.*

Planting done on the plains, at 7,000 feet elevation. Soil, light loam. Plants all died for lack of irrigation water, except two

\*Referring to the Russian trees transplanted from Colorado Springs. Drought had prevailed throughout the season, these trees were irrigated to some extent.



Russian Willows (*salix fragilis*), and six Honey Locust. The Willows are growing rapidly. Oct. 16, 1890—The Willows are now healthy bushes of three feet six inches in height.—*Herbert Skinner, P. O. Colorado Springs, Oct. 14, 1889.*

Planted with southern exposure, in sandy soil, cultivation by hoeing and irrigation; plants healthy and hardy, adapted to locality. Oct. 10, 1890—Probably thirty of the willows alive and doing well.—*F. L. Martin, Colorado Springs, Oct. 12, 1889.*

All the seeds and cuttings were planted in my back yard, and daily watered and attended to. Of the seeds I have two rows of Ash; none of the others came up. Of the slips and roots, all of the Willows and Black Locust have done splendidly. Most of the Austrian Fir are alive, and one Poplar, a strong and healthy tree; the other Poplar died in the winter. Oct. 12, 1890—The Willows are a success, doing finely. My horse broke down the Poplar.—*Francis B. Hill, Colorado Springs, Oct. 10, 1889.*

Planted in light, sandy soil; kept clean by cultivation; and neatly trimmed. Irrigated to some extent. Labels giving botanical names lost or defaced, they all grow finely. I transplanted the two kinds of Russian Poplar. The Silver Leaf grows the most rapidly, and now stands about five feet high; branches twelve feet in circumference. Seems to be very hardy; think they will make as good growth as Cottonwood.—*J. E. Kain, Rocky Ford, Colorado, Oct. 26, 1889.*

No report in 1890.

Cuttings placed in sandy soil by the side of an irrigating ditch. Were very dry when they reached me. Now have but three growing but they are doing nicely. Oct. 11, 1890.—Two of the Russian trees were considerably thrashed by the hail last spring, the other is a Willow. Will take good care of them and report next year.—*W. B. Gobin, Rocky Ford, Oct. 12, 1889.*

Cuttings received April 25, 1888, in good order. Planted them in clay loam soil, on side of furrow. Gave same cultivation and irrigation as to nursery stock. Of the Poplar *alba*, three are growing and are now seven, nine and ten feet high, with a spread of seven feet; will make hardy and beautiful trees. Of the Asiatic Poplars, five are growing—same cultivation as others had; now ten feet high, well branched, but grow only upright; have broad leaves and are a fine tree. The Willows (*salix laurifolia*) are all growing, but of no value as a tree; branches six feet long, but lie on the ground. *S. fragilis* about the same. Dec. 14, 1890.—The Poplars I received from you are a success; the Asiatic is a good grower and one of the first to open its buds in the Spring; is an upright grower, very vigorous. The Willows seem just as vigorous, but grow more spreading and straggling; not desirable to propagate from cuttings; the cuttings should be obtained in the Fall, and buried in moist soil, with butt end up,



about five inches below the surface. Leave them until April first, when they will be healed over and roots started; then, if set in nursery rows, they mostly all grow. If cuttings are made in the Spring, the leaves start before the roots, and they all die.—*J. H. Crowley, Nurseryman, Rocky Ford, Colo., Oct. 12, 1889.*

The Willows sent to me in the Spring of 1888, were planted in a sandy loam, cultivated with plow and hoe, and about one-half are alive. These have made a growth of about four feet, growing up very bushy from the roots.—*W. Curtiss, Yuma, Colo., Oct. 15, 1889.*

#### No report in 1890.

Planting was made in new ground—first plowing; soil dark, known here as buffalo sod. Plants had very ordinary attention; watered once or twice during the first season. They have all made a very vigorous growth; will average four feet, and have immense roots. Seem very hardy, and well adapted to this climate. Have preserved the name of only one variety sent me, and that is *Salix fragilis*, although I have three kinds in all. They have all done equally well. I think them a good kind for this country.—*L. Tinkel, Holyoke, Colo., Oct. 18, 1889.*

#### No report in 1890.

The cuttings you sent me were planted in black, sandy loam in the Arkansas river bottom, and made a growth of two to four feet during the season of 1888. Last winter, unfortunately, some stock ate them down, and I was compelled to remove them to another place. During the season of 1889, some of the Russian Poplars made a growth of five feet; the others about three feet. Were irrigated and hoed twice during the season of 1889. With plenty of water, they will grow well in this county and make beautiful trees. Regret that I cannot give the botanical names. October 15, 1890.—I have a number of both the Russian Poplar and Willow growing. The Poplars made a growth of about six feet this season, without cultivation, but plenty of moisture. The Willows do not grow so well; they seem inclined to branch out near the ground and spread in all directions. I think the Poplar will prove a valuable tree in this section of the State. The Silver-leaf Poplar did not grow as rapidly as the others, but is a beautiful tree, and grows finely here—with plenty of water.—*C. B. Thoman, Lamar, Colo., Oct. 12, 1889.*



## DROUGHT-ENDURING SHRUBS.

In the October 8, 1890, number of *Garden and Forest*, Professor J. L. Budd, of the Iowa Agricultural College, has an interesting contribution entitled "Shrubs which Endure Drought." He states that his list includes only a few trees and shrubs studied as object lessons for two days by a class at the college. The list, and accompanying remarks, are here given, in a condensed form, as likely to prove useful to our own people.

BARBERRIES.—Some of the Asiatic Barberries have stood the heat and drought in a surprising way. Of these, *B. Amurensis* stands well at the head for rapidity of growth, health of foliage and for the very heavy crop of handsome fruit. Several other species are also desirable. Among the perfect ones I might name *B. Esculenta*, *B. Macrocaultea*, *B. Carriacea*, *B. Fisheri*, *B. Macrophylla*, and *B. Crataegina*.

RUSSIAN PRIVET.—The Privets from Central Russia are quite unlike the common forms from West Europe, which are tender here. The leaves are broader, darker green, and in all respects more attractive. The plants are absolutely hardy; the flower racemes are large, pure white and fragrant, and prized for use as cut flowers in vases.

TAMARIX AMURENSIS.—Here the common Tamarix is frozen down during our mildest winters, while that from the Amur is perfectly hardy. It is a dry-climate plant, and will grow on the driest embankment in perfect health, where nearly all other shrubs would perish. It is now (September 18) in flower for the third time this season.

CLIMBING HONEYSUCKLE.—What we have from Russia as *Lonicera Germanica* and *L. Media* are models of health and vigor, with a grand show of brilliant scarlet berries in clusters at the points of growth. *L. Confusa*,



from North-east Germany, is hardy and a profuse bloomer.

BUSH HONEYSUCKLES.—*Lonicera splendens*, from seeds sent us by Professor Sargent, endures drought better, has better foliage and habit, and a far more abundant crop of handsome fruit than the common varieties.

SALIX ROSMARINIFOLIA.—A variety of the species from Voronesh, in Central Russia. Since July there has not been a leaf on our West European variety, while at this late date (September) the Russian form is clothed with perfect dark green, fern-like foliage, and is an object of beauty. At any season and in any part of the country, the Rosemary-leaved Willow from the East will be prized as a lawn shrub.

ROSES.—The variety of *Rosa rugosa* from China, Central Asia and Russia have not flagged a leaf or made less apparent growth than usual during the dry period.

SPIRAEAS.—Of the hardy varieties and species, the most perfect and vigorous have been *S. triloba*, *S. Van Houtteii*, *S. Callosa alba* and *S. rubra* from Russia, *S. hypericifolia* and *S. Nobleana*.

CARAGANAS.—The most northern species, such as *C. arborescens*, have not endured the heat and drought without partial or complete loss of foliage. But some of the shrub varieties from the eastern steppes have stood remarkably well and flowered profusely. Of these *C. fruticosa*, *C. fruticosa variegata*, *C. macrophylla*, *C. mollis glabra* and *C. Redowsky* stand well at the head.



**OBSERVATIONS OF HON. B. E. FERNOW, CHIEF OF THE FORESTRY DIVISION.**

During the summer of 1889, Hon. B. E. Fernow, Chief of the Forestry Division, Department of Agriculture, a well-known authority upon forestry matters, took an extended journey through the plains and mountain region of the West. His observations—embodied in a subsequent official report—upon the subject of forest tree culture on the plains, are so pertinent that I will give a portion of them here, in the order in which they were originally printed:

(1) The dryness of the plains east of the Rocky Mountains, as far as it is inimical to vegetation, is due, probably, not so much to the small rain-fall as to the enormous evaporation under the influence of the constant winds, which produce summer droughts as well as winter droughts. At least, the only means for influencing water conditions of a very large part of this region, appears to be in checking or reducing this evaporation by the planting of wind-breaks and timber belts.

(2) The area which needs such protecting timber belts is so enormous that it seems almost hopeless to rely upon the effort of pioneer settlers for this work of timber planting, especially as the unsystematic manner in which such private planting must necessarily proceed, in addition to the existing most unfavorable climatic conditions, has led and must lead to failures more frequently than to successes.

(3) A tree will die where a forest would live; that is to say, planting on a large scale and in compact bodies may be successful, where smaller plantations will succumb to the extremes of the climate. Hence the poor settler on the frontier who can not afford to start a large enough plantation, will be doomed to reiterated failure and discouragement with his trees as well as his crops.

(4) The most serviceable trees for wind-breaks and for subsistence in a dry climate—the Evergreen Conifers—which require from six to ten times less water than most deciduous trees, do not recommend themselves to the use of pioneer planters, because they require much care to establish them in the open sites of the plains and grow only slowly to useful sizes.

(5) All these considerations lead to the conclusion that successful reclamation of these broad acres and effectual checking of the destructive winds by means of systematic planting of forest belts can only be attained by co-operation, *i. e.*, by government management, be it National, State, or county.



(6). The most promising Conifers for planting on the plains and prairies, besides the Scotch, Austrian, and Norway Pines and the Juniper or Red Cedar in the lower latitudes, seem to be the two Rocky Mountain Conifers, the Bull Pine and the Douglas Spruce.

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### Forest Policy.

#### THE CONDITION AND FUTURE OF THE AMERICAN FORESTS.

The following extracts are taken from an article (by H. J. Elwes) in *Garden and Forest*, of October 8, 1890:

\* \* The time will come when the names of those persons who have made it the business of their lives to bring home to the people the condition of the national forests, will be honored as citizens who have deserved well of their country. The Russians have been described by an eminent German naturalist as "everywhere true wasters and destroyers of forests," but from what little I have seen myself in a single journey of about ten thousand miles through the United States, I do not think they can compare with the Americans; and, speaking as an English farmer and as an Indian tea-planter, who has seen in many parts of Europe and Asia the results of destroying the forests and skinning the land for the sake of a short-lived profit, I do believe that every foot of timber and every bushel of corn or wheat which you are sending us at a ridiculous price, will ultimately cost the American nation much more than the present value. Look at the present state of the forests and the land in many parts of the United States, and see what it will some day cost us to restore the soil to a condition in which successful agriculture is possible, and consider what a poor return you are getting for this enormous present waste. What is the value of a few thousand Alaska seal-skins, or a few ship-loads of Canadian fish, compared to the value of the American public forests? And yet, how much we hear of the former in the debates in your Congress and in the speeches of your public men!

I cannot help thinking that the best possible remedy at present is suggested in your editorial article on "The Army and the Forests," and I can testify from personal experience of the success of this plan in the Yellowstone Park. When the British-Indian Forest Department was first created, most of its officers were taken from the army, and though they lacked the technical knowledge which is now supposed to be all-important, and to be gained only in the forest-schools of France and Germany, they had other qualities which are often wanting in the young men who now recruit the forest-service. For years to come the questions which will be most prominent will not be

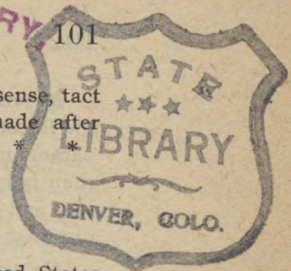


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those requiring technical knowledge so much as common sense, tact and energy in enforcing the regulations which will be made after considering local needs and actual forest conditions. \* \*



#### AN OPINION FROM GERMANY.

The wholesale extravagance of the people of the United States with the timber which abounds in this country, and the merciless way in which the forests are being destroyed, has attracted the attention of the Geological Society of Germany. At a recent meeting, Chief Forest Master Kessler called attention to the subject, quoting from the tenth census. He stated that in 1880, the 25,708 saw-mills in operation in the United States converted \$120,000,000 worth of raw timber stock into various kinds of lumber, and he asserted that, at the same rate, there would be no good sized timber left in forty years. He spoke of the enormous waste of wood through forest fires, which are the result, for the most part, of carelessness or a desire to clear land for cultivation, and declared that the planting of new forests, which has of late years received some attention in the Eastern States, cannot begin to offset the waste. He said that there is every reason to fear that America will soon be a country impoverished for tree property. Mr. Kessler made the striking comparison that while the United States had but eleven per cent. of its area covered by forests, the empire of Germany has twenty-six per cent. of its area so covered. Mr. Kessler said that the reckless destruction of forest trees in America, and the indifference manifested by Americans in the restoration of forests, is a menace, not alone to the wealth of the nation, but threatens serious deterioration, both to climatic conditions and the fertility of the soil. In a recent report to the State Department, Consul Merritt, of Chemnitz, calls attention to Mr. Kessler's remarks as worthy of the attention of the Department.

#### FOREST POLICY FOR THE ROCKY MOUNTAIN STATES— CONSENSUS OF OPINION.

In the early part of October of the present year, I wrote to Hon. B. E. Fernow, Chief of the Forestry Division, Department of Agriculture, asking for his opinion as to what should be the present forest policy of the Rocky Mountain States. The following reply was received from him:

DEAR SIR:—Your request to express briefly my views in regard to a "forest policy for the Rocky Mountain States in the immediate or near future," has been received.



My views are very simple and decided. I start on the basis that the forests, situated on the mountains, not on agricultural soil, are of paramount importance to these States both for their material and for their influence upon soil and water-flow, especially for the latter reason, and that the treatment of the forest cover affects interests far distant from the forest itself.

My second premise is that over a large part of the Rocky Mountain region, re-forestation is very slow to take place, if the original growth is irrationally treated. Nay, it can be and in parts has been made impossible by clearing, subsequent burning and washing of the soil.

My third premise is that private interest, especially in newly settled countries, is concerned only in satisfying present wants, without much thought or care for future emergencies. Besides the influence of clearing a mountain side asserts itself often so gradually, that in the absence of immediately noticeable consequences for the agricultural interests in the valley, arguments to influence the action of the private individual in the treatment of the forest are useless, but require the more, the attention of the community. And if restriction of private ownership rights appear necessary for one reason or another, it will always be found difficult and obnoxious to exercise such restriction. Hence, I draw the conclusion, ownership by the community is the only rational forest policy, wherever the above described conditions exist.

The next question is that of designating the part of the community which should be the owner of the mountain forests. It might be the county, the individual State, the General Government.

It may be argued that the community making up the county has necessarily the most immediate interests in the preservation of favorable conditions and can best guard its own interests. Yet there are often conflicts of interests arising which can be better adjusted under State ownership, and before a well settled county administration exists State ownership would be preferable.

But even State ownership, while perhaps desirable at a later stage of development, would not be expedient now, and ownership by the General Government for the present is preferable.

My reasons for this preference are:

*First*—The General Government does own the lands, and the difficulties and complications attendant upon wholesale transfer of the property can as well be avoided. If such transfer were to be effected it would necessitate almost a revolutionary change of the existing land policy of the Government, which at least at present seems neither necessary nor advisable.

*Second*—The States with a scanty population as yet, and with all parts of their economy still to build up, had better not burden them-



selves with this additional duty of forest conservation, except so far as they can aid in it without cost to them.

Other political considerations, which need not be elaborated here, lead to the same conclusions, so that altogether the expediency of retaining the public timber lands in the hands of the General Government for the present is conceded by the unbiased students of the question, provided the General Government will do what is necessary to preserve and keep in permanent forest condition this property.

To do this, above all things, it is necessary to properly regulate the disposal of the timber produced to those that need it, to protect against fire and trespass, and to so regulate the cutting that reproduction is assured.

At present the Government forces the people of the region to trespass upon its timber lands by not allowing them to obtain the needed material in a legal manner; nor does the Government employ adequate means to protect its property against loss by fire, and thus its possessions become a menacing danger to all adjoiningers.

Two things are required to change these conditions, namely, a well organized Forest administration, fully equipped, such as is provided in the bill introduced in the Forty-ninth Congress by Mr. S. V. White; and, secondly, proper laws enacted by the States, under which not only the efforts of the General Government could be seconded, but which will enable the General Government to protect its property.

For with the creation of sovereign States the United States has abandoned its jurisdiction, and can not enact or enforce criminal legislation on its property in those States. It takes, in regard to its landed property in the States, exactly the same position as any private owner, and can, therefore, protect it only under the laws of the State.

If, then, the Rocky Mountain States propose to do anything in the interest of forest preservation, there are three ways open to them, immediately or in the near future.

*First*—To bring all their influence to bear upon the General Government, to force it to a proper care and rational management of its own timber property.

*Secondly*—To pass such legislation as will enable the owners of timber lands, and the United States as such owners, to protect their property efficiently against fire and theft.

*Thirdly*—To delegate to a responsible and well-paid officer the duty of assisting in the carrying out of the law for the prevention of fires, and to care for the forestry interests of the State in general.

Printed copies of Mr. Fernow's letter were sent to a number of persons in this region, some of whom wrote



to me upon the subject. Their letters, in whole or in part, are given below; also, a few other communications upon the same general topic:

I believe in the present (Colorado) system of local forest officers, and will heartily co-operate in efforts to enforce the forest laws.—*F. R. Baker, Co. Commissioner, Fort Collins, Colo.*

Congress should be memorialized to enact a law restricting the cutting of public timber for railway purposes, in certain localities where the water supplies would be affected by such timber cutting.—*Chas. M. Campbell, Denver, Colo.*

I favor the idea of establishing agents or detectives, perhaps sheriff's officers at certain points in the State, so that in case of forest fires they may take *immediate* steps to discover the origin of the fire, and to apprehend those guilty of causing it.—*B. W. Steele, Colorado Springs, Colo.*

I am not sufficiently familiar with the subject to give an opinion that would be of value. It seems to me that Mr. Fernow's recommendations are of so indefinite a character as to estop one from passing an intelligent judgment upon them.—*H. H. Eddy, Axial, Colorado.*

I would suggest the calling of a forestry and irrigation convention, with representatives from west of the Rocky Mountains and Pacific States and territories; questions of forest policy in connection with irrigation matters to be considered and acted upon.—*Hon. Milton Kelly, Boise City, Idaho.*

The great importance of forest reform is just beginning to be realized. It is to be hoped the proposed forestry convention will be able to awaken a greater interest in it, and disseminate a wider knowledge of its advantages among the people at large.—*A. E. Beardsley, Trinidad, Colo.*

A few men, stationed on the principal roads and exposed portions of the timbered country, would, under proper direction, do great service in the matter of preventing forest fires. A half-dozen, more or less, of such patrols, might be able to protect, fairly well, an entire county. They should be actively engaged through the dry season.—*J. P. Van Dolat, Home, Colo.*

I am more and more impressed with the idea of *State and County Parks* as the great safe guards of our mountain forests. Let Colorado have quite a tract as her own. Let each county have at least a section of her own, and care for it as she can. The interest of possession is a strong one, and each community would take special care to defend its own property from fire, etc.—*Rev. C. S. Harrison, Beulah, Colo.*



I favor a forest administration that would include a system of licenses to lumbermen and others making a large use of timber. I think the honest men in the business would favor it, as tending to drive out a disreputable class who steal the Government timber.—*J. E. Reynolds, Colorado Springs, Colo.*

Failure in the enforcement of the laws for the protection of public timber is largely due to indifference on the part of the people. If those most interested in the protection of the native forests, viz: the people in the different localities in which the forests are situated, will not give attention to the due enforcement of the protective laws, the Government might as well withdraw all officers charged with such duties.—*G. C. Brackett, Lawrence, Kansas.*

Mr. Fernow clearly expresses my views upon the subject of a "Forest Policy for the Rocky Mountain Region." In addition, I would suggest that proper plans for extensive tree planting on the plains, extending eastward from the mountains, should be devised, with a view to more effectively conserving the waters in the streams and arroyos of that vast region.—*Edward Haren, Kansas City, Mo.*

There is no subject more vital to the national interests of the coming generation, than that of reform in forest management. It is important to arouse an interest that shall cause laws to be enforced that will protect the natural storage reservoirs in the forests at the heads of our streams. If we cannot accomplish that, it is folly to extend the area of cultivation plainsward, for there will be no adequate water supply. I think the Continental Divide should be made one great National Park, and reserved from sale, except the mines, and put under such police regulations, through the various officers in each county, as would insure the enforcement of the most stringent laws that can be devised for the protection of the forests.—*B. F. Rockefeller, Canon City, Colo.*

I approve Mr. Fernow's suggestions, and especially the idea of seeking protection for the forests from the General Government. We shall not be able to accomplish anything in the States for many years, and during that time the forests will be destroyed. Of course, it will be desirable to have the co-operation of the States in any such work, but I do not believe that it is necessary to have legislation from them. It is my understanding that the General Government has power to protect its lands in States as well as in Territories. But that is not at present an important question, and upon the general policy outlined by Mr. Fernow I think there is no room for doubt.—*Moses Hallett, Denver, Colo.*

We need forestry laws adapted to the peculiar conditions of the Rocky Mountain climate, and so framed as to meet the necessities of our agricultural interests in so preserving the snow-fall of winter as to furnish the largest possible quantity of water for irrigation in



summer. We can not hope for any effectual enforcement of the laws through the action of our United States marshals. There is some potent power in the hands of our mill-men and others obtaining lumber from the public domain that effectually shields them from prosecution. I believe you have outlined a forestry department, giving supervisory powers to persons under a forestry act. If these appointments could be made from persons known to favor the preservation of forests, and they be given power to enforce needed regulations, it might be a sound protective policy. Lands at high altitudes should be withdrawn from sale, and all forests should be so protected that no portion of them should be totally destroyed. License to cut fuel and lumber should be for portions only of forests, requiring a sufficient number of trees to be left to furnish shade and protection to snow.—*Alonzo Hubbard, Monte Vista, Colo.*

I am heartily in favor of Mr. Fernow's proposition for a natural, "well organized forest administration, fully equipped," etc., but we don't want such a bureau in Washington without it has a large force in the field and on the ground where the timber to be protected is located. Then it will fail in its objects unless it is backed up by State legislation and co-ordinate State supervision. How this double-headed administration would operate I do not know. I have grave doubts about that. The timber policy of the General Government has not been such as to recommend it to public favor. My own judgment is that the Forestry Bureau can best protect the forests in the Rocky Mountain States through State officials. I am in favor of State supervision and a strongly equipped State Forestry Board or Administration, backed up by the General Government—not with their influence alone, but with money. The General Government never can, and I am firmly convinced never *will*, protect our forests. And even if they do move, it will be when our timbered lands are so denuded by the fire and the axe that it will require millions to restore them, if, indeed, it be possible to restore them at all, where as many thousands now would preserve and extend their area.—*Chas. H. Burrill, Buffalo, Wyo.*

I think Mr. Fernow's views are in the main correct. His proposed remedy, embodied in the last three paragraphs of his letter, I consider the only method by which the object in view can be attained. I am not certain that that result can be accomplished; I fear not in our time. I think the General Government is the only authority that *can* protect the public forests. I very much fear that it will not make the attempt. The chief waste is by forest fires. I believe that more timber has been destroyed in the State this year by fire than has been used for all purposes by the people of Colorado since its settlement. I have no hope that forest protection can be secured through the agency of local officers. They have too many neighborhood friends and enemies, and, from personal and political consider-



ations, will not proceed against either class. Again, it is hard to make a frontiersman believe that the accidental (careless) firing of the forest or prairie is a crime, or that such an offense should be punished. The only officer that could enforce, and punish for violation, laws for the protection of timber and game, would be a roving officer, like a United States marshal, clothed with authority from the General Government, and who would have no local friendships or acquaintances. This officer might have aids in every locality, but they should be informants only, doing their work secretly and incurring no enmities.—*Wm. N. Byers, Denver, Colo.*

Many evidently misunderstand the intention and effect of forestry laws, imagining that no timber will be allowed to be cut or used, but all preserved. In fact, under proper regulations, the young growth only would be reserved and the ripened or mature trees removed. This, at the end of a term of years, would furnish a vastly larger supply for annual consumption than is had under the present wasteful methods. Other features of a proper forest administration would be the selection and propagation of the most appropriate species of trees, and the realizing of sufficient revenue from the sale of fully grown trees to pay a part, if not all, the expenses of care and maintenance, the introduction of new varieties, etc. Two of the main points to be kept in view would be the securing and preservation of necessary shade at the heads and on the borders of our rivers, and to gradually build into their banks the osier and other willows of commercial value, so as to keep the banks from being cut away by the annual rise of water and sudden floods.

In a recent letter you asked why miners should be permitted to use timber off the public lands, and why there was less liability to fires in mining camps than in tie camps. Miners could not work their mines economically without free timber for timbering tunnels, shafts, building, fuel, etc.; and there being so many and such small lots of timber to each individual or company, it would not pay to keep agents (permanent or traveling) to look after the stumpage. Besides, nearly all mines are worked, as ours here, for five years without getting any returns; and many never pay at all, but are worked, with highest wages to workers, by combinations of outside capital on speculation, hoping they will finally pay. The policy as embodied in the law, is to encourage mining and the patenting of mineral lands. The miner's interest is a permanent one, while tie-cutting is not. As proof of difference of interests, miners here have worked fourteen years, and no forest fires have been caused by them.—*Richard Irwin, Sunnyside, Colo.*



**SUGGESTED INCREASE IN THE NUMBER OF TIMBER AGENTS.**

On the nineteenth of March, 1890, I addressed a communication to the Secretary of the Interior, respecting the importance of preserving the native forests of the State; that the need was especially urgent in view of the vast irrigation systems here, wholly dependent upon the forest-protected mountain streams. The attention of the Secretary was called to the fact that the Federal Government having no duly organized forest administration, the timber on the public domain had no protection except that resulting from the futile efforts of a few scattered timber agents. In the absence of other legalized protective agencies, it was suggested that more special timber agents be appointed, and that at least two additional ones be assigned to duty in this State.

The recommendations contained in the above letter were earnestly supported in accompanying communications from Governor Cooper, Hon. John D. Fleming, Attorney for Colorado, and his predecessor in office, Hon. Henry W. Hobson. The Governor stated that forest preservation and cultivation had become a recognized first principal here, in view of the great importance of the forests to irrigation, to railroading and mining, and building operations of every sort. That undue and preventible forest destruction goes steadily on—by fire and the prevalent illegitimate use and conversion of the public timber. Mr. Fleming emphasized the necessity of having a larger force of special agents in the field here, there being at that time only two in the State. Mr. Hobson referred to the vast extent of territory here to be overlooked and the gross inadequacy of the present system. He believed a radical change should be made in the laws affecting the public timber lands. But until that could be accomplished, and in furtherance of the present law, he would recommend:



*First*—A total separation of the appointment of agents from politics.

*Second*—An increase in the number of agents in the State.

*Third*—An increase in the salaries of agents.

*Fourth*—The exercise of more care in the selection of agents, that competent Western men be appointed, and that as far as possible the appointments should be made upon the recommendations of known friends of the public timber.

*Fifth*—That such agents, collectively, be organized with one agent as the chief, or head, just as is done in the post-office inspectors' business.

*Sixth*—That, as far as possible, there be more hearty co-operation between the Government and State officials.

Our representatives in Congress were also requested to aid in securing early and favorable action upon the petitions.

Thereafter, further correspondence upon the subject was had with Representative Townsend, of this State. He was requested to make personal presentation of the matter to the Secretary of the Interior. In reply, Mr. Townsend gave assurance that he would make every effort to secure proper and necessary action in this behalf.

On the thirteenth of October following, Hon. Wm. M. Stone, acting Commissioner of the General Land Office, wrote me that, "The inadequacy of the appropriation for the protection of the timber on the public domain admits of no increase of the present force of special timber agents. Special timber agent C. Blakeley, head-quarters Denver, Colo., is at present in charge of public timber matters in Colorado."

This was followed by a further appeal to Mr. Townsend to make personal presentation of the matter to the Secretary of the Interior.



## THE CANADA PLAN.

Where private interests require protection, private co-operation will be the most effective protector, and where, as in the case of forest property, the State has an economic interest in its preservation beyond the mere protection of private rights, co-operation of the State authorities with the private interests is necessary. The adoption of what may be called the Canada plan is, therefore, recommended for such States as have large lumbering interests to protect. The substance of this plan is given in the following paragraphs taken from the recent report of the Commissioner of Crown Lands:

It is proposed that during the dangerous period, say from the first of May to the first day of October in each year, there shall be placed on such limits as are exposed to damage, a man or men, who will be empowered and instructed to use every endeavor to prevent and suppress fires in every way possible; and the ranger who is placed in charge of a limit will be authorized to engage whatever help may be necessary to cope with a dangerous fire, when prompt action is necessary. These men will be supplied with copies of the "Fire Act," and instructed to post them up in public and conspicuous places; to visit each person resident in the limit, and give them, if thought advisable, a copy of the act, explaining to them its provisions, penalty for its infraction, etc., and to endeavor to enlist their assistance and sympathy to make the act effective.

The Department will leave the limit-holder to suggest the number of men who shall be placed on his limit; and, as it is, of all things, necessary that practical bush-men, of good judgment, and well acquainted with the limit, should be selected, he, the limit-holder, will nominate the man to be placed in charge of the limit, and his subordinates, if any, the Department reserving the right to limit the number of men to be employed on any limit, and also to reject or remove any man whom it finds unfitted to discharge the duties of the position.

As to the expense incident to the working of the plan, the Government proposes to assume one-half, the other half to be borne by the limit-holders. So far as timber limit-holders agreed to bear their share of the expenses connected with the experiment, a trial was first made in 1885. Thirty-seven men were placed in the field, and kept on duty from June to October. The effect of their presence was excellent. Fires were suppressed which otherwise might have become vast conflagrations, causing incalculable losses. Persons wantonly violating the provisions of the Fire Act were promptly brought to



justice and fined, and a general and strong interest in the direction of preventing the start and spread of forest fires was created and kept alive. At the close of the season, the timber owners expressed their great satisfaction with the experiment, and urged its continuance and extension.—*Report of Chief of Forestry Division, 1886.*

I have been assured that the plan of forest protection outlined above has been found to be effective, and is still adhered to by the Canadian Government.

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#### THE SIHL-WALD, OR ZURICH FOREST.

A noteworthy example of the profitable management of a forest is furnished by the city of Zurich, in Switzerland, which municipality has owned the Sihl-wald, or forest, for nearly six centuries, and at the present time administers the same upon the most approved scientific principles. The work is done by common laborers under the supervision of a forester, and so economical and business-like are the methods employed, that last year the net profits were something over \$8 an acre, or a total of about \$20,000 for the city treasury. The city does the entire work—lumbering, manufacturing and administration, and employs the best modern labor-saving devices, the machinery being largely of American manufacture.

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#### PROPOSED COLORADO NATIONAL PARK.

In the Autumn of 1888, having occasion to visit the White River plateau region, in the north-western part of this State, I became greatly interested in a project to induce the General Government to set aside, for the purposes of a National park, a large body of public lands embracing the Plateau (or Flat-top) mountains, Trappers' and Marvine lakes, and numerous affluents of the Grand, White and Yampah rivers. The proposed reservation is about forty miles square, but quite irregular in outline. Its high altitude, severe winter climate and



rugged formation render it unfit for agricultural purposes. A large portion of it is heavily timbered. The region is exceedingly picturesque, and it abounds in fish and wild game. At the last session of our General Assembly, in response to numerous signed petitions from many parts of the State, a joint memorial was adopted asking the President to withdraw from sale or entry the land in question, until such time as Congress could take action constituting it a National Park. A joint memorial to Congress, upon the same subject, was also adopted. In aid of this very laudable enterprise, an association called the Colorado National Park Association, has been organized. So far as I am informed, neither the President nor Congress has taken action in the matter.

During the last year some local opposition to the proposed reservation has been manifested. It is alleged that in the adjustment of certain private claims against the Government, likely to arise in this connection, injustice would be done to individuals. This may be true; and any such results should be duly guarded against.

#### RESERVATION OF PUBLIC TIMBER LANDS.

The following correspondence upon the subject of withdrawing public timber lands from entry or settlement is given as illustrative of one class of existing grievances in connection with the National forests and the manifest futility of obtaining adequate redress under the present laws:

COMO, COLO., February 25, 1890.

*To Maj. J. W. Powell, Director U. S. Geological Survey, and to the Colorado Congressional Delegation, Washington, D. C.:*

The undersigned, residents of the county of Park, State of Colorado, respectfully represent that the hereinafter-described timber lands of the United States ought, and of right should be, withdrawn from the lands subject to entry under the homestead and pre-emption laws, and set apart as a reservation for irrigation purposes.



That said lands extend from the Kneosha divide, in Park county, near the head of Jefferson creek, and from thence across the headwaters of Michigan and Tarryall creeks, and include the timber lands on the eastern slope of the main range of the Rocky Mountains, adjacent to the water sources named. That these lands by reason of the timber growth upon them cause the snows of winter to lodge thereon, and largely furnish the annual supply of water in the South Platte river and its tributaries, thus utilizing thousands of acres of land for agricultural purposes, and largely contributing to the resources of the State. That these lands will soon be divested of the timber growth thereon to the great and irreparable injury of all the people of the State so interested in the waters of said river and its tributaries, unless some effective measures are adopted and put in force to prevent the same.

That your petitioners are disposed to be mindful of the interests of the whole people, and to admit the propriety of an economical use of the timber growing upon the lands of the United States, for all necessary purposes, yet we protest against the destruction and removal of the timber in the localities named, and do so in the paramount interest of the people, and allege that no serious inconvenience will result to the general welfare, or to those requiring the use of timber for the construction of railroads and for other proper purposes, by the absolute withdrawal of these lands from all rights of entry or use by the people as aforesaid. So believing, we urgently ask that the necessary and proper measures be at once taken to effectually preserve the timber now growing upon the lands herein described, and we humbly pray your aid in this behalf.

The above petition was signed by S. M. Lasell and seventy other citizens of Park county. The following State officials also joined in the request: J. P. Maxwell, State Engineer; J. S. Titcomb, Deputy State Engineer; A. Sagendorf, Register State Land Office; O. H. Henry; James Rice, Secretary of State; Edgar T. Ensign, State Forest Commissioner. The following additional correspondence in this behalf ensued:

*Office of the STATE ENGINEER,* }  
DENVER, COLO., March 1, 1890. }

COL. EDGAR T. ENSIGN,

*Forest Commissioner:*

DEAR SIR:—I heartily endorse the sentiments expressed and objects set forth in the petition of C. G. Volz, *et al.*, to Major Powell and our Congressional delegation. The withdrawal should be made more comprehensive, and include a strip four or five miles wide, from timber-line down on the headwaters of all the streams on the eastern slope, especially when the same is non-mineral in character. The



timber at this elevation is inferior in quality, and its commercial value is insignificant when compared with its importance as a factor in irrigation. The timber along this strip serves a three-fold purpose:

*First*—In catching the snows blown from the range.

*Second*—In protecting the same from the action of the wind and sun; and

*Third*—In holding the high waters back until such time as it is needed for irrigation.

The injurious effects of denuding the lands of timber, on the headwaters of some of our streams, are already apparent in a very appreciable diminution of the flow in high water time, and in hastening that time to such an extent that the high water is practically over before it is required in the irrigation of lands. I trust this matter will be favorably considered by the department at Washington, and such action taken as will result in preserving the timber referred to in the petition.

Very respectfully,

J. P. MAXWELL,  
*State Engineer.*

*Office of STATE FOREST COMMISSIONER, }  
DENVER COLO., March 14, 1890. }*

HON. HENRY M. TELLER,  
*U. S. Senate,  
Washington, D. C.:*

SIR:—The petition, of which the enclosed is a copy, was placed in my hands by Mr. S. M. Lasell, of Como, Colorado, to be forwarded to Washington, to the parties addressed. The original papers have been sent to Major Powell. Under the recent act for the promotion of irrigation in the arid region, it is believed that Major P. has advisory powers, at least, with respect to the withdrawal from sale or entry of lands of the character indicated. Permit me to add that, in my opinion, the withdrawal of the lands in question, and the preservation of the timber thereon, would greatly aid in keeping alive the streams of that region, upon which important irrigation works depend. I beg leave to request that you will, at your early convenience, bring the matter to the attention of the proper authorities, and secure action thereon.

I am, very truly yours,

EDGAR T. ENSIGN,  
*Commissioner.*



Office of STATE FOREST COMMISSIONER, }  
DENVER, COLO., March 14, 1890. }

MAJOR J. W. POWELL,  
*Director U. S. Geological Survey,*  
*Washington, D. C.:*

SIR:—In transmitting to you the enclosed papers, I beg leave to earnestly endorse the request of petitioners. If the lands in question can be withdrawn from settlement, and the timber thereon preserved, I think it would be greatly beneficial—aiding largely in the conservation of water in that region. Copies of the papers herein have been forwarded to Hon. Henry M. Teller, of our Congressional delegation.

I remain, very truly yours,  
EDGAR T. ENSIGN,  
*Commissioner.*

DEPARTMENT OF THE INTERIOR, }  
UNITED STATES GEOLOGICAL SURVEY, }  
WASHINGTON, D. C., April 5, 1890. }

EDGAR T. ENSIGN, ESQ.,  
*Forest Commissioner,*  
*Denver, Colorado:*

DEAR SIR:—I have to acknowledge the receipt of your letter of March 14, transmitting the petition of C. D. Volz and others, with reference to the withdrawal of timber lands at the head-waters of streams in Colorado. I most fully and sincerely sympathize in all efforts to preserve the timber of the Western regions against destruction, and shall be very glad at all times to do all in my power to promote measures which may lead to such protection. At the present time, however, there is not, so far as I know, any law authorizing the withdrawal of these timber lands, beyond such as you must of course be familiar with. The matter is undoubtedly one which calls for strong legislative action, and I should be extremely glad if I could be of assistance in promoting it.

I am, with respect,

J. W. POWELL,  
*Director.*

COMMITTEE ON PUBLIC LANDS,  
HOUSE OF REPRESENTATIVES U. S., }  
WASHINGTON, D. C., April 18, 1890. }

EDGAR T. ENSIGN, ESQ.,  
*Forest Commissioner,*  
*Colorado Springs, Colorado:*

DEAR SIR:—I have received your letter of April 12, 1890, and will say I am heartily in accord with the idea that something should be done in relation to the forest area in the Rocky Mountains. Especially is this true in my Territory, which I hope in a few weeks will be a State, for as yet the forests have been scarcely touched, and the



proper legislation would increase that area and its density very rapidly. I have been giving the matter some attention here, and will do what I can to help along the Dunnell measure.

Yours, very truly,

JOSEPH M. CAREY.

### USE OF PUBLIC TIMBER.

PROTEST AGAINST FURTHER LICENSE, UNLESS ACCOMPANIED BY  
PROPER SAFEGUARDS AND RESTRICTIONS.

In connection with a bill introduced in the United States Senate, December 17, 1889, by Senator Teller, of this State, the following correspondence was had:

<p>HON. H. M. TELLER, <i>U. S. Senate, Washington, D. C.:</i></p>	<p>STATE OF COLORADO, <i>Office of Forest Commissioner,</i> COLORADO SPRINGS, COLO., Jan. 14, 1890. }</p>
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DEAR SIR:—I have not yet seen the text of the Senate bill introduced by you with respect to the use of public timber by miners and others, but have noticed many protests against its passage. \* \* Will you kindly favor me with a copy of the bill, and, if you think it should become a law, a brief statement of your reasons therefor—if that is not asking too much.

You will, I presume, recognize the fact that the friends of forest reform do not desire to prevent the necessary, legitimate and economical use of timber. They seek only to prevent its waste and destruction. They are, for the most part, sincere and unselfish in their efforts in this behalf, and are every year growing in numbers and influence. I think, also, you can hardly overlook the further fact that the great body of our agriculturists, and others interested in the conservation of water, look upon the mountain forests as a most important adjunct in that connection. With best regards, etc., I am,

Very truly yours,

EDGAR T. ENSIGN.



UNITED STATES SENATE,  
WASHINGTON, D. C., Jan. 22, 1890. }

EDGAR T. ENSIGN, ESQ.,  
Colorado Springs, Colo.:

DEAR SIR:—Yours of the fourteenth inst. received. I send you a copy of the bill concerning timber cutting. It, I think, fully explains itself, and it is unnecessary to add anything, except to say that it is not the intention of the bill to encourage waste, but simply to allow those who are compelled to use the timber on the mining lands, under warrant of law. If you wish to suggest amendments, I will be pleased to have you do so.

Yours truly,

M. M. TELLER.

The Senate bill (No. 1304) forwarded by Mr. Teller, is entitled, "*A bill, authorizing the citizens of Colorado, North Dakota, South Dakota, Montana, Nevada, and the Territories, to fell and remove timber on the public domain for mining and domestic purposes.*" It is intended to amplify the act of June 3, 1878, permitting the use of public timber on mineral lands—a law which from the time of its enactment, has met with earnest and continued protest from all friends of forest reform.

The present bill provides that residents of the States named above and the Territories, shall be authorized to fell and remove, for mining, quartz-milling, building or other domestic purposes, timber growing on the public timber lands in either of said States or Territories; no such timber to be used outside of the State or Territory in which it is felled, except with the consent of the Secretary of the Interior, and the felling and removal to be subject to such rules and regulations as may be prescribed by him.

Section two of the bill makes it the duty of the district land officers to report to the General Land Office the cutting or use of any such timber, within their respective district, except for purposes authorized by the act.

Under section three, any *bona fide* resident or settler, in the said States or Territories, who has not sufficient timber of his own for domestic purposes, may, on application to the district land officers, and payment of one



dollar fee, be granted a settler's license, conferring on him the right for one year thereafter, to fell and remove from any of the public lands near his settlement, for his own domestic uses, timber, fuel and fence material, without waste, and under such regulations as the Secretary of the Interior may prescribe, this not to confer exclusive privileges, nor operate to prevent settlement. And any such citizen, or mine operator or manufacturer may supply himself or others, within the State or Territory, with timber, fuel or fence material from any quarter quarter section (forty acres) of the public lands, having first obtained license (for one year) from the local Land Office, and made payment of certain fees.

The district land officers are required to record the names and residences of the licensees, number and date of license, etc.

In the following section it is provided that any such citizen who may desire to fell, remove and sell timber on not less than one nor more than five sections of the public lands, not needed in the neighborhood for mining or agricultural purposes, may, upon compliance with certain formalities, be granted a lumberman's license. The applicant is required to pay a fee of \$25, and the further sum of \$1.25 per acre for the lands covered by his license; the license to exist for a period of two years, and the licensee to pay any costs incurred for surveys; the cutting and disposing of such timber and forest products to be done under the supervision of the district land office; the Secretary of the Interior to prescribe the size and character of the timber to be cut under such license, and the disposition to be made of the tops and limbs of trees.

Any person violating the provisions of the act, or rules and regulations in pursuance thereof, made by the Secretary of the Interior, is subjected to a fine not exceeding \$500, to which may be added imprisonment for any term not exceeding six months.



The provisions of the act are not to extend to railroad corporations any rights or privileges not now conferred by existing statutes.

The following reply was made to Senator Teller's letter of January 22 :

HON. H. M. TELLER,

*U. S. Senate,  
Washington, D. C.:*

STATE OF COLORADO,  
Office of FOREST COMMISSIONER,  
COLORADO SPRINGS, Feb. 8, 1890. }

DEAR SIR:—Your favor of the twenty-second ult., and copy of Senate bill, 1394, were received during my recent absence from home. Please accept thanks for the same.

Upon careful examination of the bill, it is my opinion that if, without change, it should become a law, it would greatly encourage the wasteful and destructive use of our public timber.

The system of licenses provided for in the bill might not be objectionable if accompanied with proper safeguards, if adequate provision were made for official supervision. The supervisory powers conferred upon the district land officers would be likely to fail in operation because those officers are few in number, they have many other pressing duties to perform, and in most instances they would be comparatively remote from the place of depredation.

I also believe that the authority sought to be given to the Secretary of the Interior, to make the rules and regulations governing such use of the public timber would be of little avail unless, at the same time, he were supplied with means with which to enforce his mandates. And should that also be done, it would, in effect, be requiring that officer to establish and maintain a system of forest administration—in addition to the multifarious and onerous duties already imposed upon him. The present bill makes no additional appropriation of funds. It is well known that lack of sufficient funds in the Interior Department has been one cause of its signal failure to preserve the public forests.

In this connection allow me to repeat what I have urgently stated upon other occasions: The government



should at once withdraw from sale or entry its timber lands. It should then provide an effective forest administration; or else a forest commission should be appointed, to thoroughly investigate the subject and make early report with recommendations to Congress.

The economic conditions of the Rocky Mountain States and Territories, are rapidly changing. Mining and stock growing, which have been the leading industries, are likely to become of relatively less importance, and agriculture may gain the supremacy. I need not refer to the vast sums of money which have already been expended in the construction of irrigation works, nor to the steps lately taken by our general government to promote the reclamation of arid lands. In these great and important operations water will be the prime necessity, and that cannot be had if the sources of our streams shall be deprived of their natural protection—the native forests.

I remain, very truly yours,  
EDGAR T. ENSIGN.

To a letter of inquiry (Oct. 15, 1890), as to the action finally taken on the bill, no reply was received by me.

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### Forestry in the United States.

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Forestry is defined as "the art of farming or managing forests." In America the art of *destroying* forests has been steadily practiced for nearly four hundred years, or since the first settlement of the country. Of the conservation of forests we have little, if any, practical knowledge. In fact, the forestry question here has not as yet made a profound impression upon the public mind.



**ACTION OF THE FEDERAL GOVERNMENT.**

Although our General Government has, from time to time, made reservations of timber fit for ship-building, and a few other limited reservations of timber lands for public parks, it has, on the whole, manifested a shameful indifference to the conservation of our native forests, either public or private. In 1876, Congress passed an act creating a Forestry Division in the Department of Agriculture. The functions of this division are, however, strictly advisory, it having no administrative powers, and but scant allowances are made for its support. The public timber-lands have been, and are still, subject to homestead and pre-emption entry the same as other Government lands.\*

For some years prior to 1854, a system of timber agencies existed under the direction of the Solicitor of the Treasury. In the year above named these agencies were discontinued, and supervision of the public timber-lands transferred to the Commissioner of the General Land Office, in the Department of the Interior. For a brief period thereafter the officers of the local, or district, land offices throughout the country were charged to a limited extent with the immediate supervision of the public timber-lands. Thereafter this system was abolished and another substituted, which is still in operation, whereby the supervision of these lands was intrusted to a few scantily-paid employes of the General Land Office, called special timber agents.

As heretofore intimated, from the beginning of our national existence up to the present time, the Government has paid but little heed to the preservation of forests. In fact, the gross inadequacy of our forest laws has tended to promote rather than hinder the destruction of forests. The executive officers of the Government have repeatedly urged upon Congress the necessity of

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\* Since this was written the pre-emption law has been repealed.



enacting more stringent forest laws. These recommendations have been most actively seconded by scientific societies, forestry associations and individuals. Some of the State Governments have also memorialized Congress on the subject. All of which has, apparently, had no effect—at least upon Congress. The indifference of that body, coupled with local opposition from the forest region, fostered by those directly interested in forest destruction, have prevented the enactment of proper forest laws for the protection of our native forests.

Let us pause a moment to note the results of such a policy:

The highest scientific authority asserts that, for the general welfare and prosperity of a country, at least one-fifth, or twenty per cent. of its entire area, should be permanently retained in forest. In the United States, owing to reckless use and waste, but *eleven* per cent. of timber lands remain. Contrast this with the twenty-six per cent. of forest in Germany, and the twenty-nine and one-half per cent. of the European States as a whole! Of the droughts, floods, climatic disturbances and other retributive evils which have followed, but little need be said. Sad experience has made them familiar to our people.

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#### ACTION BY STATE AUTHORITIES.

Nearly all of the States have statutory enactments to protect timber and prairie lands within their limits from fire and depredation. Many also have laws to encourage the growing of timber and shade trees. The imperfect enforcement of these laws, however, renders them, to a degree, nugatory and inoperative. The baneful effect of this is not so apparent in the older States, where humid conditions exist and reproduction is not unduly checked, as it is in the States of the western plains and mountain



region, where excessive aridity greatly enhances the danger and loss from fire, and where renewal of forest growth is in many cases impossible.

MAINE.—The former abundance and excellence of the pine timber in Maine gave to that commonwealth the familiar designation of the "Pine Tree State," and suggested the Pine tree as the central figure of the State seal. The favorable forest conditions of that early period have, however, passed away. Even twenty years ago a public lecturer in Maine stated that "the already destitute condition of some neighborhoods on the coast line of our State, in regard to timber and fuel, where all the farmers in the present generation formerly cut wood for the Boston market, have brought them to their last tree, and they are transporting wood from distant points for their own fires. Now, these same farms have nearly ceased to produce aught for man or beast, and domestic animals have, in a great measure, been banished from them."

NEW HAMPSHIRE.—The entire State of New Hampshire was originally covered with a dense forest growth. As in other parts of the country, however, the timber has been ruthlessly wasted and destroyed.

In 1881 a Forest Commission was instituted to inquire into and report upon the Forestry interests of the State. The report was not made until 1885. It recommended the reforestation of large tracts of waste land, and the adoption of a system for the better protection, from fire and depredation, of existing forests.

Quite recently a similar commission was instituted to ascertain the feasibility of the State acquiring ownership of certain timber lands in the mountain districts, with the view of preserving them as public lands and parks. It is expected that a report from this commission will be submitted in January next. Mr. J. B. Harrison, its able Secretary, has been unceasing in his efforts



to prevent further destruction of the forests. Among other reasons for such action, he urges the inestimable value of forests as a leading factor in the natural scenery of the region.

MASSACHUSETTS.—In 1837 Massachusetts made provision for a special survey (the first authorized in this country) of its forest resources. The examination was very thorough, and the resulting report was first published in 1846, and a second edition printed in 1875. The forest literature of the State, arising from discussion, local publications, etc., is said to date farther back and contain more valuable material than that of any other State in the Union. Although it has no forests managed upon strictly scientific principles, there are numerous tracts of woodland maintained for periodical cutting. A considerable amount of this planting is done in the eastern part of the State.

NEW YORK.—It is doubtless known to most of our people that New York has had, for a number of years, the services of an active Forest Commission. Its principal work thus far has been in connection with the Adirondack forests in the northern part of the State. The preservation of these forests is vitally necessary to the due protection of the sources of the Hudson and other important streams, and for the maintenance of normal climatic conditions, adapted to the needs of tourists and health seekers, who, in great numbers, annually resort to this region. The lands consist principally of disconnected tracts, from which one or more cuttings of timber have been made by the former owners and then abandoned; the State acquiring title by purchase at tax sale. Much of the region has been burned over, and presents a barren and desolate appearance.

Political and other adverse influences in this State have retarded, to some extent, its forestry work.



PENNSYLVANIA.—The production of lumber was once a leading industry in Pennsylvania, but it has now, by the failure of timber, dwindled to a mere fraction of its former estate. The question of forest reform has, for a number of years, been agitated in this State. It has not as yet been followed by needed legislation for the furtherance of local forestry interests. The present Governor of the State, Hon. James A. Beaver, has for the last two years held the presidency of the American Forestry Association, and in his message to the State Legislature makes particular mention of the work of the Association. He has also appointed a special commission to examine and report upon the forestry matters in the State. The Pennsylvania Forestry Association is one of the most active and efficient organizations of the kind in this country. Under its auspices is published an attractive and useful monthly devoted to the cause of forest reform.

OHIO.—In Ohio, for a number of years, the subject of forestry has received considerable attention. A State Forestry Association was formed, Arbor Day established and other steps taken in the interest of forest reform. The organization of a State Forestry Bureau, authorized by act of the Legislature, occurred in June, 1885. Dr. Adolph Leue, of Cincinnati, has, from the beginning, been its efficient secretary. It was made the duty of the bureau to inquire into the character and extent of the forests of the State; to investigate the causes of their waste and decay; to suggest needed forest legislation, and, with the consent of the trustees of the Ohio State University, to establish a forestry station on the grounds of that institution. A movement has since been inaugurated to establish a forestry department in the State University for the training of young men in forestal science. The four successive annual reports of the forestry bureau contain much interesting matter.



MICHIGAN.—In 1887, by legislative act, the members of the Michigan State Board of Agriculture were constituted a Forestry Commission, with power to inquire as to the extent to which the forests of the State were being destroyed by fire and wasteful cutting. Also, as to the effect of deforestation upon the waters of the State, and local climatic conditions. The Commission was also to report upon the protection of denuded regions, stump and swamp lands, and to recommend proper legislation for the preservation and restoration of the forest wealth of the State. In its report, the Commission commended the practice of securing the best possible returns by cutting off the mature timber of the State, but deprecated wasteful methods of cutting, and earnestly recommend the re-forestation of waste and denuded lands. Much stress was laid upon the importance of preventing forest fires.

MINNESOTA.—The first State Forestry Association within the United States was formed at St. Paul in January, 1876. It was organized by leading citizens of the State, who realized the importance of taking measures for protecting the existing timber resources of the State, and making provisions for future wants. Subsequently appropriations of money were made by the State legislature to promote the objects of the association. In the next few years, under the stimulus of premiums offered by this association, and individuals, millions of trees were planted upon the prairie lands of the State. These, however, suffered to a considerable extent from drying winds and the ravages of grasshoppers. Several editions of a useful little work, called "Forest Tree Planters' Manual," were published under the auspices of the State Forestry Association.

KANSAS.—The following facts in relation to forest tree growing in Kansas were kindly furnished by G. C. Brackett, Esq., secretary of the Kansas State Horticultural Society:—



*First*—Forest tree culture, by the settlers of eastern and central Kansas, has been very extensive, rapid and, generally, successful. Failures are caused mostly by neglect and unsuitable selection of varieties.

*Second*—There is plenty of evidence to convince the settler that forest tree growing may be successfully carried on, that the necessity therefor exists here, and that the sooner these facts are accepted and acted upon, the sooner will resulting benefits be secured.

*Third*—The State Legislature, recognizing the need of forest tree growth as a factor in the settlement of the prairie regions, has established two forestry stations in the western part of the State. They are provided with means to solve the questions of adaptation of species and methods of culture and management.

COLORADO.—Forestry work in Colorado was commenced in 1884, by the systematic publication, in the local press, of articles bearing upon forest reform. This was followed by the organization of a State Forestry Association, and by legislation establishing a Forest Commission. The act provides for the appointment, by the Governor, of a State Forest Commissioner, whose term of office is two years. County Commissioners and Road Overseers, throughout the State, are also made Forest officers in their respective localities, and subject to the direction of the State Forest Commissioner. The general effect of the law is beneficial. The executive powers of the Forest officers are, however, unduly limited, for the reason that the great bulk of timber lands in the State belong to the General Government, and the State authorities have no direct control over them.

CALIFORNIA.—A State Board of Forestry was instituted in California in 1885. It was made the duty of the Board to collect information with respect to the forest conditions of the State; to learn, by investigation, as to the adaptability of various kinds of trees to different sections of the State; to disseminate forestry information; and to do all things in its power to encourage the preservation and planting of forests, and the consequent maintenance of water supplies. By a subse-



quent act, the members of the Forestry Board, and all assistants, were constituted peace officers, with authority to make arrests for violation of the Forest laws. Liberal appropriations of money were made for the use of the Board, enabling it to secure the service of a Secretary, Forester, Botanist, Engineer, Special Agent, etc.

From the only report at hand (1887-88), it appears that among the subjects which early engaged the attention of the Board was a reform in the cutting of public forests on the mountain water-sheds. Efforts in this behalf were attended with gratifying results, illegal acts being greatly diminished, and forest management by lumbermen much improved. Notices warning people against the setting of forest fires were posted from time to time, in different sections of the State. Much attention was also given to forest tree culture. A number of experimental stations and nurseries were established. It was made the object of the Board to plant the stations in park form, and at the same time have the trees properly labeled and catalogued; thus making the stations both useful and attractive.

Many changes have occurred in the membership of the Board since its first organization. A report of its work for the last two years has not yet been issued.

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### Forestry Systems of the Old World.

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While it is doubtless true that the forestry systems of other countries should not, without modification, be applied to our own, it is also probable that a careful study of those systems would conduce to the just solution of forestry problems here.

In most European countries the forms of government are paternal in character, and quite at variance with our



republican ideas and institutions. On the other hand, there is danger that we may go to the other extreme, and, on occasion, permit our much vaunted liberty to degenerate into most harmful license.

In former times, Europe, and portions of Asia, were as well wooded as was America at the time of its discovery. But as populations increased, the primitive forests, which had given beauty and fertility to the contiguous regions, were swept away. Mountain slopes and uplands which once made generous return of wood, grass and other products, became, when deprived of their forests, barren and desolate. The denuded surfaces, exposed to the action of the elements, were soon robbed of their rich soils; these, loosened and disintegrated by frost, and beaten by furious storms, found lodgement in the valleys. Descending torrents carried with them sand, gravel and other *debris*, which choked the streams, overwhelmed arable lands, and ruined villages, seaports and harbors.

For verification of these statements, we may turn to authentic histories of Persia, India, Palestine, Greece, Italy, Switzerland, Spain and Portugal. France, Austria, Hungary, Germany and Russia, as well as other portions of modern Europe and Asia, have experienced, in greater or less degree, the evils of forest destruction. The terrible floods in China, accompanied by immense loss of life and property, are traceable to the deforesting of her mountain regions.

A time came, however, when a retrieval of these misfortunes, or at least the prevention of their recurrence, was most urgently demanded. In bitter and costly experience was gained most useful knowledge of the evils attendant upon extensive and irregular deforestation. Then followed the inauguration of modern forestry systems.

As a general rule, these plans of forest management contemplate a centralized direction, a local supervision directly responsible to the



central authority and acting under its direction, and the reservation of extensive tracts of existing timber lands still belonging to the Government. These lands are withdrawn from sale or settlement and set apart for forest management; the present supply of timber suitable for use, and of full maturity, being opened for sale under regulations tending to economical use, and to the yielding of a revenue reasonably proportioned to its worth, but not oppressive in degree. For the great body of these native timber lands the supervision is limited at first to the sale of privileges for cutting timber, under the limitations prescribed, the title of the land being still retained by the Government for such future improvement as it may find it proper to undertake.

A portion of these public lands, relatively small at first, but increasing every year as experience leads and the means allow, is inclosed and put under forest management by planting, thinning and other improvement, the intention being to extend this cultivation so as ultimately to meet the full requirements of the future, when the native supply is gone.

Experiments in acclimatization, and nurseries for the propagation of valuable species, form an essential feature in these undertakings, and efforts are made to widely disseminate a knowledge of all improvements, and to encourage private enterprise in forest planting.

A brief account of the principal existing forestry systems may here be given.\*

#### AUSTRIA-HUNGARY.

Of the total area of Austria and Hungary 32.6 per cent. is covered by forests; in Austria the forests cover 9,515,761 hectares, and in Hungary 9,325,671 hectares.

The State has exercised a careful control over the forests of the country for more than a century, but not until the year 1852, when a special forest law was enacted, was a rational forest culture adopted. Since the enactment and enforcement of this law the systematic culture of the forests has been brought to a very high state of perfection, especially in Bohemia, Silesia, Upper Austria and Salzburg.

No reliable official statistics as to the yield of these forests have as yet been published. The only estimate (not official) which has been brought to my notice, places the annual product in wood at 210,000,000 of cubic metres. Though the yield of the forests is decreasing, it is as yet sufficient to supply not only the home demand, but very large quantities of wood are annually exported.

\* Compiled from U. S. Consular reports, and reports of the Forestry Division, U. S. Department of Agriculture.



The oak forests are utilized for the fattening of hogs, especially in Hungary and Istria. The gathering of gallnuts and tanbark in these regions yield quite a large revenue.

Potash, rosin and turpentine are also among the products of the woods, especially in Northern Hungary.

#### SYNOPSIS OF THE FOREST LAW OF 1852.

By virtue of this enactment, the Government assumes entire control over (1) the imperial forests; (2) forest commons of cities and villages; (3) private forests.

No forest grounds can be used or cultivated for any other purpose except for forest culture without permission of the Government.

If waste is committed, a penalty not exceeding 10 florins per joch is inflicted, and the damaged area must be replanted.

The culture of each forest must be conducted in such manner as not to damage a neighboring forest. A wide strip of thick forest is to be left along the line of the neighboring woods as protection against the wind until these woods are sufficiently advanced in growth.

On the shores of large rivers and lakes, and on mountain sides, where land slides are probable, timber can only be cut and tree stumps extracted with permission of the Government and in accordance with established rules.

Leaves can only be gathered and raked together with wooden rakes, and the ground must not be raked up, so that young timber may not be injured.

Timber can only be cut in accordance with the strict rules established by the Government.

Forest fires are particularly guarded against. Every person is required to give notice of such fire to the nearest authorities. In case of omission, fine and imprisonment follow; fine one to ten florins; imprisonment, one to three days.

The owner of a forest on fire can summon all neighboring villages as a *posse comitatus* to extinguish the flames.

Owners of forests must guard against damage by insects, and at once give notice to the authorities on discovering the ravages of insects.

Owners of large forests, the exact dimensions of which are for the purposes of this provision fixed by law, can employ as superintendent, or chief managers, only such persons as are approved of by the Government after an examination.

In short, the control of the Government over all forests within the borders of the Empire is unlimited; waste and mismanagement are



almost impossible; private rights are completely subordinated to the public requirements.

The beautiful and extensive forests in the immediate vicinity of Vienna, which are partly the property of the Crown and partly owned by private individuals, would doubtless have been exterminated long ago were it not for the strict and systematic enforcement of this preventative enactment.

Sad experience has taught the necessity of the greatest stringency in the forest laws in the mountain districts, and there is a class of communal forests that are placed under the exclusive control of the State officials. The subdivisions of this class are :

*First*—Those on the tops of mountains. These, with, their decaying foliage, retain the snows and rains, thus diminishing the force of the spring torrents, lessening the damage of inundations below and giving supplies to the sources of springs.

*Second*—Those on steep declivities. These are most carefully cherished, not only for the above reason, but as the only security against land-slides, which have in times past caused desolation in many a lovely valley. In fact, it is but a few years since railway communication between Trieste and Vienna was for several days interrupted near Steinbrück from this cause.

*Third*—Those on the borders of rivers. The immense fall of the Isonzo, Save, Drave and Murr, with their branches from their source in the Alps to the plains, gives them a rapidity and force that the strongest and best barriers and stone-work, constructed by the ablest engineers, can hardly withstand, and the fields and meadows through which they rush are, every spring, in danger of being washed away. Whenever a communal forest borders on these rivers its maintenance is held to be of special importance. In all these forests, therefore, not a tree can be felled without the consent of the State foresters. No animals are allowed to pasture, and the greatest precautions are taken to guard against fire.

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#### FRANCE.

By a recent estimate, the total wooded area of France, exclusive of isolated trees, such as those growing in parks and on road-sides, which were not planted for the sake of the timber they produce, amounted to 35,464 square miles, or a little more than seventeen per cent. of the entire area of the country.

The general destruction of forests which has entailed such serious consequences in South-eastern France may be attributed to two general causes. The first of these is the privilege of "pasturage and passage" that has been vouchsafed for many centuries to the flocks



and herds of the peasantry, which are permitted to range freely upon all unclosed lands belonging to the commons and the State. The summers of Provence are long and dry, and the effect of continuous grazing has been to denude thin, poor soil of the hills and mountain slopes of grass and herbage to such an extent that the roots were either killed by the drought and heat, or thrown out of the loosened soil by subsequent freezing and thawing. As a consequence, the soil of many thousand acres of high pasture land has been washed away by the violent vernal and autumnal rains, leaving even the roots of trees so exposed that they, in turn, were swept down by sudden floods and the violent winds that prevail in this country. Large areas of forests were thus destroyed.

The second cause has been the improvident and short-sighted interference of man with the course of Nature. One effect of the French Revolution was to divide the land throughout a large part of France among a greatly increased number of small peasant proprietors. They were poor, and compelled by circumstances to utilize every resource. If the few acres of a peasant were covered with forest, he cut the trees away for the double reason that the timber was valuable and he needed the land for pasture. It was only after the trees were gone that he learned that the destruction of the forest entailed the ruin of the pasturage that grew beneath its protecting boughs. The consequences have been disastrous throughout nearly the whole mountain region of South-eastern France. Hundreds of thousands of acres of uplands have become barren wastes of plutonic earth, seamed by rugged chasms and gullies, which, in the rainy season, pour down torrents of mud and stones upon the fertile lands below, and fill the streams with sudden floods that devastate the valleys from mountain to sea.

To resist this serious and constantly growing retribution, the French government, nearly seventy years ago, began a system of forest supervision, followed later by the replanting of trees and grass in situations where the denudation of mountain slopes had become dangerous to the adjacent valleys. For these reasons, the forest culture in this region has been hitherto mainly for protective purposes, rather than to re-clothe the country with timber for industrial uses.

It is of interest to note how rapidly the forests were swept away during the Eighteenth Century in France. The area under forest in that country was:

In 1750, 37,055,000 acres, or of the whole, 27 per cent.  
In 1788, 19,768,000 acres, or of the whole, 14.8 per cent.  
In 1791, 14,961,905 acres, or of the whole, 10.9 per cent.  
In 1881, 20,749,311 acres, or of the whole, 15.1 per cent.

It should be noted in the foregoing statement that forests are much more easily destroyed than replaced, for in the three years, from 1788



to 1791, almost as large an area in France was deforested as has been re-forested in the last ninety years, although much attention has been paid to the subject during that time.

These simple facts ought to excite some thought with reference to taking some timely steps toward the adoption of an adequate system for the preservation of our American forests, which are now so rapidly disappearing.

**RECLAMATION OF SAND DUNES.**—From the mouth of the Gironde river to that of the Adour, there are immense hills, of different dimensions and altitudes, formed during successive ages by deposits of sand from the sea at high-tide, and which the west wind carried inland for a great distance, forming an inhospitable and barren waste of immense extent, upon which grew neither shrub nor plant. The invasion of the sand, threatening villages and agriculture on the coast, had become a terror, and every effort was made to arrest its invading march. The first effort of importance was made during the last century by Abbe Desbries, of the Academy of Bordeaux, who conceived the idea of fixing the dunes by cultivation. No reliable data is extant bearing upon the result of his labor. In 1786, Mr. Brémontthier, a civil engineer, began a successful experiment of reclaiming the dunes by first building palisades parallel to the sea and then by sowing the dunes with seed of the maritime Pine mixed with seed of the Furz and Brush Broom. Previous experiments had demonstrated that the Pine seed planted alone would not grow. Mr. Brémontthier was the first to permanently fix the sand dunes of France, and, as a result of his labor and example, the dunes to-day are covered with valuable forests, which, from their production of resin, lumber, pasturage, etc., are a source of wealth.

#### GERMANY.

The area devoted to forests in Germany is computed at 25.7 per cent. of the entire area of the Empire.

The owners of German forests are:

States of Crown . . . . .	32.7 per cent.
Communities . . . . .	15.2 per cent.
Charitable and other institutions (donated forests) . . . . .	1.3 per cent.
Corporations of forest owners . . . . .	2.5 per cent.
Private parties . . . . .	48.3 per cent.

The Government exercises not only full control over forests owned by the State, but extends the same, as far as laws permit, to forests not belonging to the State. And this is of great importance, since the latter occupy an area twice as large as the former. Without such supervision on the part of the Government, a reckless devastation of forests would be the consequence.



ADMINISTRATION OF STATE FORESTS.—The administration of State Forests, or of forests owned by the Crown, is entrusted to the Minister of Agriculture, Domains, (public estates) and Forests.

Subordinate to this head Department are:

*First*—The central direction.

*Second*—The local direction, inspection and control. The functions are vested in the Provincial Governments, with offices in the chief places (two or three) in each province.

*Third*—The administration, properly so called, under Chief Forester, assisted by forest treasurers, who keep account of revenues and expenditures.

*Fourth*—The Department of Forest Protection, with special superintendents of forestal works and constructions. These officials are called protective officers.

PRIVILEGES OF THE PEOPLE.—Poor people, living in the vicinity of forests, are permitted, provided rights of other beneficiaries are not interfered with, to gather and carry off dead branches of wood, either without charge or by paying a small sum of money.

Provincial authorities are also empowered to sell to the poorer classes limited quantities of inferior wood during the winter, at greatly reduced prices, say 25 per cent. less than such wood could be bought for in the market.

The right of grazing cattle, in exceptional cases also sheep, is permitted to the people in the neighborhood. A small charge is made, but such permission is subject to the judgment of the forestal authorities, who have to decide whether the grant of such right is not prejudicial to the growth of the trees.

Hogs are sometimes allowed to enter forests as a means of destroying insects.

Tracts within the limits of forests which can be used as meadows are rented, but much care is taken to prevent misuse.

The demand for hundreds of thousands of Christmas trees in December is supplied from the plantations which are being thinned out, and they are cut only under the direction of the foresters.

Uncultivated areas not suited for agricultural purposes, and unoccupied, must be converted into woodlands by cities or communities owning them, unless it can be shown that such waste places are irreclaimable.



### THURINGIA.

Thuringia is widely known for its vast forests, covering an area of over 1,500 English square miles. The careful attention devoted to the cultivation and preservation of these forests present such a contrast to the reckless destruction of forests in the United States, that a stranger, and more especially, perhaps an American, is struck with wonder and admiration. It is doubly so, when he observes that these forests, instead of being a source of continual expense, as is generally supposed must be the case in cultivating woodlands, are not only very profitable, but actually form one of the chief sources of income of some of the Thuringian States.

Forestry is here pursued in so careful and scientific a manner that not even ponds or marshes are allowed to be drained, if it should be considered dangerous to any of the neighboring forests. Indeed, in some parts of this district, the degree of excellence in which the forests are kept, and the profits which, under the most rigidly economical management are derived therefrom, are perhaps nowhere exceeded.

Forest legislation here began as far back as 1359. In the sixteenth century Forest Bureaus were first established and laws on the subject of Forestry proclaimed by the respective sovereigns. For instance, the Saxon-Ernestine laws of 1556, and later those at Eisenach, 1645; Coburg, 1653; Jena, 1674, etc.

The net surplus revenues from the Prussian State forests for a recent year are given at 23,819,000 marks, or nearly \$6,000,000.

The duty incumbent on the State to provide for the maintenance and promotion of the welfare of all its citizens is to be regarded as a continuous task and as a connected whole, and establishes for the Government not only the right, but also the duty to submit the economy and culture of all forests and woods to its supervision and influence to such an extent, as it is indispensable to avert—in maintaining, as much as feasible, free action of the forest owners—dangers which an unrestricted use of forests on the part of the owners threaten to entail to the detriment of the general welfare.

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### ITALY.

The management of the forests in Italy is governed by the general provision of the Forest law of June 30, 1877, supplemented, however, by special regulations for each particular province, which now form an integral part of the law itself.

The fundamental principle of the present Forest laws in Italy is directed to the preservation and care of those woods which by their nature, situation and importance have a direct beneficial influence on



the consistency and solidity of the territory, on the disposition of the water supply and on public health. It leaves, therefore, for free cultivation (that is unembarrassed by any trammels of forest regulations) those woods whose deforestation or ploughing up could do no public injury by altering the normal conditions of the regions in the three respects above mentioned.

The execution of the law is confided to the direction of Government officials; that is to departmental inspectors, with jurisdiction over one or more provinces, who, when necessary, have at their disposal sub-inspectors of districts, whose authority extends over the woodland territory of one or more administrative divisions, or even over a whole province, according to the extent of the woods therein, of their importance, and of the possibility of effective superintendence.

The executive part is entrusted to government brigadiers and overseers, dependent on the government officials. Of those last named, the State bears the charge, but the provinces and commons bear the charge of the various grades of employés and of the provincial guards, who are nominated by the prefect of the province, with the consent of the Committee on Woods and Forests, and are appointed for the care of all the woods, indiscriminately, which are subject to forest regulations. There are in Italy something over 10,000,000 acres of forests.

#### SWITZERLAND.

Early in the fourteenth century, in the more thickly populated sections of Switzerland, the people appear to have been forced, through apprehension of a deficiency in their wood supply, to take some measures for the preservation of their forests. In the year 1314 Zurich forbade its foresters to "fell, raft or sell wood from the Sihlwald." In 1339 Schwyz issued a prohibition against charcoal burning, and in 1438 Freiburg decreed that no wood should be cut in the environs of the city. In Entlebuch it was forbidden in 1471 "to draw wood from forests situated high up in the mountains," and in 1592 Berne called attention to the need of economy in the use of wood. Finally similar decrees became general.

At the beginning of the eighteenth century Swiss forestry took on, in an official sense at least, a more forward and active existence. In 1702 Zurich, always foremost in the work, appointed a commission to devise a general forestry system. In 1825 Berne followed suit, and later Freiburg, Lucerne and Schwyz took action in the same direction. From this time on the several cantons managed their own forestry matters as they wished, and entirely independent of each other up to the year 1876, when the imperative need of combined action having become apparent, the matter was taken in hand by the federal author-



ities, whose attention had been called to the pressing demand for legislative action to arrest the destruction of forests, especially in the higher mountain regions. Accordingly, on the twenty-fourth of March, 1876, a law was passed establishing federal control over the forests in all the mountain regions of Switzerland, embracing eight entire cantons, and parts of seven others.

As will be observed from the foregoing, Zurich has always evinced an actual and especial interest in forestry matters, and the result is that her forestry system is a model one, and is so regarded throughout Switzerland. Great and increasing attention is paid in Switzerland to forest culture and forest preservation. Two considerations have chiefly operated to produce its importance, if not its necessity. One, the influence in checking the sudden and disastrous floods so common in the mountain streams; the other, the protection and maintenance of the steep hill-sides, which constitute so large a portion of the agricultural area of the country.

It is the duty of the forest department to give advice and point out the necessity of renewal, replanting and maintenance of trees sufficient for shelter or protection against avalanches, land-slides and falls of rock. The communal forests are managed by the council, who employ wood rangers, qualified by examination or training in the State forestry schools.

In all the cantons, with the exception of Basle Land, Basle City and Geneva, there is a chief forester, under whom the entire administration is placed. In addition to him, nearly every large city and commune have special skilled and educated foresters, for the more careful attention to their local forests. All, however, are subject to the orders and immediate direction of the cantonal chief forester, as he is subject to the authority of the federal department of forestry.

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#### RUSSIA, SWEDEN AND NORWAY.

Forest administrations, quite similar in character to those of other European countries, exist in Russia, Sweden and Norway.\* Data concerning them is not, however, available at this time. In Russia, one important feature of the forestry work is the reclamation of arid steppes by means of planting. The writer hopes to obtain in the near future detailed information upon that subject.

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\* Ample information with respect to forestry in Sweden and Norway is given in a report (dated October 5, 1872,) to the Department of State, by the Hon. C. C. Andrews, at that time minister resident of the United States to Sweden and Norway.



**BRITISH INDIA, AUSTRALIA AND NEW ZEALAND.**

In British India, in the Australian colonies, and in New Zealand, where extensive tracts of native timber were found for the first supply of European settlers, the same improvident waste occurred as elsewhere. Their forest resources were rapidly depleted, with no care for reproduction, until disastrous consequences in the near future became apparent. The local governments then began to take active measures for arresting the waste.

As a result of careful study of the knowledge and experience gained in European countries, systems of management have been devised and, to a certain extent, applied. The difficulties in the way of some of these new and forming administrations of forest service are very great, especially in India, where a dense native population have from time immemorial, enjoyed rights of usage in cultivation and pasturage wholly inconsistent with successful forest culture, and where ancient prejudices and inveterate abuses of various kinds, must be conciliated and overcome before permanent success is assured.

It would appear, however, from recent official reports of the Inspector General of Forests in India, that even there most gratifying results have attended the work of the forestry administration. The financial showing is especially good. The public forests, instead of being a charge upon the Government, have yielded a large percentage of surplus revenue.



**CAPE COLONY.**

The total area of Cape Colony is computed at 214,000 square miles, of which something over 350 square miles is covered with large forest trees. These wooded tracts exist in the temperate regions of the southern mountain chains, near the sea, running almost parallel to the coast.

Until within a recent period, the working and management of these forests was of a very thriftless and unsystematic character. In 1880, the question of forest management was brought before the Colonial Parliament. It was pointed out that the persons in charge had received no special training for the work, which had in consequence suffered severely, and a salary for a trained forest officer was voted by Parliament. The services of Count de Vasselot, of the French forest department at Nancy, were secured, and he proceeded early in 1881 to organize the present forest department. Count de Vasselot adopted the method of dividing the forest into blocks and subdividing them again into sections. Fellings now proceed regularly in biennial sections, so that the regrowth in the first section cut may develop into mature trees by the time the working of the last section is finished; and there will thus be no occasion at any time to close the entire forest from fellings. The period for the "revolution" of fellings has been fixed at forty years.

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**JAPAN.**

The Japanese have already made greater progress in forestry than the people of the United States. As long ago as 1887, measures were inaugurated for teaching forestry in that country, and very able representatives were sent to Germany to study the theory and practice of the art there.



### Forest Schools.

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Schools of Forestry have grown up in every country in Europe in which the general or local Governments are the owners and managers of woodlands, and a plan of special training has been devised, usually following a general preliminary course in some college or other approved school, in which the ground-work of preparation is secured. Besides this, a practical acquaintance with the labors of forest planting and management is, in many cases, required, by serving for a year, or some other appointed period, under a skillful forester, before entering the forest school. But whether this practical service is required beforehand or not, it always enters into the course of the school, or follows before a regular appointment is given. Certificates of graduation from institutions of approved rank, or corresponding proofs of attainment by preliminary examinations, are required in all cases; and for those aspiring to the State service, certain other conditions, as to age, nativity, etc., are usually required. The sole aim of these schools being to impart that special information which is needed in the planting and care of forests, the course not only includes the sciences that find their application in this business, but the various details of administration necessary for the proper discharge of these trusts, including official correspondence, the making up of reports, keeping of records, and maintenance of laws and regulations generally, so far as they affect their charge.

The general tendency of this special education is to impress the student with the responsibilities of his profession, and to develop a habit of close observation; and the grades of promotion that are generally before those who deserve them, present motives for fidelity and vigilance that tend to most beneficial results.







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# HEARINGS

BEFORE THE

## COMMITTEE ON COMMERCE,

UNITED STATES SENATE,

IN RELATION TO THE

### IMPROVEMENT OF THE MISSISSIPPI RIVER.

#### TESTIMONY OF GEN. C. B. COMSTOCK.

Gen. CYRUS B. COMSTOCK, President of the Mississippi River Commission, appeared before the Committee.

\* \* \* \* \*

Gen. COMSTOCK. Outlets have often been proposed as a method of reducing flood heights on the Mississippi. The immediate results of flood heights are so evident and so beneficial when a large crevasse is formed, the good results of an opening far larger than ever occurs naturally seem so immediate and apparent that it is not strange that many persons look on them as the true remedy for great floods.

In a letter of February 1, 1890, to the Chief of Engineers, I considered the effects of making an outlet a mile wide and to a depth of 10 feet below low water from the Mississippi River into Lake Borgne, and need not repeat the discussion here. In it I assumed what is well known to all persons familiar with hydraulics, namely, that a sedimentary river flowing in its own alluvion only acquires a stable regimen when it has taken a slope suitable to its varying discharges and to the material through which it flows; and as a



rule that these slopes diminish as the size of the river increases and increase as the size of the river decreases. It may be well to give some examples of this general fact.

The South Pass carried in 1875 about one-fourth of the water that the Southwest Pass did. Its slope from the Head of the Passes to its original bar was about one-third greater than that of the Southwest Pass.

The observed discharges of the Atchafalaya in 1882 were from one-seventh to one-tenth of those of the Mississippi. Its average slope to the Gulf is double that of the Mississippi.

The Sulina Pass in the delta of the Danube carries two-twenty-sevenths of the total river flow, while the St. George Pass carries eight-twenty-sevenths. The slope of the Sulina is one-half greater than that of the St. George Pass.

These examples are sufficient to illustrate the general rule already stated, that sedimentary rivers flowing in their own alluvion take larger slopes the smaller they are. Hence, if at Lake Borgne or elsewhere in its delta the Mississippi were divided into two rivers, since each would be smaller than the present river, the two new rivers would go to work to obtain the new and steeper slopes suited to dimensions smaller than those of the original river, and hence would build up their beds. This process would only cease when the steeper slopes needed by each were obtained. Since both rivers would then have one end at the Gulf, and have steeper slopes up to their point of divergence than the main river now has, the flood surface of the rivers at that point would be higher than now.

There have been cases where the experiment of dividing a river in two has been tried by nature or by man. About A. D. 1438 the Adige broke its levees and poured its waters south into the Castagnoro and Canale Bianco, which then formed a drainage stream parallel to the Po. In 1545 the break had so increased that two-thirds of the low-water flow of the Adige and three-fourths of the high-water flow went through it. A low dam was built across the Castagnoro to check the flow into it, and both rivers raised their beds. In 1678 a new dam was built, as the old one was then buried in the deposit. The bed still rose. In 1791 a masonry dam 39 feet high, with many archways through it to allow floods to pass, was built across the Castagnoro. The bed continued to rise, and the floods on the Adige were so high that in 1838 the Castagnoro was permanently closed. In the six years following the closure, the floods in the Adige fell, and the more markedly the nearer the point considered was to the Castagnoro.

Thus far only outlets have been considered which are permanent rivers. For such outlets the effect in finally raising the flood surface of the main river will be the greater as the flow of the outlet is more nearly equal to the remaining flow in the main river. If the outlet is small, its effect on the main river will be small.

Places where there is no escape except at high stages are sometimes called outlets. For many years prior to the recent closing of levee gaps along the Mississippi below Red River, and of the gaps



which permitted water to escape from the vicinity of Turnbolls Island into the Atchafalaya Basin, the maximum flood flow past New Orleans was but about 1,100,000 cubic feet per second. This flow is ample for all navigation purposes, and no practical gain to navigation will result from increasing it. In 1882 it was estimated that about 2,200,000 cubic feet per second passed the latitude of Red River mouth. It has been proposed to allow only 200,000 cubic feet per second to go down the Atchafalaya, leaving 1,900,000 or 2,000,000 cubic feet per second to go down the main river.

In my judgment, until the heights of levees below Red River are largely increased, there should be left a free opportunity for the escape overland of 400,000 cubic feet per second from the vicinity of Turnbolls Island into the Atchafalaya Basin, in such floods as those of 1882, in addition to the 200,000 cubic feet per second which is to go down the Atchafalaya. If such an escape, existing only at high water, be called an outlet, then I think it necessary, at least for the present. It will do no harm to navigation, which was good enough for many years before the escape into the Atchafalaya Basin was reduced. On the other hand, to try to force in a great flood 1,900,000 cubic feet per second past New Orleans, with levees at present heights, is sure to renew the disasters to levees at or below Red River which have occurred this year. The injury resulting from many breaks below Red River is so much greater than that resulting from the escape into the Atchafalaya Basin from the vicinity of Turnbull's Island, that the lesser interest should yield to the greater until it is possible to protect both.

It may be concluded, then, that the reduction, by any large amount, of the flow of the Mississippi at Lake Borgne below what it has been for many years, will be ultimately followed by a rise in the flood heights at that place and a shoaling of the river below and at its mouth.

Also that until levees below Red River are much higher than they are now, about 600,000 feet per second in the greatest floods should be allowed to go into the Atchafalaya Basin, thus relieving the river below.

The opinion that the head of the Atchafalaya Basin should not be closed by levees was urged by me in the Annual Report of the Mississippi River Commission for 1884.

There is one other question, and that is, that leveed rivers raise their beds higher and higher as the levees are raised. That is a very essential question in levees, as long as are those on the Mississippi, and I have some memoranda as to them which I can read to the committee.

The CHAIRMAN. The statement has been made that the bed of the Mississippi River has risen some seven or eight feet.

General COMSTOCK. I have heard that. I have examined that question also. I have prepared a statement as to that question.

The statement is often made that leveed rivers raise their beds higher and higher as levees are raised, and hence that levees will give no permanent relief against overflow. These statements are



usually made from theoretical opinions and without a thorough knowledge of the theoretical side of the subject, and probably without any knowledge of the facts of experience, which alone can lead to conclusions entirely safe. The river Po has long been leveed, and it is often stated that its bed has risen largely in consequence of levees. The following data will show how unfounded is the statement that the bed has risen by amounts that are of much importance:

At the revival of civilization the levees on the Po were complete and continuous from Cremona to the mouth of the Oglio, 49 kilometers, or 58.4 miles. About A. D. 1300 they were carried farther down the river, and in the succeeding centuries to near its mouth. In the present century levees have been systematized as to height. Four hundred kilometers, or 248½ miles, were below the flood of 1872. At the end of 1877 it was expected to reduce this to about 30 kilometers, or 18 miles. (Cenni monografici sull' idraulica fluviale in Italia. *Roma*, 1878.)

Zendrini, in 1720, observed an extreme low water at Ponte Lagoscuro, only .36 foot less than that of 1817; and at the dam of Governolo, near the mouth of the Mincio, the river was 1.3 feet lower than a stage of water of 1609, declared by Bardazzoli to be marvelous (Lombardini, Notizii).

The Cenni Monografici gives the following :

*Pontelagoscuro.*

Years.	Mean low- est water.	Mean high- est water.	Maximum high water.	Minimum low water.
	<i>M. Ft.</i>	<i>M. Ft.</i>	<i>M. Ft.</i>	<i>M. Ft.</i>
1807-1825.....	3.28=10.4	7.42=24.3	8.02=26.3	0.38=1.3
1826-1850.....	3.26=10.3	7.38=24.2	8.96=29.4	0.72=2.3
1851-1875.....	3.19=10.1	7.39=24.2	9.32=30.5	0.62=2.0

The above gauge-readings, which have been only kept since 1807, show that there has been no important rise of the bed of the river (since that could not rise without raising the low-water surface) at Pontelagoscuro in the sixty-eight years covered; and in connection with Zendrini's observations, show that there has been no probable rise of any importance since 1720, although the raising of levees has been going on during this period. Lombardini (*Dei Congiamenti del Po*, 1852, p. 17) examines this question for points above Pontelagoscuro, which itself is 92 kilometers (57 miles) from the mouth of the Po. He concludes that at Ostiglia, which is 183 kilometers (114 miles) above the mouth, the bed appears to have risen a few decimeters (decimeter=3.9 inches) in a century, while at Governolo, 15 kilometers (9½ miles) above, it appears to have been stationary for four centuries.

In *Il grande estuario Adriatico*, 1868, *Appendix D*, he gives the following table of heights of low waters above the lowest water known, which was in May, 1817:



*Means of observed low waters, in meters.*

Years.	Ostiglia.	Sermide.	Quatrelle.	Pontelagoscuro.
	<i>M.</i>	<i>M.</i>	<i>M.</i>	<i>M.</i>
1817-1850.....	0.55	0.54	0.47	0.49
1851-1867.....	0.44	0.77	0.84	0.56

Comparing the means from 1817 to 1850 with those from 1851 to 1867, it will be seen that a small rise in low-water heights is indicated; but the observations at several stations in the first period were few, hence the results are uncertain.

The flood heights have, however, steadily risen. The following greatest floods are recorded:

	<i>M.</i>	<i>Ft.</i>
1705-1756.....	1.82=	6.0 in the year 1755
1757-1796.....	2.15=	7.1 in the year 1777
1797-1836.....	2.68=	8.8 in the year 1833
1837-1877.....	3.22=	10.6 in the year 1872

From this table it appears that the highest floods have increased in height since 1705, by 1.4 meters (4.6 feet). The rise in flood heights on the Po has not been confined to the single point, Pontelagoscuro, but has extended far above.

Gallizia (*Giornale del genio civile*, February, 1878) examines this question and gives the following results. The miles given are reckoned from the mouth of the river.

At Becca (394 kilometers, or 245 miles), within the century, there is a progressive rise of 1.53 meters (5 ft.) from 1801 to 1857; at Corossa (337 kilometers, or 209 miles) the flood of 1801 read 6.35 meters, and their heights rose gradually to 7.95 meters in 1872, or to 7.45 meters if allowance is made for a change of bed at this place. At Casal Maggivre (223 kilometers, or 145 miles) from 5.60 meters in 1801, the floods rose gradually to 6.07 meters in 1868, a rise of 0.47 meters, or 1.5 feet. At Ostiglia (149 kilometers, or 93 miles), from 6.80 meters in 1801, and 7.50 meters in 1812, to 8.56 meters, although the river was not entirely confined. At Pontelagoscuro (92 kilometers, or 57 miles), from 2.19 meters, *sopra guardia*, in 1801, to 3.32 meters in 1872, the river not being entirely confined in this last year—a rise of 1.13 meters (3.7 feet), so that on the average there has certainly been a rise of more than a meter (3.28 feet) in the last seventy-five years along the whole course of the leveed river, excluding the Parma Cremona front, where the levees are far apart, and the rise is about one-half as much.

Cenni Monografiri sull'idranlica, p. 59, attributes the increased heights of the great flood of 1839 to "the more perfect leveeing of the Po and its tributaries, preventing the lateral escape of the waters, and sending in a canal to the sea that which previously flowed over the country."

Lombardini (*Il grande estuario Adriatico*, p. 96) says the increased floods "arise in part from levees which hinder their spreading out, and also from the deforesting of mountain slopes."

Gallizia (*loc. cit.*) attributes increase of floods to deforesting, to the interest each one has to get rid of injurious water, without consideration for those below him, to the leveeing of upper parts of rivers



and their tributaries, and to the extension of the river mouth into the sea.

To sum up in reference to the Po, it may be said that during the present century the levees on the Po have been systematized and raised to follow an increase in flood height that in seventy-five years amounted to about three feet along the leveed portion of the river; and that there is some evidence of a small rise in the extreme low-water surface of the river, which may be caused by a rise of the bed. It should be noticed however, that the rise in the bed (if it really exists) amounts to only two-hundredths of a foot a year, and that the annual cost of raising levees to keep up with it would be but a small part of the annual cost of a complete system of levees.

As to the rise in the flood level as the waters are more and more thoroughly confined, it may be said that this was a necessary result of confinement; that the same thing occurs on the Mississippi, and that it will cease when the levees have been built high enough to contain the greatest floods.

On the Po, thus far, during the last seventy-five years the effect of the confinement of waters in raising the flood level has far exceeded any tendency that confinement may have had to reduce flood heights by scouring the bed.

Senator WASHBURN. Are the conditions the same in the Valley of the Po as in the Mississippi Valley?

General COMSTOCK. Yes, sir, essentially the same; an alluvial stream.

Senator CULLOM. So that your conclusion is that the bed of the river has not risen?

General COMSTOCK. Not to any considerable amount; not to exceed 6 or 8 inches.

Senator CULLOM. For how long a period?

General COMSTOCK. From seventy-five to one hundred years.

Senator CULLOM. Oh, that is the Po. What is the fact with reference to the Mississippi River?

General COMSTOCK. Our records of low water run back only twenty-five or thirty years. Our records do not go back far enough to draw an intelligent conclusion. You want a period of from seventy-five to one hundred years to say positively whether any changes have occurred.

The Rhine is also a river which, below Dusseldorf, has long been leveed, and if levees raise the bed of a river, here they should have produced their full effects, as they are rarely broken.

The following table from Fijnje (Beschonwingen over eenige rivieren, eerste gedeelte, bijlage A, p. 185) gives (in meters) the height of the lowest water which occurred in each ten years from 1772 to 1880, above the Amsterdam zero, for Cologne and Emmerich:



Years.	Cologne.	Emmerich.	Years.	Cologne.	Emmerich.
1772-1780.....	36.82	11.29	1831-1840.....	36.30	10.88
1781-1790.....	36.14	11.26	1841-1850.....	36.35	10.81
1791-1800.....	36.36	11.24	1851-1860.....	36.06	10.16
1801-1810.....	36.56	11.11	1861-1870.....	36.03	9.92
1811-1820.....	36.30	11.03	1871-1880.....	36.28	10.21
1821-1830.....	36.30	10.64			

It will be seen that the law-water surface appears to have fallen in the last hundred years at Emmerich, and possibly at Cologne.

Hagan (*Wasserstande in den Preussischen Stromen*, p. 12) carefully examines the gauge readings at Cologne, from 1846 to 1879, and at Dusseldorf, from 1800 to 1879, to detect changes in high and low water heights. Treating the gauge reading by the method of least squares, he found the most probable annual change in the water heights. At Dusseldorf he found that, with great probability, there was an annual sinking of the maximum high water in each year amounting to 0.3 inch; that the mean stage did not change, and that the annual lowest waters showed, with some probability, an annual rise of one-twelfth of an inch.

For Cologne he found that, with great probability, the high waters had sunk, and the lowest waters had risen by about the same amounts as at Dusseldorf. A rise of one-twelfth of an inch a year, or eight inches in a hundred years, is so small as not to be an important matter in a system of levees; and if the hundred years of the table above are taken, this rise disappears.

It has often been asserted that the bed of the Hoang Ho, or Yellow River of China, has risen above the surrounding country where it is leveed. The error, originally due to Abbe Huc, has been repeated by English writers on China. The following extract from a letter to me by Gen. J. H. Wilson (a very competent authority) gives reliable information on the subject:

WILMINGTON, DEL., May 6, 1890.

\* \* \* \*

In reply I hasten to say that I crossed the Yellow River on the 7th of January, 1866, near the city of Kai-fong-fu, in the province of Honan, and visited the site of the great break of 1853, about thirty miles below Kai-fong-fu; also traversed its embankments or levees on both banks of the river, visiting and measuring them at various points between Kai-fong-fu and Chinan-fu, in the province of Shan-Toong, taking observations, notes, and measurements, and having specially in view the repair and maintenance of the embankments, their present condition, and the effects produced by them. I had no instruments, however, except a hand-level, sextant, and tape-line, and could take no accurate levels across embankments, bed of the stream, fore-shores, and adjacent plains, but the conclusion I came to in regard to the influence of the levees upon the bed of the river was that they had nowhere filled it to a higher level than the adjacent country. I had heard Father Huc's narrative on that point, and I visited the plan at which the river had left its old channel in 1853, leading to the sea south of the peninsula of Shan Toong, and made itself an absolutely new one to the Gulf of Pe Chi Li, north of that peninsula. Between this place—known on the maps of Asia (Kirke Johnson's is the best) as Lung mum Ku—and Kai-fong-fu, the embankment was very large, but it was near the latter place that the great break occurred two years ago. This was closed after incredible efforts and great expense and this river forced to resume its old channel, where it is now emptying itself, according to my



advices of a few months ago, and where it will most probably continue to empty itself till it can find a shorter line and steeper declivity to tide-level.

By referring to my little book on China (Appleton & Co.) you will get other details.

In conclusion, I do not hesitate to say that I can not but believe that Abbe Huc was entirely mistaken in regard to the silting up of the channel, and that an exhaustive survey would prove beyond a doubt that no such silting as to raise any part of the bed above the adjacent country has ever taken place.

Yours, very truly,

JAMES H. WILSON.

The question of the rise of bed of the Mississippi will now be considered. Unfortunately, it has not been studied as thoroughly as the Rhine and Po, and its gauge-records go back but a few decades.

Levee building has gone on most rapidly since 1880, and as the river was very low in December and January, 1887-'88, and again in October and November, 1889, if there has been any important rise in the river-bed resulting therefrom, it should show itself in a corresponding rise in the extreme low-water surface.

Several places will be considered, selecting those where our gauge-records cover as many years as possible.

(1) *Cairo*.—The lowest water record extends back to 1859, with breaks, but is continuous since 1871. January 1, 1888, the gauge read 1.8 feet, and October 2, 1889, it read 2.7 feet. From November 10, 1859, to these dates, the record gives but three years when the water was as low as in 1888 and 1889. These years were:

	Feet.
December 26, 1871; Cairo gauge.....	-1.0
December 6, 1872; Cairo gauge.....	1.0
January 1, 1877; Cairo gauge.....	1.0

These gauge readings are lower than those of 1888 and 1889, but the period since 1880 is entirely too short to conclude that in it there was a year in which the discharge reached its lowest value, thus giving extreme low water. The greater low-water heights in 1888 and 1889 may be simply due to there being more water flowing in the river at those times than in 1871. If in seventeen years following 1888 there are no gauge readings as low as those of 1871, 1872, and 1877, it will in some degree indicate but not prove that the bed has risen. At present the data do not extend over a period long enough to draw any reliable conclusions.

(2) *Memphis*.—This gauge read:

	Feet.
November 20, 1887.....	1.20
January 4, 1888.....	0.80
October 26, 1889.....	1.90

The records of low water before these dates extend back to 1848, and are continuous back to 1871. The records back to 1848 give but three dates when the water was lower than on January 4, 1888, namely 0.80 feet. These dates are:

December 29, 1871.....	-0.92
December 22, 1872.....	-0.95
January 2, 1877.....	-0.75



Here again the extremely low waters of 1871 and 1872 show themselves, and they are lower than any since 1880. But as was said with reference to Cairo, the period since 1880 is entirely too short to enable us to assume that in it there has been a year of minimum flow, or, what amounts to the same thing, that there will not in a few years occur a stage as low as that of December 29, 1871.

(3) *Helena*.—The low-water record is continuous, excepting 1878 and 1879, back to 1871. The gauge reads:

	Feet.
December 29, 1871.....	1.15
December 26, 1872.....	0.00

The record afterwards gives no waters as low as these till 1887. The gauge reads:

	Feet.
November 20, 1887.....	1.20
January 4, 1888.....	0.80

Comparison of the two periods gives a difference too small to establish a rise of low-water level.

(4) *Lake Providence*.—The low-water record extends back to 1872, and the lowest waters are:

	Feet.
December 29, 1872.....	—3.85
October 16, 1879.....	0.55

Since 1880 the two lowest waters are:

	Feet.
November 22, 1887.....	1.52
October 31, 1889.....	2.80

There seems to have been a great depression of low water in this part of the river about 1872. The Terrapin Neck cut-off, shortening the river about 16 miles, occurred in 1866 and may have been a partial cause. The gauge readings given indicate a rise in the water surface and probably of the bed at Lake Providence since 1872.

(5) *Vicksburg*.—Excepting 1878 and 1879, the low-water record is continuous back to 1872. The gauge reads:

December 30, 1872.....	—1.30
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From this date to 1886 the lowest record is:

January 6, 1887.....	2.25
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Since 1880 we have:

	Feet
November 16, 1886.....	0.00
November 24, 1887.....	3.91
January 7, 1888.....	1.32
October 29, 1889.....	0.80

Here the gauge records indicate a fall in the low-water surface and perhaps a fall in the bed. The question is complicated by the Terrapin Neck cut-off of 1866, the Vicksburg cut-off of 1876, and the Davis Island cut-off of 1867.



From 1872 to 1881 the low-water fall in the surface of the river between Lake Providence and Vicksburg varied between 21.0 feet and 22.9 feet; in 1883 it was 24.9; in 1886, 26.2; in 1887, 29.0; in 1888, 26.7; and in 1889, 27.2 feet. The change of fall from 22.6 feet in 1881 to 29.0 feet in 1887, amounting to 6.4 feet, is very great. About two-thirds appear to be due to a sinking of the low-water plane at Vicksburg, and the rest to a rise in the low-water plane at Lake Providence. The low-water slope from Lake Providence to Vicksburg was in 1884 still much greater than just above or below. Its great value was probably due to the cut-offs. In 1884 the distance from Lake Providence to Vicksburg was 57 miles; the sum of the two cut-offs was 18 miles. If we suppose that before these two cut-offs the river was two-thirds of this 18 miles longer than now, or the distance from Lake Providence to Vicksburg to have been 69 miles, the slope would have been but fifty-seven sixty-ninths of its present value. The result of the cut-offs would be to increase the velocity of the river above and near them. This increase of velocity would tend to scour the bed and banks, perhaps making a deposit in the river below the Davis cut-off, and temporarily raising the bed there; and it may be that it is now returning to its normal low-water position by removing the deposits below.

(6) *Red River Landing*.—The low-water record is continuous back to 1872, which was the year of the lowest known low water, the gauge reading 0.0. In 1879 it fell as low as 0.55, and in 1887 to 0.47. The difference in low-water heights of 1872 and 1887 is too small to be evidence of a rise in the bed of the river.

Thus far only low waters of the Mississippi have been considered. The high water records cover longer periods, but as an increased high-water may result from confining the flood between lines, as well as from a rise of the bed of the river, it can not be concluded from a rise of flood height in the river that the bed has also risen. At Cairo—

	Feet.
June 21, 1858, the gauge read.....	49.6
May 2, 1862.....	50.8
March 21, 1867.....	51.0

The river did not again reach these heights till—

February 26, 1882.....	51.87
February 27, 1883.....	52.17

The increase in the later heights is not supposed to indicate any rise of bed, but can be accounted for solely by a greater flood or discharge.

At Memphis the record goes back to 1828. In 1862 the river reached a flood height of 34.45, the record then showing no greater one. In 1882 the greatest height was 35.15; in 1887, 35.30; and in 1890, 35.60. This rise of 1.1 feet since 1862 may be accounted for by a greater discharge, by the construction of levees below Memphis, and, perhaps by the influence of railroads across the St. Francis bottom, without the supposition of a rise of bed.



At Vicksburg the record goes back to 1828. The highest known water was 51.1 feet, in 1862. The next highest was 49.1, March 15, 1890. Here there is no indication of a rise of bed.

At Natchez the record goes back to 1828. The highest water was 49.9, in 1862. In 1890 the highest water was 48.6, on March 22. In 1815 the highest water was 48.5. There is no indication of a rise of bed.

From an examination of the Po and Rhine, it may be concluded that if their beds rise in the leveed portion (which is not entirely certain from the data), it is at so slow a rate as not to be an important factor in the maintenance of a levee system. With levees 10 feet high, if the bed rose at the rate of 1 foot in a hundred years, the cost of raising a line of levees having the length of the present Mississippi system—about 1,300 miles—by this one foot, would be but about \$4,000,000, distributed over the country, or \$40,000 per annum, which is a small part of the annual cost of the system.

On the Mississippi, the records, while not extending over a period long enough to give final results, do not, as far as they go, indicate that the bed has risen.

The opinion so often held, that levees cause a river bed to rise, is probably due to the fact that the bed of a river does sometimes rise, although leveed, and hence it is concluded that the levees cause the rise. Any sedimentary stream, having a definite succession of stages and discharges, and flowing in its own alluvion, finally takes such a slope as will give a velocity sufficient to enable it to carry its sediment, whether derived from above or from its own banks and bed farther down stream, without, on the whole, scouring or filling its bed. An average velocity less than this will give rise to deposits in its bed, or if it is crooked, it will become straight, thus in either case increasing its slope and velocity towards their normal values. An average velocity greater than this will scour its bed or cause caving in its convex bends, thus increasing its length and diminishing its slope and velocity to such values as its bed can bear without, on the whole, scouring or filling. When, therefore, the slope of a sedimentary stream suddenly diminishes from that which it needs for stable regimen, its velocity also diminishes; it drops a part of its alluvion, and its bed rises. Thus, when the Mississippi enters the Gulf of Mexico, its slope suddenly diminishes, its velocity diminishes, and it builds up bars out in deep water. So Bayou Lafourche, when its waters fall to the level of swamps but a few feet above Gulf level, builds up its bed, necessitating high levees. So, too, the Adige, where it reaches the low plains of the Po, needs for permanence a steeper slope than the country has, and raises its bed above it. In all these cases the bed would rise without levees.

The is one more cause for the rise of bed of a sedimentary river, which, however, acts at a very slow rate. The Mississippi pushes its mouths out into the Gulf at the rate of about 4 miles in a century, and this increase in length requires a corresponding increase in fall of water surface to make the waters flow out. An increase of 4 miles in length would, with existing slopes, raise the high-water



surface at New Orleans about .7 foot. The cost of raising levees to correspond with this rise per century in the water surface would, as has already been seen, be a small part of the annual cost of the system.

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#### STATEMENT OF LIEUT. COL. CHAS. R. SUTER.

Lieut. Col. CHARLES R. SUTER, U. S. A., a member of the Mississippi River Commission, appeared before the committee.

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Lieutenant Colonel SUTER. The Commission was organized in 1879. The first report that the Commission submitted in accordance with the law organizing it considered various plans that had been presented at various times for improving the Mississippi River. They were defined in the bill as the outlet plan, the levee plan, and what was called the jetty plan. The Commission reported upon all three plans and then made their recommendations as to what they proposed.

The so-called outlet plan was condemned *in toto*. The plan of improving the navigation by levees alone was not adopted by the Commission.

Of course as a protection against overflow they were unanimously favored by the Commission. The closure of the then existing gaps was recommended, as it was considered that the levee system would form an important auxiliary in channel improvement when taken in connection with the other work which was recommended. The Commission were of the opinion that an approximately uniform regimen of the river should be aimed at, and that the control over the river should extend through all its stages, including high water, which of course brings in the levees as a factor in the channel improvement. I will state that when I speak of a uniform regimen of the river I mean that the object is to introduce as nearly as possible similar conditions throughout, so that there will be no abrupt changes in its main features.

The river in its present state varies from 2,000 feet to over 10,000 feet in width, with corresponding variations in velocity and everything connected with it. The idea was to bring it into something like uniformity. Of course it was not considered advisable that the minimum width should be taken as the standard. The minimum width I think is 2,000 feet. It is not considered necessary to go that far, but the Commission found on investigation, from such surveys as were available, that a width at low water of about 3,000 feet would give sufficient depth for all navigable purposes, and the plan formulated was to reduce the river to this width at low water by proper contraction works. The kind of contraction works proposed were what may be denominated silt-catching works. They consist of systems or combinations of dikes made of piles and carrying brush screens, so designed as to check the current over certain selected portions of the river bed and induce there deposits of silt, so that ultimately the river may rectify itself by reclaiming those por-



tions of the bed which are not needed for the navigable channel and building up new banks. Eventually these shoals become the training dikes just as ordinary dikes do on rivers of the usual character. It is a system of improvement only possible on a sediment-bearing stream.

The second feature of the proposed plan was the revetment of banks where exposed to erosion, the idea of course being to make the current act on the bottom instead of the banks, in order to deepen the channel.

These two constitute the main elements of the channel improvement in the bed of the river; that is, permeable dikes to induce deposits, and revetments to hold the banks and keep the river in place. The maintainance of levees on the top of the banks was thought by the Commission to subserve two purposes. In some places there is very little question that the navigation of the river has been seriously deteriorated by the existence of breaks in the levees. That, of course, is especially manifest in those portions of the river that have been leveed for a long time; that is, where the system of levees has been kept up for a great many years.

It has been found by measurement that below extensive gaps in levees there is a very decided deterioration in the channel, and the Commission were of the opinion that this deterioration is due to the existence of these gaps; hence their inference was that if those gaps in the levees were closed the deposits formed under the influence of the crevasses would be swept away and the channel of the river correspondingly improved and deepened. Furthermore, levees were deemed essential, both for the safety of the works in the bed of the river, and to maintain the regimen at those places where it was already good. The only way to obtain uniformity of regimen, or to keep it when obtained, is to control the entire discharge of the river, which of course means the control of the floods as well as low stages. At the period of flood discharge you have an enormous volume of water, capable of almost any amount of mischief; at that period the cut-offs are formed and all sorts of accidents of that kind occur, all of which tend to upset the uniform regimen you are endeavoring to get.

From this point of view the function of the levee system may be considered as conservative; its other function confers a direct benefit. The plan of the Commission contemplated both of these functions and these three factors; that is, the channel contraction works, the revetment of the banks, and the levees on the top of the banks constitute the plan on which the Commission has worked from that day to this.

Senator GIBSON. Do you know what effect the levees have had on the navigation anywhere?

Lieutenant-Colonel SUTER. Yes, sir; I think they have had a very decided effect at Lake Providence, and also to a certain extent at Plum Point. At Plum Point the levees have been constructed by the Commission purely and entirely to improve navigation. They



are local levees, on both banks of the river, and the effects have been very marked.

Senator GIBSON. You stated a moment ago in reply to a question by the Chairman that if you were improving the Mississippi River, even if it were running through a wilderness, if the country through which it ran was not peopled, you would still build levees on the banks.

Lieutenant-Colonel SUTER. Yes, sir.

Senator GIBSON. Why do you hold that opinion?

Lieutenant-Colonel SUTER. Because I consider that the improvement of the stream for navigable purposes; without it is impossible.

The CHAIRMAN. Why?

Lieutenant-Colonel SUTER. I think you have got to retain control over the whole volume of water. The discharge which passes within the banks is less than half of the flood discharge of the river, and the low-water discharge is only about one-tenth of that which passes within the banks, about one-twentieth of the total discharge, and any works that you can put in to control the low-water flow on a stream like the Mississippi are liable to be utterly destroyed and rendered nugatory by the vastly larger volume of water which passes down the river during flood stages. At this season of the year the cut-offs occur, which will upset any plan of improvement, because they change entirely the regimen of the river, its course, its slopes, and everything about it.

Again, the water being over the works and everything else, has a chance to develop new channels precisely where you do not want them to occur. A still further effect is produced where the levees are down; the water that goes over the banks keeps going out and coming back again. Whenever it makes its appearance in the river it acts like a tributary. It produces entirely new phases, just as any tributary will. Sometimes it entirely reverses the conditions of flow. The influence that levees exert under these heads I believe I have stated as conservative. They prevent the river from doing damage to the works we put in to improve the low-water discharge of the stream.

The CHAIRMAN. If there was no question about protecting the land, and you were simply improving the Mississippi River for navigation, would you have built the levees that are now built?

Lieutenant-Colonel SUTER. Yes, sir.

The CHAIRMAN. You say you would?

Lieutenant-Colonel SUTER. Yes, sir.

The CHAIRMAN. So that, regardless of the question of the land owners, you say that this Commission has done none too much toward levee building.

Lieutenant-Colonel SUTER. That is my opinion.

The CHAIRMAN. Do you not think the people whose lands are preserved by these levees should pay a part of the expense of constructing them?

Lieutenant-Colonel SUTER. That is hardly an engineering question. I think, however, the same question might be asked with re-



gard to other improvements. For instance, one of the most important features of the work of the Commission is the protection of the banks from caving. In doing that we do it entirely in the interest of navigation, but it does at the same time prevent many a man's plantation from caving into the river.

The CHAIRMAN. In other words, you think the levee is a part of your system as well as the jetties?

Lieutenant-Colonel SUTER. Yes, sir.

The CHAIRMAN. You mean to say that these dikes and levees are necessary to preserve the channel of the river itself?

Lieutenant-Colonel SUTER. Yes, sir.

The CHAIRMAN. The permanency of the channel?

Lieutenant-Colonel SUTER. Yes, sir; that is my view.

The CHAIRMAN. How long did you say you had been on the river?

Lieutenant-Colonel SUTER. Since 1866.



## IMPROVEMENT OF THE MISSISSIPPI RIVER.

### STATEMENT OF CAPT. SMITH S. LEACH.

Capt. SMITH S. LEACH, United States Engineers, in charge of first and second districts of the Mississippi River, appeared before the committee.

The CHAIRMAN. How long an acquaintance have you had with the Mississippi River?

Captain LEACH. Since 1878.

The CHAIRMAN. Are you a member of the Commission?

Captain LEACH. No, sir; I am a subordinate officer of the Commission.

The CHAIRMAN. Where are you located?

Captain LEACH. At Memphis.

The CHAIRMAN. State what your experience with the river has been.

Captain LEACH. In the summer of 1878 the board of engineers was organized which was referred to here by General Comstock and others. I was then second lieutenant of engineers and was assigned to duty as recorder of that board. That board undertook extensive surveys, examinations, hydrometric measurements, etc. The field-work of a large part and the computations of all of these were placed in my immediate charge. I began from that time to study this question from the original data and measurements made upon the stream itself, and I have done nothing else professionally from that day to this.

The CHAIRMAN. Have you observed the overflows of the river?

Captain LEACH. Repeatedly. I have been over the river in its whole length and at almost every stage of water.

The CHAIRMAN. State to the committee as briefly as you can your idea of the improvement of the Mississippi River for navigation.

Captain LEACH. To start with what should not be done, I would mention the project of taking off any portion of the water of the natural discharge of the river at any stage whatever or for any purpose, or at any point. The salient point in connection with that topic is, first, the question of the effect upon the channel of the river above and below resulting from taking off such water under such circumstances. I have here a complete map of the delta of the Mississippi showing its approaches to the Gulf. I may state a fact, which I do not think will be denied by any one, that this single-trunk channel as it approaches the Head of the Passes is one of the finest navigable flowing streams on the face of the earth. It is of reasonable width, very deep, and has at all times a regular and



moderate current. At a point here [indicating on map] it is divided into three principal branches. Each one of those branches is narrower and shallower and more irregular in its regimen than is the main stream. This is the Head of the Passes [indicating on map].

At this point, where this main stream is divided into three branches, the phenomenon is presented of a large and deep and good channel being transformed into three narrow and shallow and poor channels. A great deal of talk has been heard about the difficulty that Captain Eads had in removing the bar at the mouth of South Pass bar. If he were here to-day he would confess a much more serious difficulty in dealing with the shoal water at the head of that pass. This is the bar that gave him the real difficulty [indicating on map]. This is the bar at the Head of the Passes at the point of diffusion, at this point division of the main stream. It was to get a greater depth over this bar at the Head of South Pass that he laid a sill over the other two passes, and constructed the funnel-shaped prolongations of the natural banks of this pass in order to augment the flow of water through there.

We have these three passes, each having a bar at each end, and each being 30 feet average depth between the bars in its original and natural condition as against 125 or 130 feet depth of the main stream. Here is the South Pass [indicating on map]. This is the one that has the great depth. This is the one that carries from 26 to 30 feet. This Southwest Pass carries less than that, perhaps 16 feet.

Now, the point I make is this: This phenomenon occurs here [indicating on map]. It occurs at the corresponding point on every known alluvial sedimentary stream on the face of the earth that branches into a delta formation.

Now if the degradation of these subsidiary channels occurs here when the stream divides into three parts, why will it not occur at Lake Borgne if you there divide it into two? The fact can be explained on no other hypothesis than that in division there is weakness, a proverb more familiar in the universe terms "In union there is strength." I never heard any other advanced for it, and its converse, which the outlet theory demands for its support, is not only absurd on its face, but contradicts every fact of the river's life which has come to my knowledge. Anything further on the subject of outlets is only an elaboration of that general statement. To substantiate that, if proof should be necessary, there are frequent observations in the bed of the river itself. These consist of a large number of exact measurements, as precise and accurate for that purpose as would be any measurement that could be made of the length of this Capitol building. We have not guessed at this thing; we have measured it, and we had no theory to establish when we made the measurement, but we made the measurement for the purpose of finding out the theory.

The measurements have shown conclusively in repeated instances that when a crevasse occurs the channel for a few miles immediately below becomes distinctly smaller. When that crevasse is closed, measurements made before and after the closure have shown that



this loss in the area of the channel is recovered. When a crevasse is closed and immediately after that closure—let me change the form of that statement—when a crevasse opens and immediately after that opening by exact measurement there is found to be a deterioration of the channel of about 12 per cent. of its area, and again when this same crevasse is closed after the next succeeding flood, there is found to be a recovery of this 12 per cent. lost, I do not think any other hypothesis will explain it.

Second in importance will be the deterioration of the navigable depth in this channel which is now an extraordinary good one, and which can be maintained there, as the experience of the last ten years has shown, at a very trifling expense. If that channel were injured and deteriorated by the natural and inevitable result of taking off a large portion of the flood discharge at a point higher up the river, you would then, instead of having little or no expense to keep it open, have an enormous annual expense, and even then the condition of the channel would be so precarious that the effect on commerce would be very detrimental. Ships will go to a port where they know they will find 26 feet of water, without doubt, more readily than they would go to a port where they were promised 30 feet and might find but 20. A reliable 26-foot channel is better than a precarious 30-foot channel.

The CHAIRMAN. You are familiar with the methods of the Mississippi Commission as to improvements?

Captain LEACH. Will you bear with me a little further on this topic?

The CHAIRMAN. Yes, sir.

Captain LEACH. The question has been discussed over and over again as regards the elevation of the bed of the river as the result of the construction of levees, and also as to the deterioration of the channel below the outlet. I know of no engineering authority that can be quoted in support of this view except by garbling, and as you have had a little garbling already before you I would like to read some full and complete extracts. I have before me the report of Colonel Ellet. I would like to read a few extracts from it; it will take but a moment. I will read the introduction pretty much *in extenso*.

The CHAIRMAN. When was that report made?

Captain LEACH. Eighteen hundred and fifty. It is a report and the only one I know of where an engineer of any standing has deliberately and definitely proposed to make a certain definite outlet.

In this paper the causes of the more frequent and more extensive overflows of the delta of the Mississippi in recent than in former times are considered, and plans suggested for the mitigation of the evil.

The greater frequency and more alarming character of the floods are attributed—

Primarily, to the extension of cultivation throughout the Mississippi Valley, by which the evaporation is thought to be in the aggregate diminished, the drainage obviously increased, and the floods hurried forward more rapidly into the country below.

Secondly. To the extension of the levees along the borders of the Mississippi, and of its tributaries and outlets, by means of which the water that was formerly



allowed to spread over many thousand square miles of low lands is becoming more and more confined to the immediate channel of the river and is, therefore, compelled to rise higher and flow faster, until, under the increased power of the current, it may have time to excavate a wider and deeper trench to give vent to the increased volume which it conveys.

Thirdly. To cut-offs, natural and artificial, by which the distance traversed by the stream is shortened, its slope and velocity increased, and the water consequently brought down more rapidly from the country above, and precipitated more rapidly upon the country below.

Fourthly. To the gradual progress of the delta into the sea, by which the course of the river, at its embouchure, is lengthened, the slope and velocity there are diminished, and the water consequently thrown back upon the lands above.

It is shown that each of these causes is likely to be progressive, and that the future floods throughout the length and breadth of the delta and along the great streams tributary to the Mississippi are destined to rise higher and higher as society spreads over the upper States, as population adjacent the river increases, and the inundated low lands appreciate in value.

For the prevention of the increasing dangers growing out of these several co-operative causes six distinct plans are discussed and advocated :

First. Better, higher, and stronger levees in lower Louisiana, and more efficient surveillance—a local measure, but one requiring State legislation and official execution and discipline.

Second. The prevention of additional cut-offs; a restraint which may call for national legislation, or possibly judicial interference to prohibit the States and individuals above from deluging the country below.

Third. The formation of an outlet of the greatest attainable capacity from the Mississippi to the head of Lake Borgne, with a view, if possible, to convert it ultimately into the main channel of the river.

Fourth. The enlargement of the Bayou Plaquemine, for the purpose of giving relief to that part of the coast which now suffers most from the floods, viz., to the borders of the Mississippi from above Baton Rouge to New Orleans.

Fifth. The enlargement of the channel of the Atchafalaya for the purpose of extending relief higher up the coast, and conveying to the sea, by an independent passage, the discharge from Red River and the Washita.

Sixth. The creation of great artificial reservoirs, and the increase of the capacity of the lakes on the distant tributaries, by placing dams across their outlets, with apertures sufficient for their uniform discharge—so as to retain a portion of the water above until the floods have subsided below. It is proposed by this process to compensate, in some degree, for the loss of those natural reservoirs which have been and are yet to be destroyed by the levees; and, at the same time, and by the same expedient, improve the navigation of all the great tributaries of the Mississippi, while affording relief to the suffering and injured population of the delta.

Now I read again from part 2 of Prolongation of the Delta :

It is a popular belief that the bed of the Mississippi is gradually *rising*, and to that assumed cause is not unfrequently attributed the constantly increasing height required for the protecting levees. But this belief can be traced to no better evidence than the fact that certain points which formerly exhibited deep soundings have subsequently become shallower, a circumstance which is attributable altogether to the shifting nature of the shore and bottom of the river. As consequences of the changing and movable character of the soil through which the Mississippi flows, shores which are at one period curved subsequently become salient; banks that at one time wash and cave in, at a later date fill up; places which during one period are gradually growing deeper, at another become less deep and to the sounding-line indicate an elevation of the bottom. There is, in fact, no evidence of any change in the general level of the river's bed beyond what may be inferred from the evident prolongation of the delta, the lengthening out of the course of the stream, and the consequent diminution of the plane of descent. But this elevation of the bed is not indicated by any increased depth of the stream, though it must of necessity occasion a corresponding elevation of the surface. Any increase in the height of the floods produced by a given body of water discharged in a given time, beyond what may be justly attributed to this extension of the delta, must, therefore, be sought in other adequate causes.

It is customary to point to the Po in evidence of the effect of embanking the coasts of streams in producing an elevation of the bed of the river. And it is



assumed that because the bottom of the Po and of all rivers that empty into the Adriatic is to be found in the great quantity of earthy matter which they transport to the sea, and the shallowness of the gulf into which this material is conveyed, this deposit in the course of twenty centuries has produced a prolongation of the delta of the Po, estimated at about 25 miles, and has converted cities which at the commencement of the Christian era were respectable sea-ports into inland towns, at this day 20 miles from the sea-shore.

Senator GIBSON. You mean to say that more modern investigations have shown that the Po did not rise.

Captain LEACH. At the time that Colonel Ellet was writing in the United States, Lombardini had written in Italy a complete refutation of De Prouy's conclusions as to the bed of the Po rising. Lombardini's researches were probably not known to Colonel Ellet, who, feeling himself obliged to accept the current belief that the bed of the Po had risen, is so confident that levees had and could have nothing to do with it that he takes pains to bring forward another explanation.

Cut-offs are mentioned in this outlet scheme as being in the dim future desirable to be done.

Among the causes of inundations that have recently produced so much loss and distress on the lower Mississippi, in the opinion of the writer, must be enumerated the cut-offs which have been made at and below the mouth of Red River. It is true that men of science have denied and do still contest this point. But the opinion here entertained rests on what are deemed to be the natural laws of the flow of the river, and, moreover, on indisputable results. The theory which is entertained by many intelligent persons, that by shortening the channel and cutting off the bends of the river the velocity of the current will be increased, the channel scoured out wider and deeper, the floods conveyed more rapidly to the sea, and the surface therefore reduced, is all perfectly true, excepting the practical conclusion.

\* \* \* \* \*

After describing outlets in full he says :

But, in addition to all this, the protection of lower Louisiana will require other expedients. For this State, indeed, there is no alternative. She can not wait for Congress to discuss, doubt, survey, and appropriate. She can not wait for the slow machinery of legislation. She must build levees without hesitation or delay, or see her fields annually swept by the floods.

\* \* \* \* \*

But, while recommending these prompt and vigorous measures, it is the duty of the writer to express his conviction that, after all these means of relief, carried as far as prudence and proper regard to economy and the interests upon which this excess of water will be turned, have been exhausted, they will be found insufficient to secure even the State of Louisiana against the floods which, at no distant day, will be poured down the Mississippi, while the great area subject to inundation in the States of Arkansas and Mississippi can receive no sensible relief from any of these expedients but that of levees. To secure the whole delta it will be necessary to commence promptly and press vigorously the great work of retaining the water in the mountains.

This is the reservoir idea. There are more of these extracts than I thought there were. I think I have read all that are really important, and I hope enough to give you the opinion that the idea, the tenor of this report, as previously put before you, is erroneous. I hope it was unintentionally done, but I can scarcely believe it.

Now, if this report is read, the impression is obtained that Colonel Ellet was in apprehension of a perfectly appalling increase of floods in the Mississippi. He goes so far as to say that he thinks in no long period of time the increase of floods due to the progress of deforesting and the extension of cultivation and drainage, together



with the building of levees, will cause an increase in the height of the floods of 18 feet at Red River. Since that time deforesting has gone on for forty years, and I believe now is about at a maximum. I think that tree-planting is keeping pace with deforesting. Cultivation and drainage have gone on in the Mississippi Valley, and have gotten nearly as far as they are going, and we have had no such elevation of floods. We have as yet had no floods that could not be restrained with levees of moderate heights.

Such floods as Colonel Eilet anticipated have never been realized; never will be; never can be. The whole tenor of his report shows very plainly that he was forced to accept the outlet theory against his deeper conviction, simply because he thought that no levees which could possibly be built would restrain the floods which he expected in the future.

His idea was that the extension of the levees would hurry forward the discharge from above. The elevation of the flood-line would begin at Cairo and increase until it reached this figure, 18 feet at Red River.

Subsequent experience has shown that these apprehensions were entirely unfounded. We get a good illustration of that from the Po at Ferrara, which occupies a position on the Po about the same as that of Vicksburg or Natchez on the Mississippi. The super-elevation of the flood surface within the history of the Po for several hundred years, due to the extension of levees and other causes, is about 3 feet. It is reasonable to suppose that the super-elevation caused by the hastening forward of the discharge of the floods will bear some relation to the slope of the river and its size. In slope the Po leaves off at the sea about where the Mississippi begins at Cairo. If the hastening forward of the flood on the Po, with a slope of from 30 inches per mile at its head-waters to 5 at the sea, results in an increased height of 3 feet at Ferrara, we may reasonably expect that the super-elevation of floods due to the same cause on the Mississippi will be less in amount—less than 3 feet—since the greatest slope of the latter stream is but little in excess of the least slope of the former.

The CHAIRMAN. In how long a period?

Captain LEACH. Forever; the causes of increase must culminate at some time.

The CHAIRMAN. Captain Leathers says the bottom of the river has risen 7 or 8 feet now.

Captain LEACH. I know he does.

The CHAIRMAN. What do you say about that?

Captain LEACH. The gauge records show that the absolute elevation of the low-water surface is about, as nearly as can be figured, where it always has been at various points. Captain Leather runs his boat through low water, at about 7 feet depth, and if the bottom has risen 7 feet, the surface remaining stationary, he would have no water to run his boat through. He would have to run it on wheels. The low-water surface has not risen. We have unquestionable evidence as to that. We have measurements just as good as any man can make. We have records that have been made at various places



by a great many different people, so that there could be no collusion about it, no mistake about it. They agreed perfectly; they are consistent with each other. Their reports are that the low-water surface is exactly where it was for about the same volume of discharge. The records at Natchez go back to the beginning of this century.

The CHAIRMAN. Captain Leathers says the bottom of the river has risen at Memphis.

Captain LEACH. I do not know what Captain Leathers has stated. The records at Memphis show nothing of the kind.

The CHAIRMAN. Now, captain, the committee will be glad to have you give your views as to the plan the Commission have adopted to improve the river.

Captain LEACH. As to the improvement of the river, I do not know that I have anything new to add over and above what has been stated. The plan of the Commission has been outlined. The degree of success that has been attained has been stated. In all those points I can do no better than to say that I fully concur.

The CHAIRMAN. General Comstock says that in his opinion levees are not necessary to improve the navigation of the Mississippi River, while Major Suter says that in his opinion the levees are essential. What is your opinion about that?

Captain LEACH. My opinion is that they are absolutely essential; that there are certain well-defined possibilities to the improvement of the Mississippi River. There are certain natural conditions present which by proper scientific treatment can be made to produce a stream of a certain degree of navigability. It has its ultimate possibilities. With levees that possibility can be attained; without levees it can not. Without levees a stream can be improved; with levees it can be improved much more. That is my idea of the river with and without the levees.

The CHAIRMAN. General Comstock, what is your view—is it best in making an appropriation of two or three millions for the improvement of the Mississippi River to direct the expenditure of money at particular points?

General COMSTOCK. If the money is intended to be spent in protecting towns and cities and villages along the river, that object will be attained by that process, but probably there will be very little left for the improvement of the river generally.

The CHAIRMAN. Has not the Commission, so far as navigation and its interests are concerned, been very much crippled by the action of Congress in thus disposing of its appropriations?

General COMSTOCK. I think so in some degree, because I think Congress would have given us probably a larger amount for the general improvement of the river, if they had not made specific appropriations. For instance, in the last bill there was an appropriation of fifty or sixty thousand dollars for Columbus, some for Greenville, and so on down. Those were all places where money would come out of what we otherwise would have had to use for the general improvement of the river.

The CHAIRMAN. Major Suter, I want to ask you the same question.



Major SUTER. My opinion is about the same as General Comstock's.

Captain LEACH. That is a question rather higher in the horizon than I have ever been called upon to consider. I am only a subordinate. I have tried to execute the plans of the Commission and to carry out the will of Congress expressed in the law, and in regard to probable or possible improvement in the method of making appropriations I do not know that I have any opinion to express.

Senator WASHBURN. I would like to ask a question. Suppose Congress should appropriate two and a half or three million dollars for the improvement of the lower Mississippi without restriction, how would it be expended by the Mississippi River Commission?

General COMSTOCK. I can answer that. I do not think it would be an unjust distribution to make the distribution we have made heretofore, two-thirds for the improvement of the river and one-third for the levees.

Senator GIBSON. Captain Leach, you are not a member of the Mississippi River Commission?

Captain LEACH. No, sir.

Senator GIBSON. I suppose shortly after you graduated from West Point you were assigned to the Mississippi River Commission.

Captain LEACH. I graduated in 1875, and in 1879 I was assigned as secretary of the Commission.

Senator GIBSON. Did you have any preconceived notions as to how the river should be treated?

Captain LEACH. Not at all.

Senator GIBSON. Your opinion is based upon your experience and observation on the river?

Captain LEACH. Entirely so.

Senator GIBSON. Are you a native or a resident of the valley of the Mississippi.

Captain LEACH. No, sir; I am a native of Indiana.

Senator WASHBURN. You do not agree with Colonel Ellet in the opinion that these outlets, what you call high-water outlets, are desirable?

Captain LEACH. No, sir.

Senator WASHBURN. Under no condition of things?

Captain LEACH. No, sir; because the conditions under which Colonel Ellet arrived at the conclusion he did were predictions for the future. We are now in a good part of that future. We see that those predictions will not be realized.

Senator WASHBURN. Why should not the same principle apply? We have had very high water this year, perhaps not as high as he contemplated, but certainly very high. Why should not the same principle apply in the very high water we have had this year as he contemplated?

Captain LEACH. The best method of controlling a flood is by levees. There are physical limits to the building of levees, and if a flood went so high as to exceed those limits, then it would be nec-



essary to obtain relief. It was under such apprehension, in my opinion, that Colonel Ellet proposed an outlet.

Senator WASHBURN. Major Suter takes the position that the river with these outlets would not discharge the water as rapidly as though it were held in one channel.

Captain LEACH. I think it is fully agreed that there would be an immediate relief. The great destruction will come on the second or third generations hence, and of course if a man is under water he will get out, regardless of what is going to happen to his descendants.

Senator WASHBURN. You think that by making these outlets, take the Atchafalaya, we would afford immediate relief from the great floods?

Captain LEACH. It would afford slight local relief from the pending flood, undoubtedly.

Senator WASHBURN. In other words, it would discharge the water more rapidly than though you attempted to maintain it in one channel?

Captain LEACH. I do not know.

Senator WASHBURN. You would get rid of it?

Captain LEACH. Yes, sir; it would reduce the level slightly. Two years ago I thought myself, and stated before a committee of this Senate that I thought it possible to reduce the surface 10 feet by opening the Lake Borgne outlet. I should be compelled to divide that by 2 now—5 feet, by any possible outlet.

Senator WASHBURN. And you hold still further that the degree of elevation would decrease as the years went by?

Captain LEACH. Very much. The scope of the river to the mouth of the passes would be increased. Now, if you want to increase the inclination of a line, one end of which is fixed, it can only be done by raising the other end. The Mississippi River from the Gulf to New Orleans is such a line. Its lower end is fixed at Gulf level, and if it is compelled by division to take a steeper slope, it can only do it by raising its level at New Orleans. The divided channels must inevitably take a higher slope, and in doing so the point of their divergence must be elevated absolutely.

Senator GIBSON. And that would make a bar.

Captain LEACH. Unquestionably, and it will raise the flood line also. Nothing else you can do will elevate the flood plane so certainly. In fact, that is the one solitary thing that must give New Orleans bigger floods than ever before.

The CHAIRMAN. Captain Cowden wants me to ask you certain questions. Would you levee-dike, spur-dam, etc., the upper end of a sediment-bearing stream before you would improve the lower end of such a stream?

Captain LEACH. That would depend entirely upon the conditions. If the lower end demanded improvement in the interest of navigation and the upper end did not, I would sacrifice my theories and improve the lower end first, provided I held such theory, and on the converse, if the upper end demanded improvement and the lower



end did not, I would improve the upper end. I would improve the end which first demanded it.

The CHAIRMAN. Will water flow down an angle or incline of 2 inches to the mile faster than it will flow down an incline of 1 inch to the mile.

Captain LEACH. Not necessarily. It may flow very much faster down the lower inclination.

The CHAIRMAN. The same volume and the same width?

Captain LEACH. No restrictions with regard to volume were made. I was only asked one question with regard to velocity and slope. The velocity depends, as nearly as it can be stated in brief terms, on the square root of the angle of the fall and the square root of the mean depth. To increase the mean depth will increase the velocity just as much as an equal increase of slope. The average mean velocity of high water from Cairo to New Orleans does not differ very much from 6 feet in a second; that regardless of considerable changes in slope. Repeated observations, hundreds of them, are available to show that there is a remarkable uniformity in the mean flood velocity from Cairo to the Gulf.

The CHAIRMAN. Is the fall greater at Cairo than at New Orleans?

Captain LEACH. It is.

The CHAIRMAN. Is the current greater at Cairo than at New Orleans?

Captain LEACH. A little greater at low water, but at high water it is almost the same.

The CHAIRMAN. Then does not the greater [current above bring the mud down faster than the slower current at the lower end can discharge it?

Captain LEACH. There is no greater current above.

The CHAIRMAN. If you build levees higher at the lower end than at the upper end, does that increase or decrease the angle of fall?

Captain LEACH. I do not think it has any effect at all.

The CHAIRMAN. It is claimed that the inflow of water is 2,100,000 cubic feet per second, and that the outflow of water at the mouths of the Mississippi is 1,100,000 cubic feet per second, and, if this be true, how would you prevent overflows?

Captain LEACH. By one of the best known principles of river physics, that is, that there is a very appreciable reservoir effect in the volume of the channel itself. If the water is flowing in at Cairo faster than it is flowing out at New Orleans and I am asked where the surplus goes, I am able to reply that it goes to raising the surface of that water. There are thousands of square miles of water to be raised and it rises sometimes in places as high as 2 or 3 feet a day.

The CHAIRMAN. Is the South Pass in any sense an outlet of the Mississippi?

Captain LEACH. Yes, sir.

The CHAIRMAN. Are the mouths of the Mississippi in any sense outlets?



Captain LEACH. In every sense.

The CHAIRMAN. If you wanted to get the floodwater of the Mississippi into the Gulf of Mexico quicker than it would now flow through the present mouths, would you close up all of the present mouths or would you open more outlets?

Captain LEACH. I certainly should not close up all the mouths of any stream under any circumstances. I admit that I would leave at least one open.

The CHAIRMAN. Would you open any more outlets?

Captain LEACH. No, sir.

The CHAIRMAN. If it were possible to make the Lake Borgne outlet wide enough and deep enough to lower the flood-line of the Mississippi River at that place down to the Gulf level, would that enormous outflow of flood water increase or decrease the current of the Mississippi River?

Captain LEACH. It would increase the current for a short distance above enormously and it would decrease the current below. In fact, if the hypothesis stated were realized, there would not be any current at all below except a little ebb and flow of the tide, and of course it would increase the current enormously above, it would aggravate the destruction of the banks, and in that way would not only make the maintenance of a levee system along there very precarious, but it would make the work of regulation of the stream very difficult.

The CHAIRMAN. How does this year's floods compare with floods of previous years?

Captain LEACH. The data are not in yet. There are some peculiar developments that would require study before expressing a definite opinion. I would say as the result of what I have seen that I believe the flood at Memphis was about 5 per cent. less than in 1882, the greatest in volume we have ever had, taking the whole length of the river. At Helena it approached closely to the 1882 flood, and below Helena it was the greatest flood of record in every respect except one, duration. In every other respect it was the greatest flood on record.

The CHAIRMAN. How does the land actually overflowed compare with that of 1882?

Captain LEACH. About 20 per cent. as much.

Senator WASHBURN. Twenty per cent. less than in 1882?

Captain LEACH. Only 20 per cent. of what was overflowed in 1882.

The CHAIRMAN. What do you charge that to?

Captain LEACH. The levees. The overflow was made possible by the breaks in the levees. There were breaks of less than 2 miles, perhaps, in 1,300 miles. I may say, generally speaking, in regard to the possibility of maintaining a levee system for restraining floods, we have this year with the greatest flood on record approached more nearly the complete restraint of the flood than ever before.

The CHAIRMAN. Suppose the levees had not broken, would the overflow not have occurred?

Captain LEACH. The river was almost at its height before the breaks began, and from information which will be placed before the



committee later it will be seen that the taking out of a very large quantity of water, at one place 400,000 cubic feet per second, had a very slight, unexpectedly slight, effect in reducing the height of the river. It is perfectly reasonable to suppose that an addition of 400,000 cubic feet per second would have had no greater effect in raising the river than the outlet had in depressing it. I think there is a great deal of evidence to show that with grades in some parts 2 feet higher than we now have, and in other parts no higher than now, and with levees thoroughly policed and controlled from the beginning of the flood, there would be few or no breaks.

The CHAIRMAN. What was the difficulty?

Captain LEACH. Defective foundations.

The CHAIRMAN. Whose fault is that?

Captain LEACH. I do not know exactly where to put it.

The CHAIRMAN. Were they built by the United States Engineers?

Captain LEACH. Some of them, and some not; but the foundation was simply what nature left, not prepared foundations. I think, however, that we have underestimated the necessity of thoroughly exploring the foundations of the levee. I think all the engineers connected with the levee work are agreed upon that now.

The CHAIRMAN. Do the levees cave into the river?

Captain LEACH. Occasionally. The Commission within the last two or three years has distinctly committed itself to the policy of preferring, in the order of progress in bank protection by revetment, localities where the caving will involve large levees. I may say, generally, with regard to the history of the levee system, that over three-fourths, probably, of the entire sum of money expended by the States in the last ten or fifteen years in the construction of levees would have been saved if the United States had prevented the banks from caving.

Senator GIBSON. You said that this recent flood was the greatest flood of which you have any record?

Captain LEACH. Yes, sir.

Senator GIBSON. You mean in its height, or in its volume?

Captain LEACH. In its volume.

Senator GIBSON. You were speaking of the volume?

Captain LEACH. Yes, sir; but at some places it was greater in height.

Senator GIBSON. More water has passed down the Mississippi this winter in its flood stages than ever before?

Captain LEACH. I believe so; that is, below the mouth of the White river. The very top of this flood was caused by the discharge of a phenomenal volume of water out of the White and the Arkansas rivers upon the fairly large flood which was passing Memphis.

Senator GIBSON. Have you any knowledge, from tradition or data, of the flood of 1828?

Captain LEACH. There is some data on that subject, but I am not familiar with it now. I have not looked at it for a long time.

Senator GIBSON. Have you heard from old people living in the valley anything about the flood of 1828?



Captain LEACH. No, I have not. The only thing I know about it is that there is a paragraph about it in the Humphreys and Abbott report, and what data there is is collated there.

Senator GIBSON. You ascribe these breaks in the levees to the enormous body of water that pressed against them?

Captain LEACH. To the water against them, so long and with greater head than was ever known before in their history. By greater head I do not mean greater actual height of water in the river, but you know very well that if levees break extensively and back-water rises behind them, of course there is little or no head against them. In the flood of 1882 the levees, to be sure, were exposed to water perhaps 50 or 60 per cent. longer than this year, but this year they were mostly dry behind.

Senator GIBSON. What are the facts, first, as to the number of miles that gave away this year in comparison with the floods of 1882 or 1884 and so on, and, secondly, the number of breaks?

Captain LEACH. I have here the report of a number of engineers made to the recent Vicksburg convention. It is signed by about fourteen or fifteen engineers. This number comprises the United States engineers in charge of the district where the principal overflow occurred this year, two members of the Mississippi River Commission, and all the civil engineers engaged under all State organizations in the guarding and maintenance of levees during this flood. If anybody in the world has information about this thing these men have, and if any statement could be relied upon these gentlemen's statements certainly can.

The disasters from the recent flood have been exaggerated and magnified beyond their true proportions by the sensational treatment, and which has tended to shake confidence in the efficiency of the levee system. In confirmation of this, attention is called to the following:

In 1882 the total number of crevasses in the levees was 284, aggregating 589 miles in width.

In 1883 the number of crevasses was 224, with an aggregate width of 341.1 miles.

In 1884 the crevasses numbered 204, aggregating 106.04 miles in width.

The result of the crevasses enumerated during these three years were the general overflow of the Mississippi delta.

In the present flood, the dangers of which are nearly passed, the crevasses which have occurred number 23, aggregating about  $4\frac{1}{2}$  miles in width in a total length of 1,100 miles of levee—one-half of 1 per cent. of the total line of levees, notwithstanding that the present flood has exceeded those of the three years cited in the height attained and all points below, and has not exceeded in duration.

Senator GIBSON. I wish you would state what levees constructed by the Mississippi River Commission, or in accordance with their plans, by the Army Engineers, have given away.

Captain LEACH. I really have no information on that point whatever.

Senator GIBSON. Has a single one given away?

Captain LEACH. I do not know. None of these levees are in my district.

Senator GIBSON. Yours is the Memphis district.



Captain LEACH. The first and second. This year we had but a single break, one at Austin, less than 300 feet wide.

Senator GIBSON. Built by the United States?

Captain LEACH. By the State.

Senator GIBSON. Has any of the work in your district built by the United States engineers given away?

Captain LEACH. No, sir.

Senator GIBSON. Are there any there?

Captain LEACH. Yes, sir; I have about 30 miles on one side and 15 on another, 45 miles in all, at Plum Point Reach, and about 15½ from Helena down. Half of this was built by the United States and all the Plum Point levees.

While I am on the subject of the Plum Point levees I would like to make a little statement.

The Commission in carrying out the work in the early years at Plum Point had not provided for any levees. In a debate in the Senate on one of the river and harbor bills the point was made by a Senator that the Commission was professing to make an experimental application of their system at Plum Point Reach and a part of their plan was a levee. That year an allotment was made and a levee built on the Tennessee side of the Reach. The next year an allotment was made for levees on the Arkansas side and those levees were built. A party was engaged all the time in making surveys. The surveys made after the construction of the second line of levees and before the first flood and again after the first flood showed that the high bars in the regulated or deepened channel of about 3,500 feet width had had their tops scalped off 8 feet uniformly. Nothing of the kind had ever occurred before, and in the two crossings under control and under improvement the maximum depths had increased in one case 1 foot and in another case 2 feet, and they have remained to this time.

The CHAIRMAN. Since the levees were built?

Captain LEACH. Yes, sir.

The CHAIRMAN. Have you any idea what it would cost to repair these levees?

Captain LEACH. That would depend entirely upon the scheme adopted. My belief is now that we can strike with much more certainty than ever before. This flood, with all its disasters, has convinced me, and others, I think, of what we before believed, but could not prove—that is, that we can with reasonable levees confine any flood we are likely to have, and it seems to me that instead of working as we have heretofore we ought to change the plan altogether and give a little more money and reduce the risk. I think it is perfectly safe now—a year ago I would not have dared to say so—to have a scheme of levees that will be almost impregnable, and to do that I suppose it will cost in the neighborhood of \$10,000,000 at prevailing prices.

The CHAIRMAN. Ten millions for repairs alone?

Captain LEACH. To repair and enlarge and levee the St. Francis basin. To repair the present breaks alone, I think \$100,000 will do at present rates. The breaks are not very large and do not occur



where the levees are very high. No very high levees have broken. The massive levees are all intact.

Senator WASHBURN. Let us understand what you propose to do with the \$10,000,000.

Captain LEACH. Ten millions will put up a line of levees 4 feet above the highest known water, with strong profile on the west bank from Cairo to the mouth of the St. Francis. That is the first thing. It will also increase the work at Plum Point to that standard. It will build up the White River front from Helena to and including Laconia to the same grade and profile. It will enlarge the Arkansas levees from the high land at Ames Ridge down past Arkansas City and on past the State line down to Red River. It will enlarge the lower district of the Yazoo front, and make some enlargements from point to point as may be necessary in the upper district. It will increase and strengthen the levees on both sides of the river wherever they now exist.

Senator WASHBURN. Would it build all the levees that are required?

Captain LEACH. Yes, sir.

Senator WASHBURN. What is going to become of the other \$65,000,000 which have been estimated for?

Captain LEACH. That sum will be required for the caving banks and for any other work that may be necessary in closing high-water chutes, and in case of local obstructions of navigation, taking such means as may be necessary to remove them. I mean that the sixty-five millions will control the whole river.

Senator WASHBURN. How will the seventy-five millions be expended? You propose to expend ten millions for levees; how would the other sixty-five millions be expended?

Captain LEACH. In the first place I may say that sixty-five millions is the maximum estimate of any engineer connected with the work. My own estimate would be less than half of it, and I do not think my estimate is the lowest possible. Some of the money would have to be expended to protect the banks of the river from caving.

Senator WASHBURN. How do you get at that?

Captain LEACH. By a system of revetment, mattresses of brush ballasted with stone.

The CHAIRMAN. Have not some of these mattresses caved in?

Captain LEACH. Not recently. Not since we found out how to build them? We have not lost any since we found out how to build them.

The CHAIRMAN. Then, in your opinion, the amount of money that it required to build a canal from Manchester, England, to deep water will protect the Mississippi River from top to bottom?

Captain LEACH. Fifty millions will do it handsomely.

Senator WASHBURN. Do you agree with General Comstock that so far as the improvement of navigation is concerned, that is to be accomplished more by improvements in the bottom of the river than by levees?

Captain LEACH. No. I do not agree with him in that respect. I have stated my position as definitely as I can. I believe that the



improvement is progressive, that a little improvement is better than none, and that complete improvement is best of all, and is what the people need and demand. Partial improvement may be effected by partial control. Channel works will protect the river and control it so long as it is in its natural banks. Complete improvement is possible only with complete control. That is only possible by levees.

With regard to the specific way in which levees are made useful, I may illustrate by the practice in sewer constructions. Where the river makes a sharp bend at high water when it is well out of the banks, the fall across the point is equivalent to the fall around the bend. Therefore the rate of the fall is very much greater across the point. The result is that a greater or less amount leaves the channel at right angles and flows across the point. If you try to make a junction of a branch sewer with the main at right angles you will have considerable trouble. They do it effectually by bringing the joint in at an acute angle. If water flowing squarely into a sewer will obstruct it, why would it not do the same thing in a river? There is only one way to keep it from flowing in and out of the river, and that is to build a levee. The water does harm when it comes out, and it does harm when it goes in.

The CHAIRMAN. I suppose the most important place is the middle of the levee where the water goes out and returns in the same place.

Captain LEACH. Yes, sir. I think the levee should be made to follow the convolutions of the river as closely as the nature of the ground will permit. If they could be built at a uniform distance, a mile apart the whole length of the river, the conditions would be the most perfect that could be hoped for. If that is impossible, then the next best thing is to build them as nearly at a uniform distance apart as can be done.



## STATEMENT OF HENRY FLAD, C. E.

Mr. HENRY FLAD, a member of the Mississippi River Commission, appeared before the committee.

The CHAIRMAN. Have you ever considered this outlet question which has been presented?

Mr. FLAD. I used to discuss the question of outlets with Captain Eads years ago and formed an opinion in regard to it at that time.

The CHAIRMAN. What conclusions have you arrived at touching the outlet proposition?

Mr. FLAD. I am opposed to the opening of an outlet like that now proposed to be made at Lake Borgne. It would give temporary relief only.

The CHAIRMAN. Why?

Mr. FLAD. The outlet would probably silt up. If it would increase in depth and in quantity of discharge it would interfere with the efficiency of the jetties in securing a deep channel at the mouth of the South Pass.

The CHAIRMAN. So that your method would be by narrowing the channel to 3,000 or 3,500 feet and then by revetments on the banks.

Mr. FLAD. Yes, sir.

The CHAIRMAN. And levees outside of those?

Mr. FLAD. Yes, sir.

The CHAIRMAN. Wherever necessary?

Mr. FLAD. Yes, sir.

The CHAIRMAN. That you would require only for the purpose of navigation. What I mean to ask is this: Do you say that the interests of navigation require levees and revetments and the narrowing of the river, throwing out of consideration the question of protecting the people from overflows?

Mr. FLAD. I believe that the improvement of navigation demands the narrowing of the river, revetment of shores and levees properly located and constructed.

The CHAIRMAN. So that if you were on the river undertaking alone to improve navigation and disregarding the people living on the banks you would still build levees?

Mr. FLAD. I would.

## ADDITIONAL STATEMENT OF MAJOR B. M. HARROD.

Major HARROD. I would like to testify also about outlets, and particularly about the Lake Borgne outlet. I concur generally with the testimony which has been given here, particularly with that of Captain Leach. I speak about the Lake Borgne outlet because I am city engineer of New Orleans, and that city is very largely interested in an outlet located below there.

The Lake Borgne outlet would discharge over a tract of land about 6 miles wide into Lake Borgne. Lake Borgne has a depth of 7 or 8 feet. The distance from the river through Lake Borgne



to such deep-water as you find off the mouths of the passes is some 60 miles. Although Lake Borgne is now at tide level, and the tide ebbs and flows there, that condition would immediately cease when the Lake Borgne outlet would be made, and you would then have a fall of 15 feet at high water—the height of the river above the Gulf—you would have a fall of 15 feet distributed over the 60 miles from where the Lake Borgne outlet is located to deep water in the Gulf.

That distribution of slope means inevitably the elevation of the surface of Lake Borgne. I should estimate that when the channel was built through it would amount unquestionably, in my opinion, to 5 or 6 feet. Lake Pontchartrain empties into Lake Borgne. Therefore if you raise the level at Lake Borgne you raise the level of Lake Pontchartrain.

The CHAIRMAN. Necessarily?

Major HARROD. Yes, sir. They are practically on the same level, except, perhaps, it would be fair to say that Lake Pontchartrain is 3 or 4 inches higher than Lake Borgne. If Lake Borgne is raised Lake Pontchartrain will be also. Now, sir, if Lake Pontchartrain were raised 4 or 5 feet, nineteen-twentieths of the city of New Orleans would be probably 3 or 4 or 5 feet below that water surface, and would need constant protection. When I say nineteen-twentieths I mean not value but area.

The topography of the city of New Orleans is this: It is thickly built up along the alluvial slope of the river bank, and within a distance of three-fourths of a mile from the river bank you reach practically a tidal marsh, a marsh which is overflowed in southeasterly gales. If Lake Pontchartrain be raised a foot or 2 feet, or more, it places part of the city of New Orleans that much under the surface of Lake Pontchartrain.

The CHAIRMAN. New Orleans is lower than the lake?

Major HARROD. Some portions of it are as much as  $1\frac{1}{2}$  feet. At present Lake Pontchartrain is  $1\frac{1}{2}$  feet above its natural level, from the Nita crevasse above the city of New Orleans. In its normal condition some parts of the city are  $1\frac{1}{2}$  feet below, and it would devolve, I suppose, on the Government to protect the city of New Orleans and generally the lake bank against overflows.

The CHAIRMAN. If an outlet were made into Lake Borgne, of course it would create a current down through that outlet. Would not that current scour out a canal through Lake Borgne to a depth and with a current which would prevent this filling up of Lake Borgne, which you suggest?

Major HARROD. I think not, sir. The bed of Lake Borgne and the bed of Lake Pontchartrain both are old sea-beds and are of hard clay mingled with shells. I do not think the river unaided would excavate anything like a sufficient channel. I think it would fill this Lake Borgne up with sediment generally, with a number of tortuous and worthless channels through it. It would become a marsh, intersected with bayous, tortuous and shallow. It would make very much such a result as has been made at the



Jump and also at Cubitt's crevasse. Cubitt's crevasse is, say thirty years old, and there is a large subdelta built out there now through which runs a number of bayous of no particular importance. The outlet at the lower end Jump, I am told, is practically unnavigable. I think luggers do not go through there at times. This is what has occurred at these places, the building up of large marshes. I should expect the same thing to happen to Lake Borgne. The elevation of the water surface is a thing that certainly will happen.

Your tide level which now extends up to within 6 or 7 miles of the Mississippi would be pushed out 60 or 70 miles to deep water in the Gulf. Motion means slope, and if it flows 60 miles before reaching deep water it means 60 miles of slope, and in Lake Borgne you are very near the head of that slope, and it would, I have no doubt, amount to several feet ultimately, or as soon as the regimen of the outlet was established.

Now I want to speak a little more about outlets. I think there is observed a very great difference in the effects of outlets in relieving flood waters. There is a marked difference between their effect of lowering the flood surface of a river accordingly as there are sudden breaks at flood stage or as there are permanent ones. I think Captain Leach testified about the relief you got from a crevasse, a sudden break which occurs when the river is in flood. That is indisputable. In the case of the Nita crevasse the effect that Captain Kingman testified to was  $1\frac{1}{2}$  feet. You got this local and temporary relief. I do not think that there is any reason to expect that such relief would be permanent.

#### STATEMENT OF H. B. RICHARDSON.

Mr. H. B. RICHARDSON, chief State engineer of Louisiana, appeared before the committee.

Senator GIBSON. How long have you been chief engineer of the State?

Mr. RICHARDSON. Since 1880.

Senator GIBSON. Will you be kind enough to state to the committee your opinion as to the proper manner to treat the river, both for navigation and for the protection of the people living in the valley, and in that statement you will discuss, of course, the jetty system, the outlet system, and the levee system?

Mr. RICHARDSON. I believe the plans of the Mississippi River Commission for the improvement of the navigation of the river are correct. I believe the bringing of the river to a somewhat uniform width must result in giving it a somewhat more uniform depth than it otherwise would have. The building of revetments for fixing the bank of the river in some one position and the building of levees along its banks for retaining its flood waters I think are of greater importance than the channel works. You have had the river improvements so fully discussed, and I so fully agree with what has been said by the engineers who have discussed it, that



I need not take up your time by saying anything more than that I generally concur and agree with them.

Senator GIBSON. What do you think would be the effect of an outlet at Lake Borgne?

Mr. RICHARDSON. I think the effect of an outlet at Lake Borgne, if it were made into a previously prepared channel at once would be similar to the effect of a crevasse, which would produce an immediate temporary and local relief to the flood conditions of the river. Its final effect I believe would be to silt up Lake Borgne as any other crevasse silts up the country in its neighborhood, or the lakes or country into which it discharges, and that such a channel could not be maintained for many years. If it were maintained it would necessarily result, in consequence of a division of the channel into two parts, in the manner which has been frequently stated here yesterday and to-day, in a deterioration of the channel below, a deterioration of both channels. If the channel through Lake Borgne were maintained the present channel of the river would be deteriorated. My belief is that the Lake Borgne channel would close before a very long time. It would result, meanwhile, in the elevation of the bed of the river below, and consequently of its flood levels below and above.

#### STATEMENT OF CAPT. THOMAS W. SHIELDS.

Mr. THOMAS W. SHIELDS, of Cairo, Ill., appeared before the committee.

The CHAIRMAN. What experience have you had hitherto on the Mississippi River?

Mr. SHIELDS. My experience has been from a practical standpoint altogether and actual observation; nothing from a scientific standpoint. I have been on the river for nearly twenty-five years, and during all that time I have been steam-boating between Cairo and New Orleans, commanding some of the largest steamers on the river.

The CHAIRMAN. What is that distance?

Mr. SHIELDS. Twelve hundred and fifty miles.

The CHAIRMAN. By the river?

Mr. SHIELDS. Yes, sir.

Senator GIBSON. What line of steamers?

Mr. SHIELDS. Mostly the Anchor Line. I have been on the river in all its stages, from its highest floods down to the very lowest water. I was on the river before the Mississippi River Commission was created and before it commenced its work. I listened to Captain Ernst's testimony in regard to Horse Tail Bar, for I have bivouacked there for a week at a time on a steam-boat, sparring off and going on, and I have also had a very sad experience at Plum Point, pecuniarily. These have always been great obstructions, so far as navigation is concerned, with steam-boatmen, and also Lake Providence. I believe the reason they were selected by the Commission was because they were the worst



places on the river. Horse Tail is between St. Louis and Cairo. Plum Point is about 100 miles below Cairo, and Lake Providence is still further down the river, about 75 miles above Vicksburg.

Senator GIBSON. How long were those stretches that were bad for steam-boatmen?

Mr. SHIELDS. Horse Tail was a succession of bars, probably 5 or 6 miles long. Plum Point was about the same and caused by a very large spreading of the water; the water was very wide there and there were a great many outlets and bars, and at Lake Providence there were also long reaches and very wide, and they are termed by the Commission as Plum Point and Lake Providence reaches. They are designated as reaches.

Senator GIBSON. One is estimated at 41 miles and the other at 31 miles?

Senator WASHBURN. Why do they call them reaches?

Mr. SHIELDS. I do not know except that it comprises that portion of the river that is to be improved; but that is what they call them.

The CHAIRMAN. What has been the result of the operations of the Commission?

Mr. SHIELDS. They have been very satisfactory indeed. Commencing at Horse Tail the work has been satisfactory. At Plum Point I seldom hear of steam-boats even taking soundings there at low water. I believe the lowest water they have had there for the last two or three years has been, as far as I can learn, from  $11\frac{1}{2}$  feet to 13 feet at the very lowest stages.

Senator GIBSON. What was it before?

Mr. SHIELDS. I have seen it at Plum Point as low as  $4\frac{1}{2}$  and 5 feet; at Horse Tail  $3\frac{1}{2}$  and 4 feet.

The CHAIRMAN. What do your steamers draw?

Mr. SHIELDS. Eleven feet, when loaded.

The CHAIRMAN. Can they go through the reaches now, loaded?

Mr. SHIELDS. Yes, sir; they could go through them in low water, but there are other reaches that have not been improved by the Government. These reaches would obstruct the steamers going through in low water. These reaches above prevent a steamer loaded to her full capacity from getting through. As steam-boatmen we believe that if the practice is carried out by the Commission they will virtually make the river so that there will be practically no low water, and the boats can go along without any fear of obstruction whatever.

The CHAIRMAN. You want them to treat the other reaches in the same way?

Mr. SHIELDS. Yes, sir.

The CHAIRMAN. Is there any navigation on the Mississippi now?

Mr. SHIELDS. Yes, sir.

The CHAIRMAN. How many steamers are running regularly on the Mississippi River?

Mr. SHIELDS. The Anchor Line, I think, has eleven steamers running. They are building one new steamer, which will be out



on the 5th of next month, at a cost of about a hundred thousand dollars. The president says that he was going to contract for two more.

The CHAIRMAN. What does one of those steamers carry?

Mr. SHIELDS. The New Orleans steamers have a capacity of about 2,000 tons. What is called the Natchez steamers have a capacity of about 1,600 tons. They tow barges in extreme low water, over the upper end of the river.

The CHAIRMAN. How many other lines do you know?

Mr. SHIELDS. The Mississippi Valley Line is one of the largest transportation lines, I presume, in the United States to-day, and has more tonnage than any other line.

The CHAIRMAN. Between what points?

Mr. SHIELDS. New Orleans and St. Louis. They use what we call tow-boats and barges; they tow six and seven and eight barges at a time, and those barges are built to carry about 2,000 tons apiece. They have have been taxed to their utmost capacity for the last twelve months in carrying grain.

The CHAIRMAN. What does it cost to carry grain from St. Louis to New Orleans?

Mr. SHIELDS. There are different prices, and really I do not know what the barge rate in bulk is. The usual price now is about 15 cents a hundred, or \$3 a ton on grain in sacks; that is the heavy part of the cargo. That is fifth-class freight. Other freights are higher. Bulk grain is much lower.

The CHAIRMAN. What becomes of this grain transported down the river to New Orleans?

Mr. SHIELDS. It is exported abroad.

The CHAIRMAN. Shipped direct for import?

Mr. SHIELDS. Yes, sir.

Senator GIBSON. I desire to say on this point that I received—and I expect the Senator from Missouri did—a memorial from the Chamber of Commerce of St. Louis, stating that 20 per cent. of the entire corn crop of the United States was exported by way of New Orleans.

The CHAIRMAN. What proportion of the wheat crop?

Senator GIBSON. I do not know.

The CHAIRMAN. Where is the corn exported to; Liverpool?

Mr. SHIELDS. Yes, sir; and to various other countries.

Senator WASHBURN. You do not mean 20 per cent. of the entire crop?

Senator GIBSON. I understood him to say 20 per cent. of the entire crop.

The CHAIRMAN. He is mistaken.

Senator GIBSON. Yes, sir; I think he means 20 per cent. of the entire export.

The CHAIRMAN. This is a matter which interests me. It may not interest these Mississippi River people, because they know about it. How much additional commerce is there on the Mississippi River between St. Louis and Cairo and New Orleans?



Mr. SHIELDS. Mr. Chairman, there is one line of steam-boats running from St. Louis directly through; also a barge line. There are several lines on the river from St. Louis to the tributaries; also three or four lines of steam-boats on different parts of the river from Memphis, Vicksburg, Natchez, and Bayou Sara. Then the Southern Transportation Line and Cincinnati and Memphis lines come in at Cairo from the Ohio River. All the coal that is burned in that country is transported down the Ohio River and then down the Mississippi River.

The CHAIRMAN. In barges?

Mr. SHIELDS. Yes, sir.

The CHAIRMAN. So that really there is an enormous amount of freight going down the river now?

Mr. SHIELDS. Yes, sir; we think so, and in fact we believe that the Mississippi River controls the freight rates of the United States to-day.

Senator VEST. The chairman asked you in relation to the transportation on the Mississippi River. Are not the boating interests looking up? Are you not hopeful?

Mr. SHIELDS. The business has increased in the last year from 20 to 30 per cent; this business increase not being caused by any competition, but from the development of the country, as there has been no loss of traffic on the railroads; but the railroads are taxed to their utmost capacity, and we take it that it is a natural increase. The growth of that country is greater than the increase of transportation facilities.

Senator WASHBURN. There is a very general impression that the importance of the Mississippi River has been lessening all the while.

The CHAIRMAN. That was my impression.

Senator WASHBURN. On account of railroads running east and west. In your judgment what are the facts? How does the commerce, the tonnage, on the Mississippi River, the Lower Mississippi, compare with what it was twenty years ago?

Mr. SHIELDS. There is not the tonnage on the river—that is, in steam-boats. There is double the tonnage in barges.

Senator WASHBURN. That is the same thing.

Mr. SHIELDS. There is fully double the tonnage in barge shipping. There are not as many steam-boats. There are finer and larger steam-boats to-day than there were twenty years ago.

Senator WASHBURN. It does not make any difference whether the tonnage is carried in steam-boats or barges.

Mr. SHIELDS. I believe that statistics could be furnished which would show that there is much more freight going down the river to-day than twenty years ago; a greater quantity of it.

The CHAIRMAN. By boat?

Mr. SHIELDS. Yes, sir, and barges together.

The CHAIRMAN. Notwithstanding the fact that twenty years ago there were no railroads?

Mr. SHIELDS. Yea, sir; the development of the country is such



that it requires that much more transportation facilities. There are shipped from Cairo, you might say, several hundred tons daily down the Mississippi River, besides the coal interest and aside from the railroad interest. That is down the river. The steamboat men think that steam-boating is getting back to its former days on the river. They are very hopeful of it anyhow. Statistics to that effect could be furnished very readily.

The CHAIRMAN. What is your opinion of the method adopted by the Commission; has it improved the river?

Mr. SHIELDS. I am decidedly in favor of following their policy.

The CHAIRMAN. Levees and all?

Mr. SHIELDS. Yes, sir.

The CHAIRMAN. Would you use levees?

Mr. SHIELDS. Yes, sir; that is the idea of the steamboat men generally. If you will permit me, in substantiation of what I say, I would like to read a resolution adopted by the Mississippi River Pilots' Association. I will say in explanation that there are about 150 of these men who are now engaged upon the navigation of the Mississippi River, some of them for as long as forty years, and any one knows, who knows the Mississippi River, that they are men selected with great care; thousands of lives are placed in their hands, and all the tonnage that goes down the river is in their charge. On the other hand, a great many of these pilots up to the present flood were skeptical as to whether the levees were an advantage to the Mississippi or were an improvement of the Mississippi River. With your permission I will just read from that resolution.

Senator GIBSON. They have held a meeting?

Mr. SHIELDS. Yes, sir; they held a meeting at their rooms in St. Louis on April 25 and submitted this to the convention.

The CHAIRMAN. How many were present?

Mr. SHIELDS. You might say this resolution was unanimous.

The CHAIRMAN. Do you not suppose there were just a half a dozen present?

Mr. SHIELDS. No, sir; I do not suppose you will find one in a hundred who disagrees with this. They submitted this to the convention:

Whereas the present is the only complete system of levees we have ever had between Cairo and New Orleans, thus affording for the first time (up to the time said levees gave way under the flood) an opportunity of proving the engineers were correct; and—

They were like a great many other men; they did not believe much in Government engineers; before that time they believed in practical demonstration.

Whereas we observed a greatly increased current, caused by said levees confining the surplus water to the natural channel, thereby clearly showing that this is the quickest way to get rid of the surplus water, while at the same time the friction is greater in the bottom than on the bank, in flood tide, as banks cave very little when they are full, the water acting as a support to save banks;

Resolved: First. That we indorse the levee system as proposed by the "Mississippi River Commission" as being the first part of the solution of the problem of river improvement, verifying as it does the statement in a report of one of the



engineers of the commission, viz.: "That a river that will discharge its surplus water from Cairo to the Gulf between levees in ten days when it takes one hundred days for it to reach the same through the swamps can be controlled."

Second. That as the Mississippi River in its present unimproved condition fixes the rate on transportation for 150,000 miles of railroads, we can not understand why so eloquent a plea as this fact alone makes should receive so little attention by the representatives of 60,000,000 people in Congress assembled.

From conversations I have had with many of the pilots, I know they have come to the conclusion that this season, up to the time the levees broke, that the levees were confining the water to its natural bed, thereby increasing the velocity of the current and scouring out the channel, and that some of the captains were counting the extra expense in fuel in coming up the river, meeting this flood. The current was a great deal deeper and a great deal stronger, and it necessarily took more fuel to come up the river. The impression that prevails upon the river to-day is that whenever the Government has gone on with the work they have succeeded in confining the channel and making a deep low-water channel, so that there is no trouble in navigating. I do not know of anything else.

#### ADDITIONAL STATEMENT OF MAJOR B. M. HARROD.

Major HARROD. Mr. Chairman, there has been some testimony given here that the gauges of the Mississippi River have been changed with a view to falsifying the records. I am on the committee of gaugers of the Mississippi, and I want to contradict that statement absolutely. There has never been a change made in a gauge that has not been recorded and printed. These gauges are officially kept up and the proper corrections are made in the publication of gauge-reading. I wish to contradict absolutely any statement to the effect that any change of gauge has ever been made without proper publication notice and correction of the record.

#### STATEMENT OF H. B. THOMPSON.

Mr. H. B. THOMPSON appeared before the committee.

Senator VEST. Have you heard the statement of Captain Richardson?

Mr. THOMPSON. Yes, sir. So far as the general conditions of the river and the methods of levee construction, which we have both been engaged in for some time, are concerned, I can verify his statement, and I fully agree with him in everything he has said.

Senator VEST. Have you any new matter to introduce?

Mr. THOMPSON. I hardly think so.

#### STATEMENT OF JOHN H. RICE.

Gen. JOHN H. RICE, of Fort Scott, Kans., appeared before the committee.

Senator GIBSON. Where do you reside?

Mr. RICE. At Fort Scott, Kans.

Senator GIBSON. You have heard this discussion of the Mississippi River. Can you not give us your view and your opportunities for acquiring knowledge?



Mr. RICE. Well, sir, my opportunities have not been very great. My business has led me to make my residence principally for the last three years at Natchez, Miss., on the river, and my business has induced me during that time to study the river very closely, and especially these overflows. I have been trying to interest, and have interested several gentlemen in the East to make an investment of money there, and I had to try to satisfy them that their property would not be totally washed away and destroyed by the overflows of the river, and that led me to investigate this river matter very closely.

I am not a civil engineer. All I know is simply from investigations I have made from that time and from observation. I am satisfied in my own mind, sir, that if the river were perfectly leveed, from what I have seen, that it would give a channel for navigation without let or hindrance from Cairo to the Gulf. There is not a mile of river, from Cairo to the Gulf, where the channel is only 3,000 feet wide or less where the water is not from 40 to 100 feet deep; and not a mile where it widens—spreads out—as it does in many places, from 5,000 to 10,000 feet wide where the water does not shallow—form sand bars—and at low water is only from 7 to 15 feet deep.

Take Natchez for instance. At the lowest stage of water last summer it was 1,961 feet at the narrowest place. I suppose the depth of the river there is not less than from 80 to 90 feet. You go down the river 8 or 10 miles to the head of Natchez Island, where it spreads out, and at low water there is only 7 to 9 feet at the most on the bar; from my observation that holds good everywhere on the river.

There has been something said about rocks. I want to say something about that. I think I read in the testimony of some witness—I do not remember who—that the gauge at Natchez was placed on a rock, that there had been a gauge on a rock, and that the bottom of the river had risen. I want to say that in my opinion the man does not live who ever saw a rock at Natchez. There is no rock there. There never was, unless it was hauled there on a steamboat or railroad. I was last week in a cut on the bluff of Natchez where the cut has gone down over 100 feet. There is no evidence of any rock anywhere. The gauges at Natchez are situated as follows: One is on a post on a small island close to bank; one on a sill of O'Brien's coal-house, and one a nail driven in an old brick wall. There is no rock there. At very low water there is a little gravel point that runs out 200 feet under the bluff and runs out into the river a little way. There are chunks of it; it is not rock, and has no firm consistency like rock. If you hit it a lick with a sledge-hammer it goes all to pieces.

I know this fact, also, in relation to the lowering of the flood tide by outlets. There is now 8 miles above Natchez what is called the Ferraday crevasse, pouring an immense amount of water into Concordia Parish. Immediately below Vidalia is another crevasse, close to town, some 3 to 4 feet deep. Down 18 or 20 miles below is the



Henderson-Ashley crevasse. There is an immense amount of water going through there; and then the crevasse at Bayou Sara, and the still larger crevasse at Morganza, and they have all been running now for some ten days or two weeks, and the water when I left Natchez, Tuesday last, was not 4 inches lower. I think that alone refutes the idea that a crevasse will lower the height of the flood surface to any considerable extent.

Senator GIBSON. What is your business?

Mr. RICE. I am trying to build a railroad from Natchez to Kansas City.

Senator GIBSON. Which makes you very much interested in the prosperity of the country?

Mr. RICE. I am, sir.

Senator GIBSON. What is the judgment, so far as you can learn, of the intelligent practical men in that community about levees?

Mr. RICE. I do not know a single intelligent practical man between St. Louis and the Gulf of Mexico, in the Mississippi Valley, but who is in favor of the plan of the Mississippi Commission and in favor of levees. It is universal amongst men of intelligence and men who know anything about it; and the people in Kansas are very much interested in it. I know that in the shipment of corn from Fort Scott on the railroads that the rate of freight to-day is largely controlled by the Mississippi River. If you want to ship grain from Kansas City or Fort Scott to Liverpool by way of New York the rate of freight to New York is controlled by the freight rates on the Mississippi River.

Senator GIBSON. The farmers of Kansas, therefore, are very much interested in it?

Mr. RICE. There is not a farmer in the Mississippi Valley who has not a direct interest, in my judgment, in the improvement of the Mississippi River.

Senator GIBSON. Do they all know that?

Mr. RICE. Yes, sir; they do know it. Many of them, however, believe that a deep-water harbor on the Gulf coast would do them much more good. I had the honor of being a member of the Galveston deep-water harbor convention. I was at the last harbor meeting at Topeka, and I there made a speech in which I tried to show them that there was an harbor at New Orleans 130 miles long and 100 feet deep; that they already had deep water; but of course they were after the Galveston harbor. They have got the same interest in the Mississippi that they have in that. Their attention has not been so much drawn to it, but those whose attention has been drawn to it understand the matter.

Senator GIBSON. Are you president of this railroad which you are attempting to construct?

Mr. RICE. Yes, sir.

Senator GIBSON. Have you ever held any public position at the hands of the people of Kansas?

Mr. RICE. Well, no, sir. I had the honor to head the electoral



ticket for Mr. Blaine when he was a candidate for President. That is all.

The CHAIRMAN. That gives you a certificate of good character. [Laughter.]

Mr. RICE. Thank you, sir.

#### STATEMENT OF WILLIAM G. YERGER.

Mr. WILLIAM G. YERGER, attorney for the Board of Mississippi Levee Commissioners of District No. 2, of the State of Mississippi, appeared before the committee.

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Mr. YERGER. A few years ago in summer time, at low water, the Anchor Line had habitually withdrawn their best boats, whose carrying capacity is from 1,500 to 2,000 tons, and put in small stern-wheel boats for the purpose of doing their transportation business. I may also add that they did not own these boats; they chartered them. Now they ply the river with their own boats, and I do not hesitate to say in my judgment that it is the best organized transportation line I ever saw.

In my judgment it is a great mistake to suppose that their only difficulty is to navigate the Mississippi at low water. I believe the commerce of the river is greatly interfered with and the navigation of the river in a large measure impaired at flood height. It has not been a month since I made a trip from Greenville to Vicksburg on one of the very best of the Anchor Line steamers, and I know personally that she is piloted by two of the very best pilots in that line, and that both endeavored to make a landing at Jeffries, and because of the water over the bank out of the channel of the river, that boat grounded and remained there five hours and was pulled off by another vessel. Our people, of course, are primarily interested in the matter of levees for the purpose of protection, and they are an intelligent people in the main, and their thought has been directed to this matter. Since 1865 they have subjected themselves to a tax, a maximum tax of a cent a pound on cotton, and for a number of years they paid that; but from time to time it has been reduced until last year it was 30 cents a hundred, together with an ad valorem tax of 5 mills upon the value of their property for the purpose of maintaining and constructing levees.

The disaster of 1882 very greatly cast down our people. They were thoroughly demoralized and well nigh ready to abandon the levee system, but they went at it again, and I am glad to say that the disaster of 1890 will be a lesson to them.

Recently there was held a levee convention at Vicksburg, and in my whole life I have ever seen such united levee sentiment as exists in the Mississippi Valley to-day, and I believe it comes because of the increased intelligence which is being bestowed by the Government to civil authorities upon this work of navigation and protection. At times of high water, as suggested by Captain Shields, these steamers are unable to land, and in addition to that, the people are unable to get to them, and in consequence thereof your com-



merce is very much lessened, for the people can not transport their produce on these vessels at such times, and they can not get to them to transact their business.

**STATEMENT OF T. G. DABNEY, Civil Engineer.**

Mr. T. G. DABNEY, engineer in charge of Upper Mississippi levee district, appeared before the committee.

Mr. DABNEY. Mr. Chairman, I am the engineer in charge of the Upper Mississippi levee district, with headquarters at Clarksdale, Miss. There are two districts in our basin. It is divided into two levee districts. Colonel Yerger, who has just occupied this seat, lives in the lower district, No. 2. I am in charge of the upper district, extending from the State line southward to the lower district, and the official designation of it is the Yazoo—Mississippi delta, Mississippi district.

The CHAIRMAN. How long have you lived on the Mississippi in that country?

Mr. DABNEY. I have been engaged professionally on the Mississippi River for a large part of my time for twenty years. To properly understand and appreciate this discussion, it should be borne in mind that the channel of the Mississippi River, which without the obstructive sand-bar would be a deep trough, seated in a hard formation as it presents itself now, is a succession of deep pools and sand-hills, obstructive sand-hills across the channel. Those sand-hills, as I term them, oscillate with the rise and fall of the river. That is a matter of common observation by pilots as well as the truth which has been adduced by an examination by the River Commission. To explain my meaning, if there is a crossing with only  $5\frac{1}{2}$  feet of water on it at extreme low water, when the river rises 20 feet there is not  $25\frac{1}{2}$  feet of water on that bar, but only 15 feet. I will endeavor to explain, Mr. Chairman and Senators, what I mean by these expressions.

When the river rises it becomes very heavily charged with sediment, and when it has to encounter these wide obstructions it loses part of its energies. As it continues to rise this precipitation continues, and when it is at its maximum these bar-crests are at their maximum. When the river recedes it loses a good deal of this sediment, and as it lowers it lowers the crests of these bars. If the river was suddenly disclosed, the bed of it at extreme high water, or if it were suddenly to drop to low-water mark, there would be no movement of water; there would be no open channel; there would be dams across it at frequent intervals, by reason of the building up of these bars during the progress of the rise in the river.

Now, when the water is dispersed laterally from the channel that enervating effect increases and builds the bars up higher than they would if the water were confined within the levees. The confinement of it gives it increased energy and power to carry this matter over the crests into the pool beyond, so that the crests of these bars never rise very high during maximum flood times, and in the process of falling they would be borne away. The general effect of



that would be to approximate an equality of depth as between these bars and the pools between them. That, I believe, is the *modus operandi* by which the river obstructs itself from the dispersion of its waters, and conversely gives itself greater capacity to avoid its floods, and consequently a diminishing flood height when it is confined between levees.

Senator GIBSON. You concur in the opinion of the engineers who have expressed it, that the effect of contraction is to remove these sand-bars from the bottom of the river and to increase the velocity?

Mr. DABNEY. Yes, sir; it would diminish the height of those bars and would produce a greater uniformity or a nearer approximation of uniformity of depth than when the water runs wild over the country dissipating the energies of the river.

If I may be permitted, I would like to give some expressions on the general subject of levees, as the impression which I have is that the efficacy of levees to restrain floods is in question before this committee. The effect of this present flood has been adduced in support of the contrary view that they are not efficators. There have been expressions here from engineers who are more familiar with the matters than I am, controverting that view. I think, perhaps, it would throw additional light on the subject if I should give some of the facts that are known to myself and occurred in my own experience, in my levee district, during this flood season.

I have a frontage of 120 miles of levee. The district next below me has an extent of 60 miles, reaching from the lower end of mine to where they had their first crevasse—I mean the crevasse highest up—making a stretch of 180 miles of levee. There was one break in my front. It attained a width of 280 feet. From the head of the Yazoo Basin, on the Mississippi side, there was an extent of 180 miles of levee that was practically maintained during the last flood, and that extent of levee covered and protected about five-sixths of the entire Yazoo Basin. Less than 20 per cent. of the territory in the entire Yazoo Basin was submerged this year, and in my own levee district only about  $1\frac{1}{2}$  per cent. of the country was submerged.

The greatest enemy to the maintenance of levees is the caving of the banks. I may say it is the only serious difficulty in the way of restraining the floods of the Mississippi River. It is because that considerable sections of the levee line have been annually sacrificed to the river by means of its changing its channel, caving the banks away and caving the levee away with the banks, and they have had to be renewed. That has constituted an enormous burden upon the tax-payers.

In my own levee district that evil is less than anywhere else in the delta. I have less to contend with. Therefore in the construction of my levee I could afford, if the means were available, to make permanent works on all the lines, works that I would have assurance would not have to be renewed by reason of caving banks, and I think I have exercised more care in the construction of my levees than they have in other parts of the delta, and I have now a better line of levees than elsewhere for the same extent.



I found no difficulty in building levees high enough to restrain the floods, and the only weakness exhibited under the extraordinary strain of this year was where either in old levees we had concealed weaknesses that I knew nothing about, and had not been able to detect and remove, or where the formation underneath the levee was of such a character as to permit the passage of water. In some localities there is a sub-stratum of sand a short distance beneath the surface, and in these cases I had some trouble in combating the danger, but I had no break in any place except one, where the evidence all shows there was an old long-disused wooden culvert under the levee. I knew nothing of it until since the break occurred, but the levee was abundantly strong and resisted the strain upon it.

Now I have been up and down the river a good deal. I have been employed by the Government as an attache of the Army Engineers on levees, and I have been interested professionally in the treatment of the river for a good many years and over a considerable extent of it. I have heard a witness here state that there were rocks at various points in the river at very remote periods in the past, which have since disappeared. I observed that he located some of those rocks near Myersville, in Mississippi. That place is about 40 miles from the nearest hill formation, and if rocks were there they could not have been there as permanent fixtures. They must have been deposited there in an accidental manner, because that region has several hundred feet of alluvial deposit under it. As to those rocks having since disappeared, I may mention that in many places along the river steamboats have been sunk and buried and disappeared. In other places islands have grown up and come entirely above the surface even up to high water. The channel has been, and is still, shifting continually.

#### STATEMENT OF HIRAM R. STEELE.

Senator GIBSON. State your residence.

Mr. STEELE. My present residence is Natchez, Miss., but my business interests are in Louisiana.

Senator GIBSON. Where is your legal domicile?

Mr. STEELE. Tensas Parish. I do not know but at present my legal residence would be at Natchez, as my family is there. I have lived on the banks of the Mississippi and in Tensas Parish for the last twenty-five years.

When the proposition was first announced that it was the duty of the Government to build levees as an aid to navigation, while I thought it was absolutely proper and necessary that the Government should build the levees, and still believe that the Government will take absolute charge of the levees some day, I could not see that it was an aid to navigation; but since the demonstrations that we have had, I am convinced that we owe the navigation of the river to-day to the levees that have been maintained by private capital.

My reason for this opinion, and I think it might be proper to explain to laymen what perhaps you do not understand, is that this is a deep river with occasional sharp peaks of sand, as stated by the



last witness. We find that these obstructions to navigation exist invariably where there have been crevasses or outlets. We find that upon closing those outlets, and in many instances where there have been no other works done, these obstructions are removed. If you could see a profile of the bed of the Mississippi—for illustration, at Natchez in extreme low water it is 90 feet deep, while at the same time the state of the water at about 15 miles below, at Natchez Islands or St. Catherine's Bar, is about 12 feet. So that you find the river is driving against a wall there over 180 feet high. These conditions extend not quite so deep as this, because this is the narrowest point in the lower river that I have any knowledge of. But I suppose there is from 40 to 80 feet all the way up.

At the mouth of the Red River the difficulty with which the Government has been dealing for I do not know how many years, ever since the settlement of New Orleans, we have two hundred and odd feet in front of New Orleans, which extends down until we get to the Passes, and there we find a mountain coming up on a profile, which appears to be a sharp peak, which absolutely closes the navigation in its natural condition; and we find a reason for it, that the defined channel is lost, water disperses, and it forms this bar very suddenly to a great extent.

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Now, it is suggested that as the water is so deep below Red River that levees are unnecessary. There is every reason to believe that if the same conditions should arise at any point below Red River the same results would follow as we find at the Passes, and there is great danger if the stream is left uncontrolled that it will break away and find new outlets, find new channels. That is the tendency of a stream after it reaches the condition the Mississippi now has reached, but there is a very simple and easy manner, as has been demonstrated, and is probably the only practical power by which we can dredge out these obstructions, and that is to do it by using the river itself. That has been most thoroughly demonstrated at the jetties, notwithstanding, I think, that the testimony given here, read by a person who did not consider it closely, might lead to the impression that all the works which have been done by the River Commission are an absolute injury and the people's money thrown away.

We on the river know that it is a most magnificent success and has captured the most skeptical, even the Pilots' Association, who were unable to understand how these results were to be accomplished. I do not know of any difference of opinion among intelligent people, irrespective of politics or religion.

We used to see during the low-water season large boats tied up. We know they are now running all the time from St. Louis to New Orleans, the same large packets. It may be true that at some stages of low water they do not carry as large cargoes as at high seasons; but so far as the impression upon the public is concerned we know that the boats run and that the result has been accomplished. They are very large boats. We do not have the same impression that



some of our packets are tied up and that some of our little stern wheelers are running in their places. It is known throughout the world that we have one of the deepest harbors in the United States at New Orleans.

Now, as to one consideration before this committee, the protection from floods. I think the great difficulty we have to contend with in this country is that levees are known throughout this country as private affairs; that they are necessary to the occupation of that valley, and the first impression created upon the public mind is that we are trying to get the Government to do something for private benefit.

The CHAIRMAN. That impression does not prevail with all of us.

Mr. STEELE. We hope that impression may be overcome. If it is true (and I think the people of the United States could be thoroughly satisfied with the improvement of the navigation of the river), what Eads asserts in one of his communications to the Commission or to the committee that with the levees maintained continuously to Cairo for twenty years he would guaranty 20 feet of water at extreme low water, and at the end of ten years the levee would not be required—that would be the most economical investment that could be made of the people's money.

There is a feature of this question, however, that I think would authorize you to take charge of this system aside from the question of navigation purely and without being called upon to violate the prohibition which we have had in our recent river and harbor bills, and that is that it is an interstate matter.

Now, I live in the northern district of Louisiana. We are not overflowed by the water that runs from our own banks. The water that overflows our district of country enters the country in Arkansas, and we are prohibited by the Constitution from making contracts with the State of Arkansas, and for the last series of years we have, by courtesy, with our own money spent over \$100,000 in building levees. We are taxing ourselves to the utmost capacity to build levees in Arkansas. We have no police control. We have no power of supervision of these levees. We find that we can not exist without them. We have a most magnificent territory.

There are over twenty parishes that are affected there, and by courtesy we are going into Arkansas and building levees where we can not protect them or prevent people from riding on them. It is a very small part of Arkansas that is interested. It is only two counties below the mouth of the Arkansas River. The balance of the State has no interest in this matter. This little corner is not sufficient to shape legislation in Arkansas. It is only that they do not care that they allow us to build the levees there. They had an idea some years ago that it would be just as well to let the water run down on Louisiana. This year they have got one of our levees up there. The good people have denounced it, but it does not excite any interest in Arkansas. We have been discouraged from that source, causing indignation almost enough to start a war. This levee system is a national system. It requires a sort of action be-



tween eight States and districts and counties. Our States are not all alluvial land. Our legislatures are divided. We have to have special legislation for these districts, and it is not always certain that we can carry our legislatures on these matters.

It is certainly a Federal question from the very nature of it. Another feature of it which seems to me ought to enable the Commission to say that it is not illegal to build levees, is the fact that the immense commerce of this whole Southwest is interrupted. I do not know that you gentlemen are aware that to-day the Illinois Central Railroad, which is just building a bridge costing \$2,000,000 at Cairo, can not run a train into New Orleans, their terminal, and has not for thirty days.

The immense Texas Pacific is cut in two. The Southern Pacific, extending from New Orleans to San Francisco, has not run a train for a long time, and is cut squarely in two by the breakage of these levees. Now the mail service is entirely stopped there.

This immense commerce and this road, which we properly know is the Mississippi Valley Road, runs through the Louisville district from Mississippi to New Orleans, and is the connecting link of the southern system. It has absolutely had more traffic in the height of the season in handling the cotton crop of that country than it could carry with a single track. The business upon the railroads does not seem to have diminished the business upon the river. The business upon the river has been increasing. The officers of the Anchor Line stated within the last thirty days that the last twelve months has been the most successful in their history, not only in freights, but that they had had a large amount of passenger business. Since these improvements they told me that they had stopped insuring their boats; and for this committee and the public who read of this investigation to get the impression that the people's money is being thrown away in improvements on the river is a great wrong. The improvements have had a most brilliant and magnificent success. They are in charge of a corps of men of which the nation has a right to be proud, and notwithstanding all the slanderous reports no one has ever dared to say that one dollar has ever been stolen or misappropriated. We ask that the people of the whole country may sustain them. We do not know what they are going to do, but we are willing to trust them. Let them handle this matter and we know that success will follow.

#### STATEMENT OF T. W. STRINGER (Colored).

Mr. T. W. STRINGER, of Vicksburg, appeared before the committee.

The CHAIRMAN. Where do you live?

Mr. STRINGER. Vicksburg. I have lived there continuously since 1865, just after the conclusion of the war, when they were throwing no more marbles at each other.

The CHAIRMAN. There was a gentleman who appeared here the other day, representing the colored people of the Mississippi bottoms, as he stated, who said that this levee business was a scheme of the



Bourbons, meaning, I suppose, a scheme of Senator Gibson and others [laughter], and he said that the colored people up and down those bottoms were opposed to the levee system; that they were taxed and were furnished rations and things of that kind, but that they were compelled to pay twice what they were reasonably worth when there was a chance to work, and that the poor people or the colored people up and down the river were almost entirely united against the levee system. Now what have you to say about that?

Mr. STRINGER. I do not know who he was. I have no hesitancy in saying that he did not represent us in the delta at all.

The CHAIRMAN. He did not represent the working-men?

Mr. STRINGER. No, sir. We are in favor of the levee system as represented here to-day, and expect our friends to keep it up in that manner. The reason is obvious. Without that we can not subsist down there; there is no use talking about it. We have the cotton to make. Take away the protection of the levees when our lands are overflowed and we starve to death. Within these few years we have been buying little homes. We are buying them in the delta; we would not go anywhere else. We are adapted to making cotton, and we have got just enough good common sense to go where we can live, and they are coming in from Georgia, North Carolina, South Carolina, and from all around into that belt, and ere long you may call that Africa [laughter], and of course we ask our friends to protect us in our endeavors to make ourselves men.

Senator WASHBURN. Whom do you consider your friends?

Mr. STRINGER. We know who our friends are. [Laughter.]

Senator GIBSON. Have you anything further to say?

Mr. STRINGER. Nothing more than we indorse the idea as advanced by the engineers in deepening the bed of the river. We would not wish it to be otherwise, because we are going to raise cotton.

Senator GIBSON. How long have you lived in the Mississippi country?

Mr. STRINGER. I went to Mississippi in 1833, and have been in that country and know all about it from beginning to end. There is one thing which is apparent to all, that if you keep your water up here we will have no trouble down there. [Laughter.]

Senator GIBSON. Are there many colored people going into the cotton country?

Mr. STRINGER. I suppose there must be twenty thousand going in there this year.

Senator GIBSON. Are they buying their own homes?

Mr. STRINGER. Yes, sir. Last year some 40,000 acres of land passed into the hands of colored men, and they are preparing, as I say, to Africanize that delta. We are adapted to the products of that country and only want a few white friends to engineer it.



The committee report in submitting to the United States Senate Committee on Commerce, the memorial of colored citizens and Republicans of the Mississippi Valley to the President and Congress of the United States.

Mr. Chairman and gentlemen of the committee, in appearing before you in the interest of the Mississippi Valley, we have premised from your inquiries that the chief point at issue is why the Government should take steps to control and restrain the floods of the Mississippi River independent and apart from the relief to be afforded us.

It is the great receptacle from the water-sheds of all the States lying west of the Rocky Mountains, comprising about three-quarters of the territory of the United States, and as the forests of this vast area are annually encroached upon by the advancing tide of civilization, its surplus waters are more certainly and rapidly transmitted to the Gulf through the medium of the Mississippi River.

Such is the magnitude of its service, that it is recorded by historian, poet, and muse as the Father of Waters.

We have no means through which to more thoroughly comprehend its national character than the history of the late war, and a contemplation of the blood and treasure expended in restoring to the nation this *greatest highway* from its heart to the sea, and the almost unchecked success to our arms after this great key was recovered.

On the banks of the Mississippi River and its innumerable tributaries are situated great marts of trade for collecting and distributing the products of the farmer, the miner, and artisan. The relations of the Mississippi River to these great factors of the nation's progress and prosperity are similar to that of the spinal marrow to the human system. The framers of our Constitution seemed to fully realize that it would require the combined skill and intellectual power of the nation, exercised in its highest legislative capacity, to successfully stimulate and develop the intricate affairs of commerce, which is the prime factor in denoting the highest attainments of civilization.

From Cairo, Ill., southward to the sea the Mississippi in its tortuous course traverses a scope of country nearly 1,200 miles in extent, known as the Mississippi Valley, comprising the basins of the St. Francis, the Yazoo Delta, the Red River Basin, and the delta of the Mississippi.

Such is the aggregation of its waters flowing through this territory that it is termed an inland sea, which the advancement of engineering science has proven to be capable of affording safe and easy navigation for the largest of our merchant marine at all seasons of the year, provided the powers and duties of Congress specially delegated by the Constitution, section 8, article 3, be properly exercised to control and direct its improvement. At the head of this great valley the Mississippi enters an alluvial bed which it has doubtless been building for ages from its deposits.

Experience and scientific research have demonstrated that the greatest agency available for its improvement is its own current. The researches of these eminent engineers Humphrey and Abbott



(chapter on basin Mississippi River, page 85, marginal note "Beds of swamp rivers") demonstrates that the bed or bottom of our alluvial rivers are composed of a blue clay, which is not affected by the general flow. Consequently we may reasonably assume that by a proper application of the principles so fully and successfully illustrated by that veteran engineer Captain James B. Eads in deepening the mouth of the Mississippi, that any part of it, by proper confinement and direction of its flow, may be made to scour its channel to the depth of the blue clay strata, adapted by nature as the bottom of our alluvial rivers.

Observations and the reports of our present engineers will show that wherever the channel is reasonably restricted in width by its natural banks, it has sufficient depth for safe navigation. But wherever from the action of floods, caving banks, and other causes it becomes unduly widened and the course of its current divided into different channels, it deposits shoals and impediments to navigation. The succession of basins lying on either side of this great stream in the district of its alluvial formation contains about 20,000,000 acres of land possessing a most fertile and inexhaustible soil which is subject to destructive floods, occurring in a greater or less degree annually, which endanger and destroy human life, and lay waste to millions of property.

As to the necessity of Government protection and the value to be contributed to the general commerce and exports of the nation that will be derived therefrom, we submit the following memorial from the colored citizens and Republicans of the Mississippi Valley:

*To the President and Congress of the United States:*

We, the undersigned citizens of the Mississippi Valley, respectfully represent that there are about 20,000,000 acres of land, having a most fertile and inexhaustible soil, lying on either side of the Mississippi River, which has been, is now, and will continue to be, subject to destructive floods, occurring in a greater or less degree annually, but which might be made the equal of any, if not the most valuable section of the United States, in point of productions, and possibly superior to any in the known world, by the action of the Federal Government, provided this subject is properly considered and appropriate legislation provided for its redemption.

Much has been written and spoken for and against the feasibility or practicability of redeeming this important section of country from the visitation of these annual overflows, and, owing to the imperfect data that has heretofore been available upon which to predicate correct conclusions, the public mind is still undecided as to the practicability, or otherwise, of protecting this section from floods.

A brief statement of the facts upon which the many conflicting ideas have been based is perhaps necessary, in order to have anything like a correct appreciation of the reasons for the many diverse opinions which now exist upon this important subject.

In the first place, it is necessary to state that up to this time there has been no plan of action which was supported by any power adequate to supply either the thought or means necessary to comprehend, elaborate, or carry out any plan on a sufficiently large scale to even give promise of any great success.

It is to be remembered that not even the States adjacent to the Mississippi River, as a rule, have taken action in their capacity as States, but the efforts that have been made toward protection from overflow have been made by the various river counties, at most by a few counties organized into districts under legislative enactment by the several States. And even in these districts, where so organized, they have been made up of counties that would suffer by an overflow of a particular section or locality, and have not been extensive enough to protect all of any of the three or four great basins which lie between Cairo and New Orleans, first upon one and then upon the other side of the river.



It will be manifest that it was unreasonable to expect anything but failure in such disconnected and limited organizations, which in the main have been without means, except such small sums as could be gathered from taxation of a district which, owing to the fact that it has been subject to these destructive floods, is up to this time but sparsely settled. Enough has been accomplished, however, in this very disconnected and limited manner to prove beyond question the feasibility and practicability of redeeming this vast and fertile section at a cost which is very insignificant in comparison to its value to the nation when reclaimed.

Owing to the fact that the portion of the river country subject to overflow lies partly in as many as four or five States, and that owing to the further fact that in none of these States is there a large enough section of such State subject to overflow to give a controlling power to the legislature, it is almost out of the question to hope that, for at least many years to come, the strength and power of the States can be enlisted in any intelligent system of legislation on this most important matter.

It may be truly said that this is strictly an interstate question, the more so when it is taken into consideration that the water of this great river is derived from the following States and Territories, viz: New York, Pennsylvania, Maryland, Virginia, West Virginia, North Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Tennessee, Kentucky, Ohio, Indiana, Wisconsin, Minnesota, Dakota, Montana, Wyoming, Colorado, Nebraska, Iowa, Kansas, Missouri, New Mexico, Indian Territory, and Arkansas.

The framers of the Constitution very wisely reserved to the Federal Government the treatment of all such questions, for the simple reason that whatever concerned several states was primarily the concern of all the States. Believing, as we do, that this great subject comes within the province of national legislation, and further believing that when this fact is realized by the people of the United States, this vast country can be redeemed, as already stated, at a comparatively insignificant cost, through a system of dikes or levees, we earnestly request your attention to this subject as a matter that concerns the people of the United States at large, and as of vital interest to the colored race.

It is peculiarly in this section that the colored people of the United States can, with reasonable chance of success, make for themselves homes, and become an independent and self-sustaining population of the country.

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During the present year, however, we have had a recurrence of the flood of 1882, with all its disastrous effects, except as the country, in the primitive way heretofore mentioned, has been protected by the present levees. But enough has been shown to make it an absolutely demonstrable fact that, with wise legislation on the part of Congress, which would establish a system of levee work extending over half a dozen years or more, with a moderate appropriation of, say \$5,000,000 to \$7,000,000, to be expended annually, the whole of this vast section of country could, through a system of levees, be made almost, if not quite absolutely secure from overflow. And after this system of levees is constructed they could be maintained at a comparatively insignificant cost to the Government.

There is no denying the fact that the confinement of the water within given limits would contribute immensely toward the maintenance of the unobstructed navigation of the river through the deepening of its channel.

In addition to all the foregoing considerations, it may be stated that the annual products of this section of country, which would be produced mainly by the labor of the colored race, would contribute an aggregate sum of nearly \$1,000,000,000 per annum to the nation's wealth. This section would become their home, in a large measure, and would remove much of the supposed threatened friction between the races, about which so much has recently been said; and when that race is once in possession of homes of their own, from which so large a contribution to the national wealth annually flows, it is believed that they would no longer be objectionable to the people of any section of the Union, and that if there still should linger in the minds of any portion of the community a prejudice, the very independence of the colored people that would thus be brought about would be sufficient to, in the end, remove such objections and render the race independent and no longer a subject of public consideration any more than would be any other portion of the community.

In view of all these facts, we again earnestly entreat the Congress of the United States to take this matter into consideration and adopt such wise legislation as will bestow upon our people, and especially upon the colored race, the protection



which would bring to us such blessings and benefits as we confidently believe would result.

We hereby appoint and constitute the following committee as our representatives to lay this matter before the President and Congress of the United States forthwith:

W. H. ALLEN.	ISAIAH T. MONTGOMERY.
L. A. BELL.	G. W. GILLIAM.
A. T. WIMBERLY.	G. W. GAYLES.
PETER MITCHELL.	W. E. MOLLISON.
T. M. BROADWATERS.	A. J. OAKES.
GEO. W. BUTLER.	W. W. COX.
JOHN SCALES.	T. W. SPRINGER.
FRANK HAWKINS.	J. S. PRATT.
W. H. SMITH.	A. P. POLLARD.

And especially request our Representatives in Washington to render them all the assistance in their power.

Very respectfully submitted this 28th day of April, 1890.

L. A. BELL.	W. H. SMITH.
JAS. A. SCOTT.	HENRY AVANT.
G. W. GILLIAM.	W. H. ALLEN.
E. H. HUMPHREY.	GEO. H. OLIVER.
G. W. GAYLES.	A. C. JACKSON.
J. E. OUSLEY.	I. T. MONTGOMERY.
J. H. BUFFORD.	F. M. BROADWATERS.
L. C. REYNOLDS.	L. C. MOORE.
A. G. PEARCE.	PETER MITCHELL.
W. H. SMITH.	ANDERSON LEVY.
GILBERT HORTON.	B. F. GARRETT.
W. E. MOLLISON.	S. B. BLACKWELL.
HENRY SCOTT.	N. A. ANDERSON.
WESLEY CRAYTON.	T. W. STRINGER.
THOS. BELL.	DR. JAMES PORTER.
A. J. OAKES.	S. B. BROOKS.
GEO. W. BUTLER.	W. W. COX.
D. J. FOREMAN.	GEO. COX.
HENRY HALL.	JOHN REED.
JOHN SCALES.	B. F. BOOTH.
FRANK HAWKINS.	J. S. PRATT.
AUSTIN BELL.	A. P. POLLARD.
	And many others.

Presuming that the investigations conducted by your committee have demonstrated the necessity of protection and development of this great valley coincident with the improvement of navigation, we will now briefly refer to the most approved means to be employed. The chief plans now under consideration seem to be (1) the reservoir system, (2) the outlet system, and (3) the levee system.

Here again we have recourse to the exhaustive researches of Humphrey and Abbott, under the heading of "Analysis of Plans for Protection." Pages 381 to 386 show conclusively that the system of reservoirs, while admirable in conception, owing to natural physical conditions are utterly impracticable as a means of preventing overflow.

The levee system (see Humphrey and Abbott, pages 150 to 167) seems to have been the general mode adopted for protection since the earliest settlement of the valley.

You will notice that every step of their improvement has marked a corresponding growth of commerce and material development. Humphrey and Abbott undoubtedly favored them as perfectly practicable and the only means for preventing overflow.



The engineers of the River Commission have not only sustained that conclusion, but have also shown that improvements of the Mississippi channel can not be perfected and maintained without the levee system.

Being natives of the valley and active participants in the building of levees, and close observers of floods locally, we are practically familiar with many points disclosed by the testimony of the Commission, which are also attested by Humphrey and Abbott, viz., "That overflow waters returning to the river occasion an excess of flood height at and near the point of their return, and materially prolongs the duration of floods."

We have shared the very natural opinion that the confinement of the river to its bed during floods would tend largely to raise its flood height. Experience, however, has shown this opinion in a great measure to be erroneous. In all localities where excessive flood heights have taken place local causes were apparent.

This system has been brought to its present stage by taxation, as stated in our memorial, at a cost of from \$12,000,000 to \$15,000,000, only \$3,000,000 of which was paid by the United States. Our constituents are the chief producers in the districts affected by the levee taxes.

Therefore the raising of this enormous sum has drawn heavily upon their substance, and will continue to do so until practical relief is afforded.

We have reliable data of a community of colored people that came into existence three years ago in a wild and thickly wooded district of Bolivar County by purchases, which now aggregate about 5,000 acres. The second year their levee taxes amounted to \$300, the third year at present rates they will amount to about \$1,200 or \$1,500, and if no change occurs, will increase at the rate of \$600 annually till its maximum is reached.

We would murmur but little at this great burden if it was adequate to protect, and the end could be seen.

You gentlemen can not realize the harrowing feeling of doubt and alarm that linger over communities living miles away from the high lands and water-courses during the flood stages of the Mississippi River.

We believe that our cause is a just one, and will commend itself to all parties. But we have been encouraged to place our case before a Republican administration from the knowledge of the facts; that it is the party of progress and development; that it is fully identified as the author and finisher of every era that marks the unparalleled advancement of this great nation.

Very respectfully submitted,

THOS. W. STRINGER,  
ISAIAH T. MONTGOMERY,  
A. T. WIMBERLY,  
*Subcommittee.*



The CHAIRMAN. Who prepared that?

Mr. MONTGOMERY. That is the work of our committee.

The CHAIRMAN. Are you a property owner?

Mr. MONTGOMERY. Yes, sir.

The CHAIRMAN. To what extent?

Mr. MONTGOMERY. Myself and cousin own 840 acres.

The CHAIRMAN. Do you raise cotton?

Mr. MONTGOMERY. Well, we have just moved into a new community. We have not gotten well to raising cotton yet. We are just clearing the land. We can not do much at raising cotton in three years. We only have about 150 acres in cultivation.

Senator GIBSON. Were you born down there?

Mr. MONTGOMERY. I was born on the Davis Bend, and have lived on the river all my life.

Senator GIBSON. Are you the son of Mr. Montgomery who bought Mr. Davis' place?

Mr. MONTGOMERY. Yes, sir.

Senator GIBSON. Were you sent to school and educated?

Mr. MONTGOMERY. I never went to school.

Senator GIBSON. Did you compose the paper you have just read?

Mr. MONTGOMERY. I just finished it up. I have not had a chance to transfer it to ink. We thought our committee would be called in the morning, and we did not expect to report before to-morrow.

#### MISSISSIPPI RIVER.

Extracts from a speech of Hon. T. C. Catchings, delivered in the House of Representatives on the 22d ultimo.

\* \* \* \* \*

Discussion hitherto has been largely confined to the consideration of the effect which the rectification and control of the river might have upon the fortunes of those who dwell in its lower valley by securing to them immunity from the blighting embrace of the angry waters which periodically, with unrestrained fury, rush savagely down to the sea.

With some, the fact that this immunity from disaster might result, has been regarded as proof that the work is but local in scope and effect; while with others, I fear, this fact has been accepted as furnishing a conclusive reason why it should not be undertaken by the General Government at all.

If nothing more than the protection of the Mississippi Valley from desolating floods should be achieved, so large a community would be relieved and the wealth of the country would be so vastly augmented that the very magnitude of the result effected would suffice to divest it of all local characteristics and stamp it as a work of the highest national concern.

The Mississippi Delta alone extends across  $8\frac{1}{2}$  degrees of latitude, stretching from  $29^{\circ}$  to  $38^{\circ} 30'$  north, being about 600 miles long and averaging about 60 in width.

It embraces about 40,000 square miles, of which at least 36,000, or 23,000,000 of acres, can be reclaimed and placed in cultivation.

A moderate estimate would give at least 6,000,000 acres of sugar lands, 15,000,000 of cotton lands, and 2,000,000 of corn lands.

These lands are more fertile than those of the valley of the Nile, which by the richness of its soil was the granary of the East, and became the seat of ancient civilization and the heart of one of the mightiest systems of government the world has ever known. The value of these lands when reclaimed from overflow would easily reach \$30 per acre, or a total of \$690,000,000. But stupendous as would be the result of this reclamation of the lowlands of the Mississippi Valley, it by no



means furnishes the sole standard by which to measure the benefits to the American people which would come hand in hand with the restraint, control, and discipline of this mightiest of navigable rivers.

\* \* \* \* \*

The Mississippi and its navigable tributaries constitute a system which embraces not less than 14,000 miles of water way. They intersect, and when suitably improved will furnish facilities for transportation to, almost every part of the great agricultural region which extends from the Gulf of Mexico to the Lakes, and from the Alleghany to the Rocky Mountains, comprising an area of about 3,000,000 square miles, which is about two-thirds of the whole area of the United States.

The Mississippi Basin proper contains 1,257,545 square miles, according to Walker's Statistical Atlas, but Foster, in his work on the valley, estimates the area drained and benefitted by this great water-way system to be 2,000,000.

When this valley, as in accordance with a just popular demand it must soon be, is connected by way of the Illinois River with the great lakes at Chicago, the value of the Mississippi as a highway of commerce will be so multiplied as to be absolutely beyond computation.

The multiplication of routes of transportation, the greater profits from all agricultural and industrial pursuits, the growth of centers of population which would follow this connection of the lakes and the Mississippi River would add untold millions to the wealth of the country.

It is the part of wisdom to prepare this river for the mighty work which the near future is certain to impose upon it, and every consideration, whether utilitarian or sentimental, demands for it broad and generous treatment.

Even in its present unimproved condition, and competing, as it does, with the elaborate railway systems which penetrate and intersect its valley and often follow its actual borders, the river is the vehicle for the transportation of a prodigious quantity of merchandise and agricultural products.

In 1886 the Western farmers shipped by it, via the city of New Orleans, 743,439 bushels of grain, and in 1887 3,973,737, there being in a single year an increase of 3,230,298 bushels. Stated in tons, this makes in 1886 302,870, and in 1887 396,060.

From January 1 to July 1, 1887, it carried by barges of package freight 35,597 tons, and of bulk freight 203,873 tons.

By steamboats during the same period it carried of package freight 73,525 tons, making a total of 312,995 tons.

I have no figures since 1887, and none at all showing the amount of up-freight, though it was undoubtedly very large.

Indeed, a very significant fact in connection with the commerce upon the river is the marvelous growth of shipments designed for various points in the Mississippi Valley from New York and the East by the Atlantic Ocean to New Orleans and thence up the river by barges and steamboats.

\* \* \* \* \*

Although I have shown that, even in its present condition, a prodigious commerce is carried on upon the river, yet gentlemen who have not investigated the subject will be, I am sure, amazed at the sum total of its value.

This can best be appreciated by comparing it with that which passes through the Sault Ste. Marie Canal, a commercial gateway upon the Great Lakes whose greatness and importance we all boastfully proclaim. The convention which assembled at Superior, Wis., in August, 1889, to devise measures to insure the speedy completion of the new lock in process of construction, estimated the value of shipments through the canal in 1889 to be \$83,732,527.15.

The value of shipments upon the Mississippi River to and from the port of New Orleans alone in the year 1887 was \$98,591,781, or \$14,859,254.85 in excess of that passing through the Sault Ste. Marie Canal in 1889.

It is a very moderate estimate to say that the total commerce upon the river was as much as \$250,000,000. Indeed, a very much higher estimate is placed by Capt. J. W. Bryant, for many years the river statistician of the New Orleans *Times-Democrat*, who is a practical steamboat man, and thoroughly familiar with the subject.

But this is a bagatelle to what the business of the river will be when the thousands in the valley shall become millions, when the hamlets shall become cities, and when our trade with South American countries shall have been developed as it must very soon be.

\* \* \* \* \*



About 3 miles above the Head of the Passes, about twenty-seven years ago, a crevasse occurred which is known as Cubitt's Gap. It was caused by a small canal between the river and the Gulf, used by fishermen. The distance between the two was less than 1,000 feet, and the difference in the surface height of the river and that of the Gulf was a little over 3 feet. The fall was at first about 15 feet per mile, and in a few years the crevasse was over 2,000 feet wide and 100 feet deep where the bank had formerly stood.

As soon as the water passed through, its velocity was gradually checked and the sediment was deposited in a fan-shaped area of 20 or 30 square miles. Islands and shoals were built up, which subdivided the volume into innumerable bayous and small channels, none of them having a greater depth than 5 or 6 feet; and each overflow builds up the islands and diminishes these outlets more and more; in a few years, by this process, the gap will be entirely closed.

Fifty years ago another crevasse, called the "Jump," occurred 21 miles above the Head of the Passes. A similar filling up resulted, forming an immense subdelta, upon which there are now large forests and rice plantations.

Innumerable bayous permeate this subdelta formation, no one having at its mouth more than 2 feet of depth. There are well-defined traces of similar outlets, long since closed up, at Bayou Terre au Bœuf, within 3 miles of the proposed Lake Borgne outlet, and at Kennerville, just above New Orleans, through Bayous Metairie and Gentilly.

Such would undoubtedly be the fate of an outlet, should one be made, at Lake Borgne. The lake is small and shallow, having a depth of from 5 to 10 feet, and the immense amount of sediment carried by the flood waters of the Mississippi would soon fill it up, doing immense damage to surrounding property and the fishing industries on the Mississippi Sound. In a few years the outlet would consist only of a few shallow and tortuous bayous, and eventually it would be a thing of the past.

In the meantime, however, while utterly failing to effect any reduction of the flood height, it would have caused extensive shoaling of the river channel below it, thus inflicting disaster and obstructing navigation, without making the slightest compensation therefor.

If any gentleman desires further evidence of the effect which this proposed outlet would produce, I invite his attention to the charts of the lower river, just published by the Coast and Geodetic Survey, upon which we will see definitely marked not only the shoaling of the river below the "Jump" and "Coteet's Gap" (the two outlets before referred to), but the immense deposits by which the river has practically closed them up.

\* \* \* \* \*

Leaving entirely out of consideration the navigable character of the river and the business carried on upon it, the injury to its postal service and to this enormous railway interstate commerce is of such magnitude as to command public attention, and make it the high and imperative duty of the nation to prevent its recurrence in the future.

Having now shown that the floods can be restrained by means of levees, and that they can not be by any other means, and that the interests involved and the beneficial results to be achieved are of such character as to demand governmental aid, it is but proper that the cost should be shown to be within the value of the benefits to be realized.

I wish at this point to correct an impression which seems to prevail that the levees along the river have been chiefly constructed by the Government. There are now 1,100 miles of levees, and the Government has only expended \$3,018,601.50. This statement will suffice to show how insignificant a part of the burden has been assumed by the nation. Since 1866 the State and levee districts of Louisiana have expended \$15,255,327.13; since 1882 the Mississippi levee districts have expended \$3,098,745.74; and Arkansas has expended \$340,417.

This does not take into account the extensive levee work done many years ago, of which a very large part in a more or less available state survived the neglect and ravages of the war period.

It will thus be seen that no people in the world have taxed themselves to such an enormous degree as have these inhabitants of the valley. And notwithstanding the perpetual and gigantic struggle, they have steadily gone forward felling the forests, opening up lands for cultivation, building up villages and cities; and by their cotton and sugar and other products they have added enormously to the wealth of the nation. Nor have they failed to make substantial progress in their



efforts to shut out the floods of the mighty river. "In 1882 the total number of crevasses in the levees was 284, aggregating 56.09 miles in width; in 1883 the number of crevasses was 224, with an aggregate width of 34.1 miles; in 1885 the crevasses numbered 204, aggregating 10.64 miles in width." These crevasses resulted in a general overflow of the Mississippi Delta.

In the present flood, which in height exceeded and in duration equaled any of which we have record, the total number of crevasses in the whole 1,100 miles of levees was but 23, aggregating but 4½ miles in width; and notwithstanding the sensational accounts to the contrary, fully 80 per cent. of the alluvial basin has enjoyed absolute immunity from the floods.

Without these levees the entire basin, excepting possibly a few high ridges of very limited area, would be absolutely uninhabitable. On May 1 of this year a convention was held at Vicksburg, composed of delegates from the States of Louisiana, Mississippi, Arkansas, Missouri, Kentucky, Illinois, and Tennessee, which was the equal in intelligence, ability, wealth, courage, and lofty purpose of any which ever assembled in this country.

Among these delegates the sentiment was universal that floods could be prevented by levees and by levees only.

This sentiment was concurred in by a splendid corps of engineers present and participating in the proceedings, and by the Mississippi and Ohio River Pilot Society, which, in the interest of navigation alone, it emphatically affirmed, by a series of resolutions, presented by it without suggestion or solicitation.

There is absolutely but one opinion among those interested in the river and having practical knowledge of its history and characteristics.

This convention and the engineers attending it estimated that \$10,000,000 from the Federal Treasury, added to what the States and the levee districts would contribute, would be sufficient to build levees of such dimensions and strength as are needed to forever control and restrain the floods.

What an insignificant sum compared to the enormous benefits to be attained!

The investment of that sum would give you an improved river, which for purposes of commerce is without a rival on the face of the globe; it would enable the farmers of the West to annually save such portion of their earnings as would in a few years make hard times a chapter of ancient history; it would relieve from disastrous interruption the great overland interstate commerce; it would give safety to the postal service; it would reclaim an empire richer than any for which the nations of Europe have so freely poured out their blood and treasure; and last, but not least, it would bring joy and peace and content and plenty to millions of American citizens.

What other nation is there upon the face of the earth that would not, without hesitation, expend one hundred times this sum if needed to obtain such a magnificent and glittering prize? We have by our levees, built almost entirely with our own means, given the facilities for the development of an enormous commerce which without them could not have existed; we have made possible the wide extension of the postal service; we have added untold millions to the national wealth; we have built up markets for the transaction of business with all the States of the Union.

The work needed to effect the perfect accomplishment of the end we are seeking to reach and its permanent maintenance can not be successfully done unless the nation does it.

The States are forbidden by the Constitution from making compacts and agreements among themselves. What they do, therefore, can not be done in a perfect, systematic, and scientific manner.

Unless placed under one supreme control levees can not be scientifically located and constructed.

If there be any one thing more national than all others, it is this great and noble stream, no matter from what standpoint we contemplate it.



## REPORT OF ENGINEERS.

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VICKSBURG, MISS., April 30, 1890.

*To the Committee on Resolutions of the Mississippi Improvement and Levee Convention:*

Your committee, to whom was assigned the duty of preparing a statement on the subject of levees, beg leave to submit the following:

The testimony of all engineers familiar with the subject is, that there is no engineering difficulty in the way of restraining the floods of the Mississippi River through the agency of levees, and that this is the only agency through which that object can be accomplished. The levees, as they existed at the beginning of the recent flood, were admittedly too weak generally, in height and width, to stand an extraordinary high water, as was recognized and affirmed by all Levee Engineers.

The fundamental defect in the present system of levee building is that they have not been designed and constructed on engineering principles, in the most thorough manner, with the sole view to certain efficiency, as is the case in all other classes of engineering work; but it has always been a mere question of doing the best that could be done with an insufficient amount of money.

The great desideratum has been to pile up as much dirt as possible in the cheapest possible way, so as to cover the greatest extent of territory with the highest bank of earth attainable with the means at hand. This consideration has precluded such treatment of the foundations as the character and service of the structures demanded, to which deficiency is attributed much of their failure to successfully resist the extraordinary pressure of this flood at various points. The disasters from the recent flood have been exaggerated and magnified beyond their true proportions, by the sensational treatment which the subject has received, and which has tended to shake confidence in the efficiency of the levee system.

In confirmation of this, attention is invited to the following facts: In 1882 the total number of crevasses in the levees was 284, aggregating 56.09 miles in width; in 1883 the number of crevasses was 224, with an aggregate width of 34.1 miles; in 1884 the crevasses numbered 204, aggregating 10.64 miles in width.

The result of crevasses enumerated during these three years was a general overflow of the Mississippi Delta. In the present flood, the dangers of which are nearly passed, the crevasses which have occurred number 23, aggregating about four and one-quarter miles



in width, in a total length of 1,100 miles of levees, or less than one-half of one per cent. of the total line of levees, notwithstanding that the present flood has exceeded those of the three years cited in the height attained at Memphis and all points below, and has not been exceeded in duration. This excess of height was, at Memphis 00.5 feet, at Helena 00.6 feet, at Sunflower Landing 1.2 feet, at Arkansas City 2.3 feet, at Greenville 1.7 feet, at Providence 3.1 feet, at Vicksburg 00.1 foot, at Natchez 00.8 feet, and at New Orleans 00.5 feet. The general result has been a large measure of protection afforded by the levees this year, notwithstanding the extraordinary character of the flood, which has never been enjoyed during previous high waters of considerable magnitude.

For example, in the Yazoo Basin between 80 and 85 per cent. of its area is protected from overflow, there being only one crevasse of 280 feet in width, affecting a very small area, in 180 miles of levee extending from the upper extremity southward. There were other crevasses on this front below this locality. On the Tensas front are two reaches of continuous levee, being respectively 81 and 125 miles in length. The right bank below Red River has 180 miles of continuous unbroken levee, and the left bank has 200 miles with only one break. Of the territory dependent upon the last-named levees, 75 per cent. has been protected. The percentages of areas protected as above noted embrace all classes of lands subject to overflow; as the lands sought for cultivation are the more elevated portions, the percentage of their area protected is much greater.

From our knowledge of this subject we now feel justified in declaring that very great progress has been made during the past five years in the construction of a complete levee system by the joint efforts of the General Government and the riparian States; and also that the experience of the present flood has strongly added to our conviction that such a system presents the only solution of the protection of the alluvial valley from inundation, in connection with the general improvement of the river. We unhesitatingly express our condemnation of all theories for the regulation of the Mississippi River and controlling its floods by the agency of "outlets;" it is our conviction that such a system would prove destructive to all the interests which are sought to be conserved and improved in connection with the treatment of the Mississippi River. We also state with thorough conviction and emphasis, that the belief entertained by some that the effect of long confinement of the Mississippi River by levees will be to produce a permanent elevation of the river bed, is a fallacious one, which is refuted by experience and contrary to all observation. We are familiar with all surveys that have been made of the Mississippi and with its present navigation, and declare that there is no evidence from either of these sources, or elsewhere, of progressive elevation of the bed of the Mississippi River from levees or other cause, except where caused by, and immediately below, outlets.



We submit the following information relating to expenditures upon the levees from the following sources:

By the United States Government, through the Mississippi River Commission, since 1882 .....	\$3,018,601 50
The Mississippi Levee Boards, since 1882 .....	3,098,745 74
State and levee districts of Louisiana, since 1866 .....	15,255,327 13
Of which since 1882 about .....	5,000,000 00
Arkansas .....	340,417 00

The above do not include expenditures which have been made by counties, corporations, and individuals in the several States. We estimate that a further expenditure of \$10,000,000 by the General Government in co-operation with the riparian States, if promptly applied, will suffice to complete a system of levees that will prove entirely effective to restrain all future floods of the Mississippi River.

B. M. HARROD, C. E.

J. H. WILLARD, Capt. Engineers, U. S. A.

W. YOUNG, Capt. Engineers, U. S. A.

S. W. FERGUSON, C. E.

HENRY B. RICHARDSON, C. E.

WM. STARLING, C. E.

T. G. DABNEY, C. E.

H. S. DOUGLAS, C. E.

ARTHUR HIDER, C. E.

H. BOLIVAR THOMPSON, C. E.

H. ST. L. COPPEE, C. E.

JOHN SMYTH, C. E.

HENRY GOODRICH, C. E.

JOHN EWENS, C. E.

GEORGE M. HELM, C. E.

HORACE MARSHALL, C. E.



# LEVEES.

---

## RESOLUTION OF THE SOUTHERN PRESS ASSOCIATION.

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CHARLESTON, S. C. *April 30.*

At the meeting of the Southern Press Association the following resolution was adopted:

*Resolved,* That it is the sense of the members of the Southern Press Association that the maintenance of an efficient system of levees on the Mississippi River is a matter of national concern, and that the Government should take the necessary steps to build and sustain such a system. Experience has shown that the people living along the banks of the river are unable to bear the burden of taxation necessary to support such a system, and it is not right that they should be required to do so. The Mississippi is essentially a national river; its floods should be restrained by the National Government.







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By GIFFORD PINCHOT.

II.  
The Present Condition of the Forests  
on the Public Lands,

By EDWARD A. BOWERS,  
Secretary of the American Forestry Association.  
(Formerly Inspector of Public Lands.)

III.  
Practicability of an American Forest  
Administration,

By B. E. FERNOW,  
Chief of Forestry Division, Department of Agriculture, Washington, D. C.

AMERICAN ECONOMIC ASSOCIATION.

May, 1891.



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The three papers on Forest Administration here printed together were read at the joint session of the American Economic Association and the American Forestry Association, at Washington, D. C., December 30, 1890.

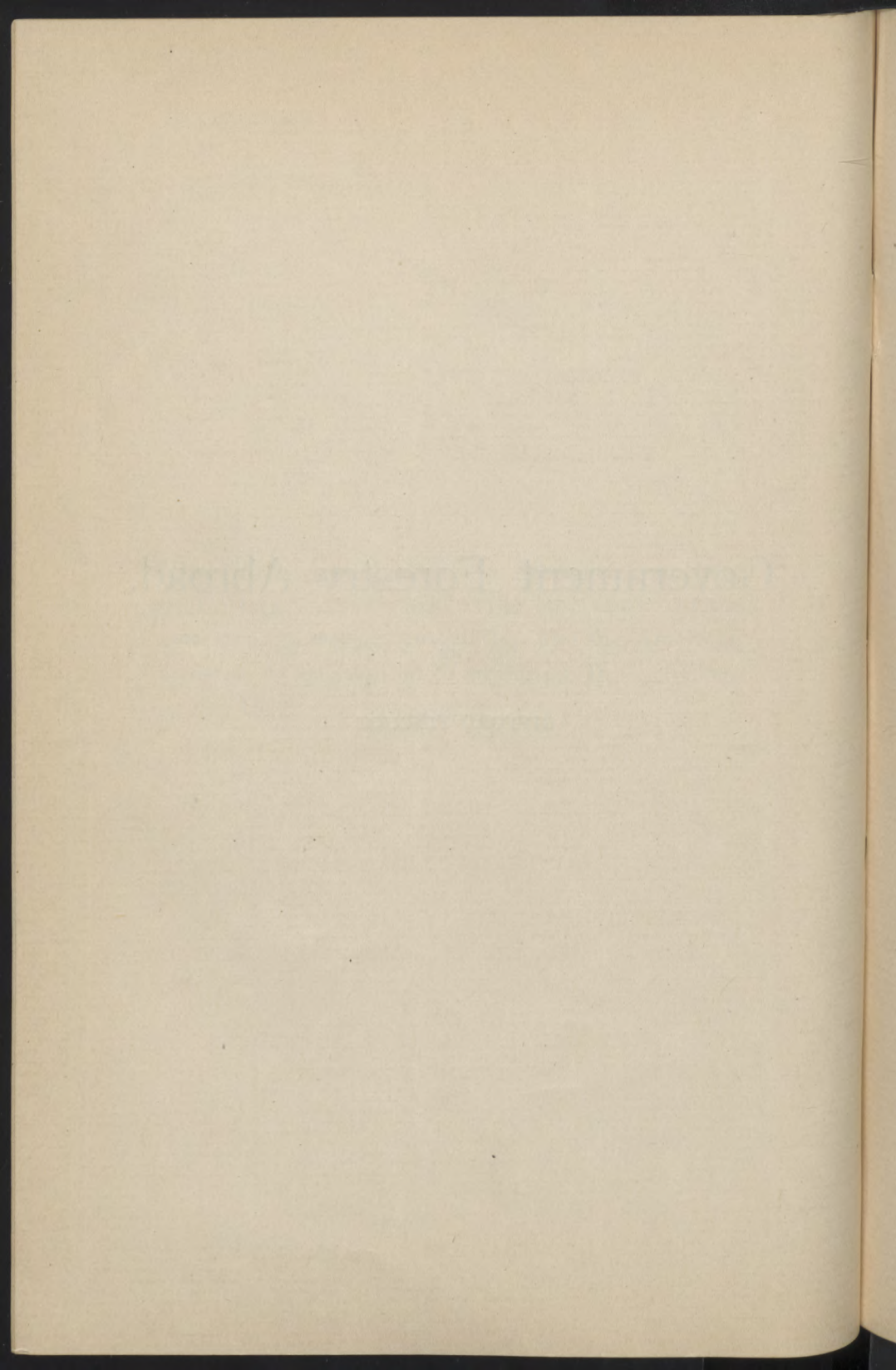


# Government Forestry Abroad.

BY

GIFFORD PINCHOT.







## Government Forestry Abroad.

---

BY GIFFORD PINCHOT.

---

The following article has been rather hastily prepared from such materials and experience as the writer was able to command, and while from the nature of the case it cannot claim to be a comprehensive treatment of the subject, it is believed that the statements and statistics which it contains are accurate.

Germany, France and Switzerland have been dwelt upon more at length, both because forestry has reached a wider development there, and because the writer can speak concerning them from personal observation.

The history of the forest has developed itself along similar lines in all the countries of Europe. Its course in the central part of the Continent, which may be taken as fairly representative of what it was elsewhere, is thus briefly summarized.

At first the forest held the same relation to man as to the game upon which he lived. His demand upon it was insignificant, but, as he advanced in the scale of civilization, he began to call upon the forest for greater supplies of timber, and especially for the pasturage of his herds. Until comparatively recent times this was the chief service which gave the wood



lands value. The increasing density of population and the more complicated needs of life then gave gradual rise to more vigorous attacks upon the forest. For a time the demand was small and the areas cut over easily covered themselves with young growth. The forest renewed itself and maintained its productive power. But, as the demand increased, the areas cut over increased with it, and the actual regrowth no longer kept pace with the quantity of timber which it was called upon to yield. At the same time the land needed for agriculture was being taken from the timbered area, and the wood lands, attacked along two lines, were beginning to suffer seriously.

"It is true," says Dr. Gayer,<sup>1</sup> "that the forest belonged at that time chiefly to the herdsmen and the game, but the steadily increasing tendency to destruction of a growing population made the general cultivation of the chase an undoubted advantage to the forest. Indeed the hunter has been at all times one of its best friends. For numerous acts of violence may be referred to, extending over the whole of mediæval times, as a result of which much free land belonging to the early communities, or the rights to its enjoyment, passed in course of time into the hands of the rulers. From a legal standpoint these are indeed events to be deplored, and from them the oppressive burden of actual prescriptive rights takes its rise, but the present extensive State forest holdings in Germany have chiefly to thank this universal love of *venerie* for their existence.

"It is unquestionably true that the forests have been at no time in a more deplorable condition than in the second half of the Middle Ages, and thence on to the middle of the last century. The results which must follow this condition of affairs were evident, and led to the most serious fears of a widespread timber famine. And although this foreboding, as it filled the minds of men toward the end of the Mediæval period, and as it was brought to the attention of the people through numerous publications, may have been exaggerated, nevertheless, in view of the commercial relations of the

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<sup>1</sup>*Der Wald im Wechsel der Zeiten.* Inaugural address as Rector of the University of Munich, November, 1889.



time and the narrow boundaries of supply, it was on the whole by no means unjustified. It gave, at least, the first impulse to economy. Under the influence of this universal sentiment, but perhaps caused even more by the interest in hunting and in the security of the rights of property, a gradual change for the better appeared in the destiny of the forest. Its importance as a national treasure had at all events penetrated the minds of the more intelligent classes.

"There begins now a time of restless work in the forest, a time of struggle for its preservation and rehabilitation, the results of which no other nation has realized so fully as the German.

"Apart from the measures which were demanded by the security of property and the economical ordering of forest utilization, the efforts of the forester were chiefly directed to the regeneration of the forest. This was accomplished in those regions which had partially escaped destruction by the assistance of the free regenerative power of nature, in the totally devastated areas by artificial means. The rational treatment of the wood lands had begun."

All forest management may be said to rest on two closely related facts which are so self-evident that they might almost be called axioms of forestry, but which, like other axioms, lead to conclusions of far-reaching application. These are, first, that trees require many years to reach merchantable size; and, secondly, that a forest crop cannot be taken every year from the same land. From the last statement it follows that a definite, far-seeing plan is necessary for the rational management of any forest, from the first; that forest property is safest under the supervision of some imperishable guardian; or, in other words, of the State.

#### GERMANY.

It is natural in treating the subject of State forestry to begin with Germany, since it is here that it has reached its furthest development and most stable condition. In Germany, then, the forests cover an



area of 13,908,398 hectares, or 26 per cent. of the total surface of the country. It is extremely significant, in view of the popular talk about the "inexhaustible" forest resources of the United States, to note that the latest available data put the percentage of wooded land in our country also at 26 per cent. It is true that the relative density of population in the two countries is a factor which enters largely into such a comparison, but it is equally true as regards the relative economy in the use of wood, and the fact that Germany is very far from supplying her own demand for timber. Further, the contrast between the permanent productive powers of the German and American wood lands, as they stand at present, adds another somber tint to the picture of our condition. In Germany, the State either owns or controls about two-thirds of the forest area, and for these lands the point of lowest production has been past. It is coming for us at a time when the need of timber is at its highest.

It is necessary when dealing with forest policy in the German Empire to treat independently the different States of which it is composed. Differences in forest organization and management have arisen through differences in politics and geography, even a superficial examination of which would exceed both the space and the scope of the present paper, and it is fortunately the less needful to go into so extended a discussion, because one common principle lies at the root of forest policy in each of them, and may be fully illustrated by reference to any one. This principle, special to no country or form of government, holds that "the State is the guardian of all public interests." It is in its interpretation that, for



the purposes of this paper, its chief interest lies. From this point of view "public interests" must be taken to mean all interests other than private ones. So understood, this maxim may be said to sum up the forest policy of nearly all the nations of Europe, as well under republican as under governments of a distinctly paternal character.

The Kingdom of Prussia, both as the head of the German Bund and as the State which has developed the forest organization most worthy to be taken as an example, will furnish the completest illustration.

Covering an area of some 8,153,946 hectares, the forests of Prussia occupy 23.4 per cent. of the total surface of the country. Of this wood land it may be said roughly that one-third is stocked with deciduous trees, and two-thirds with the less demanding conifers, a reversal of the old conditions, which is largely due to the deterioration of the soil and to the fact that the richer ground has been rightly claimed for agricultural uses. The ownership, a point of capital importance in relation to our subject, is divided as follows: To the State belong nearly 2,718,256 hectares, or 29 per cent.; to towns, village communities and other public bodies, 1,302,508 hectares, or 16 per cent., and to private owners 4,382,251 hectares, or 55 per cent.

The relation of the State to the forests which it owns is simple and rational, based as it is on the idea that its ownership will be permanent.

Holding it as a duty to preserve the wood lands for the present share which they take in the economy of the nation, the State has recognized as well the obligation to hand down its forest wealth unimpaired to future generations. It has recognized and re-



spected equally the place which the forest holds in relation to agriculture and in the economy of nature, and hence feels itself doubly bound to protect its wood lands.

In a word, it has seen that in its direct and indirect influence, the forest plays a most important part in the story of human progress, and that the advance of civilization only serves to make it more indispensable. It has, therefore, steadily refused to deliver its forests to more or less speedy destruction, by allowing them to pass into the hands of shorter lived and less provident owners. Even in the times of greatest financial difficulty, when Prussia was overrun and nearly annihilated by the French, the idea of selling the State forests was never seriously entertained.

But the government of Prussia has not stopped here. Protection standing alone is irrational and incomplete. The cases where a forest reaches its highest usefulness by simply existing are rare. The immense capital which the State wood lands represent is not permitted to lie idle, and the forest, as a timber producer, has taken its place among the permanent features of the land. The government has done the only wise thing by managing its own forests through its own forest officers.

The organization of the Forest Service is briefly as follows: At its head stands the Department, or more correctly, the Ministry of Agriculture, State lands and forests, which exercises general supervision over forest affairs through the medium of the (Oberland-forstmeister) chief of Forest Service. A part of this central office is the Bureau of Forest Surveys and Working Plans, a factor of very great impor-



tance in the general organization. A working plan is the scheme according to which the technical business of a forest range is carried out. "Its object," says Dr. Judeich,<sup>1</sup> "is so to order the management of a forest in time and space as to fulfill to the utmost the objects of this management." The following subdivision of the general subject of working plans is taken from his admirable work, "*Die Forsteinrichtung*." The first section is entitled "Preliminary Work," under which are included: forest surveys, forest or timber estimating (which includes "the investigation of all conditions inherent in the forest which have an influence on its present yield, or which are of importance for the calculation of its yield in the future;" that is, the very thorough study and description of both soil and timber), a study of the general and external conditions by which it is affected (its topography, history, ownership, nature of the surrounding land and people, and any other considerations which may influence its management), and, lastly, maps and records.

The second section, which may be called Forest Division for want of a better English name, considers the formation of ranges, each of which is in charge of an executive officer, then the division of the range into units of management called blocks, each of which is treated to a certain extent independently of the others, and into compartments, which are generally well over a hundred acres in extent, and are marked on the ground by open lanes and boundary stones. This second section contains also less important matters which cannot be touched on here.

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<sup>1</sup> *Die Forsteinrichtung*. 4th Ed. Dresden, 1885.



The third section, Determination of the Yield, explains the various methods of calculating and fixing the amount of timber which a given forest may be safely called upon to yield.

The next section treats of the construction of the working plans proper; that is, "of that document in which the essential results of the preliminary work, the determination of the yield and the regulation of the management are so put together that they may serve as a guide . . . to the executive officer of the range."

The final section relates to the posting and continuation of the working plans, especially as regards the periodic revisions, which take place in general at intervals of five and ten years.

Next in authority to the department just mentioned is the *Bezirksregierung*, a council in charge of one of the thirty-five minor divisions of the Prussian State, which has full control over forest business within its sphere of action. The members of the controlling staff, the *Oberförstmeister* and *Forstmeister*, are also members of this council. Their duties lie in the inspection of the officers of the executive staff, of whom there are 681 in Prussia. These officers, styled *Oberförster*, are charged with the actual management of the public forest lands, and it is on them that the security of public interest in the forests chiefly rests. Upon their selection and education the utmost care and forethought are expended.

Their course of training, one which has produced perhaps the most efficient forest staff of the present day, is briefly as follows: It begins, after graduation from a gymnasium, with a year of practical work



under some experienced Oberförster, to enter which the candidate is required to show, besides his certificate of graduation, that he is under twenty-two years of age; that he has certain moral and physical qualities, and that his financial resources are sufficient to carry him through his whole forest education. The object of this preparatory year is to introduce the beginner to the forest and its management; to enable him to become acquainted with the more important forest trees; to take part in planting and felling and the protection of the forest; to do a little surveying, and last, but by no means least, to learn to hunt. It may be said in passing that the love of hunting, which the Prussian forest service is careful to encourage, has very much to do with the faithfulness and efficiency of its individual members. Great stress is rightly laid on this year of preparatory work, chiefly because of the vastly greater force and reality which it gives to the subsequent theoretical teaching. As one who has suffered from the lack of it, I may perhaps be permitted to bear my testimony to the value of a custom which is unfortunately less widely extended than its merits deserve; but which I hope to see one day established in the forest schools of our land.

The young Prussian forester who has had the good fortune to pass through this preliminary year next spends two years at a forest school, presumably either Münden or Neustadt Eberswalde, both of which are in Prussia, and like all other similar German schools, are supported by the State. The candidate may, if he chooses, attend any of the other forest schools, of which Germany numbers six (Aschaffenburg and the Forest School of the Munich University, which



together form one complete institution; Tharand, Tübingen, Karlsruhe, Giesen and Eisenach), but he must cover the same ground as at the institutions which are standard. The technical school is followed by a year of jurisprudence and political economy at some university, and the young forester then comes up for the first State examination. He must present with his credentials the maps and field notes of a plot surveyed and a level run, as well as a timber map covering at least 1,235 acres, all his own work. The examination itself bears first on forestry, in which it requires a thorough knowledge of the general theory as to silviculture, working plans, calculation of the volume and yield of standing timber, its capital and selling value, the utilization of forest produce, forest technology, protection and police, and forest history and literature. In mathematics it demands about what is included up to the second year of one of our colleges, and in surveying the requirements are somewhat larger. Zoology, botany and mineralogy, especially the second, are strongly insisted on, while chemistry, physics and law command a smaller share of attention.

The examination is followed by at least two years of travel and work, during which the candidate, now promoted to the title of referendar, must perfect himself in the field and office management of a forest range. For this purpose he is required to spend five months in the practical administration of a range, under the responsibility of an Oberförster, and four months in the preparation of working plans. Half a year, including the months from December to May, is to be passed in the discharge of all the duties of an ordinary forest guard. During this time the



referendar is personally responsible for all that goes on in his beat, which must be the same for the whole period. At the end of this rather lengthy preparation comes the much-dreaded final examination, which, like the first, is held partly in doors and partly in the forest. This second test dwells more especially, apart from forestry proper, on law, political economy, finance, forest policy, and the organization of the forest service, but without slighting the laws and lore of hunting.

The referendar now becomes forest assessor, and is at length eligible for serious paid employment. The actual career of the forester can hardly be said to begin, however, until the appointment as Oberförster, for which the assessor has no sort of guarantee, and which may delay its coming for from six to twelve years. That once obtained, the list of promotion lies open, and includes every grade up to the highest. Still, it must be said that, as a rule, the Prussian Oberförster is wholly satisfied with his position, and very often unwilling to exchange it for one of greater honor and profit.

That it should be so is scarcely to be wondered at. The Oberförster, with almost independent control of a range of some 10,000 acres, and, what is of first importance to him, with an exclusive right to the excellent shooting which it usually offers, lives a healthy, active life, about equally divided between the woods, his office and his friends. His pay, which may reach 6,400 marks, including a consolidated allowance for horses and the incidentals of his office work, is ridiculously low from our standpoint, but entirely sufficient from his. Promotion means a change from the moderate activity of overseeing the planting and



felling of his forest, and the quiet of home life, to the constant activity of travel. The stimulus which ambition fails to give is supplied by the admirable *esprit de corps* which pervades the whole body of forest officers, and forms here, as elsewhere, the best security for the efficiency and healthy tone of the service.

Immediately subordinate to the members of the executive staff are the various grades of forest guards, upon whom the protection of the forest directly and exclusively rests. In general, each guard is in charge of one of the five beats into which the average range is divided. "The forester (I quote from the Service Instructions) must protect the beat entrusted to him against unlawful utilization, theft and injury, and see to it that the forest and game laws are observed. He is charged with the execution of the felling, planting and other forest work under the orders of the Oberförster, and he alone delivers all forest produce, on receipt of written instructions, to the persons qualified to receive it."

The training of the protective staff is provided for with a care which in any other land might be thought more suitable for officers of a higher grade, and a period of preparation only less long than that for Oberförster stands before the beginner.

But lest the necessity for so long a course of preparatory work should seem unduly to enhance the difficulties of forest management, it should be noted here that in countries whose grade of excellence in forest matters is closely second to that of Germany the schooling of forest officers is very considerably shorter. There will be occasion to refer to this matter further on.



Such is in outline the organization of the Prussian forest service. The principles upon which it rests are thus stated by Donner, now Oberlandforstmeister, in a work which carries all the weight of an official document.<sup>1</sup> He says:

"The fundamental rules for the management of State forests are these: First, to keep rigidly within the bounds of conservative treatment; and secondly, to attain, consistently with such treatment, the greatest output of most useful products in the shortest time."

And again:

"The State believes itself bound, in the administration of its forests, to keep in view the common good of the people, and that as well with respect to the lasting satisfaction of the demand for timber and other forest produce, as to the numerous other purposes which the forest serves. It holds fast the duty to treat the Government wood lands as a trust held for the nation as a whole, to the end that it may enjoy for the present the highest satisfaction of its needs for forest produce and the protection which the forest gives, and for all future time, at least an equal share of equal blessings."

The same authority elsewhere formulates the general status of the forest, as follows:

"The forest is a trust handed down from former times, whose value lies not only in its immediate production of wood, but also essentially in the benefit to agriculture of its immediate influence on climate, weather protection in various ways, the conservation of the soil, etc. The forest has significance not only for the present nor for its owner alone; it has significance as well for the future and for the whole of the people."

With respect to the second class of forest property, that belonging to towns, villages and other public bodies, it is again impossible to speak for the whole of Germany except upon the broadest lines. The State everywhere exercises oversight and a degree of control over the management of these forests, but the sphere of its action varies within very wide limits. Even within the individual states it does not remain

<sup>1</sup> *Die Forstliche Verhältnisse Preussens*, 2d ed., Berlin, 1883.



the same. Thus far, however, the action of the Government is alike not only throughout Prussia but in all parts of Germany. It prevents absolutely the treatment of any forest of this class under improvident or wasteful methods; nor does it allow any measure to be carried into effect which may deprive posterity of the enjoyment which it has a right to expect. How far the details vary may be gathered from the fact that while in the Prussian provinces of Rhineland and Westphalia the village communities appoint their own forest officers and manage their own forests, subject only to a tolerably close oversight on the part of the controlling staff, in the former Duchy of Nassau, now Prussian territory, their share in the management does not extend beyond the right to sell the timber cut under the direction of the Government Oberförster, the right and obligation to pay for all the planting and other improvements which may be deemed necessary, and the rather hollow privilege of expressing their opinion. But however galling so extensive an interference with the rights of property may appear, it is none the less unquestionably true that in France, as well as in Germany, the State management of communal forests lies at the root of the prosperity of a very large proportion of the peasant population, and the evils which have attended its withdrawal in individual cases are notorious. While on the one hand villages whose taxes are wholly paid by their forests are by no means rare, on the other the sale of communal forest property in certain parts of Germany in 1848 has been followed with deplorable regularity by the impoverishment of the villages which were unwise enough to allow it.



The relations of the State to the third class of forests, those belonging to private proprietors, are of a much less intimate nature. The basis of these relations is, however, the same. To quote again from Donner, "The duty of the State to sustain and further the well being of its citizens regarded as an imperishable whole, implies for the Government the right and the duty to subject the management of all forests to its inspection and control." This intervention is to be carried, however, "only so far as may be necessary to obviate the dangers which an unrestrained utilization of the forest by its owners threatens to excite, and the rights of property are to be respected to the utmost consistently with such a result." Prussia, of all the German countries, has respected these rights most highly, and the Government exerts practically no restraining influence except where the evident results of deforestation would be seriously dangerous. Here it may and does guard most jealously the wood lands, whose presence is a necessary safeguard against certain of the more destructive phenomena of nature, and which have been called in general protection forests. Of their many sided influence so much has been said and written of late in America—both truly and falsely—that no farther reference to the subject seems needful.

The State leaves open a way of escape for the private proprietor who finds himself unwilling to suffer such restriction of his rights for the public good, and shows itself willing to buy up areas not only of protection forest but also of less vitally important wood lands. On the other hand, it is ready, with a broadness of view which the zeal of forest authorities sometimes unfortunately excludes, to give up to pri-



vate ownership lands which, by reason of their soil and situation, will contribute better to the commonwealth under cultivation than as forest. In this way the forests whose preservation is most important are gradually passing into the hands of the State; yet the total area of its wood lands is increasing but slowly.

The policy of State aid in the afforestation of waste lands important through their situation on high ground or otherwise is fully recognized (a notable example exists upon the Hohe Venn near Aix-la-Chapelle), but the absence of considerable mountain chains has given to this branch of Government influence very much less prominence than in the Alps of Austria, Switzerland and France, where its advantages appear on a larger and more striking scale.

In closing this brief sketch of forest policy in Prussia, you will perhaps allow me to refer for a moment to the erroneous ideas of German forest management which have crept into our literature. They have done so, I believe, partly through a desire of the advocates of forestry to prove too much, and they injure the cause of forestry, because they tend to make forest management ridiculous in the eyes of our citizens. The idea has arisen that German methods are exaggeratedly artificial and complicated, and not unnaturally the inference has been made that forestry in itself is a thing for older and more densely populated countries, and that forest management is inapplicable and incapable of adaptation to the conditions under which we live. It is true, on the contrary, that the treatment of German forests is distinguished above all things by an elastic adaptability to circumstances, which is totally at variance with the iron-clad



formality which a superficial observation may believe it sees. It is equally true that its methods could not be transported unchanged into our forests without entailing discouragement and failure, just as our methods of lumbering would be disastrous there; but the principles which underlie not only German, but all rational forest management, are true all the world over. It was in accordance with them that the forests of British India were taken in hand and are now being successfully managed, but the methods into which the same principles have developed are as widely dissimilar as the countries in which they are being applied. So forest management in America must be worked out along lines which the conditions of our life will prescribe. It never can be a technical imitation of that of any other country, and a knowledge of forestry abroad will be useful and necessary rather as matter for comparison than as a guide to be blindly obeyed.

It must be suited not only to the peculiarities of our national character, but also to the climate, soil and timber of each locality, to the facilities for transportation, the relations of supply and demand, and the hundred other factors which go to make up the natural character of a hillside, a county, or a State. Its details cannot be laid down *ex cathedra*, but must spring from a thorough acquaintance with the theory of forestry, combined with exhaustive knowledge of local conditions. It will necessarily lose the formality and minuteness which it has acquired in countries of older and denser settlement, and will take on the character of largeness and efficiency, which has placed the methods of American lumbermen, in their own sphere, far beyond all competitors.



All forest management, as contrasted with our present hand-to-mouth system of lumbering, must mean the exchange of larger temporary profits for returns which are indeed smaller, but which, under favorable circumstances, will continue and increase indefinitely.

Under these conditions I do not believe that forest management in the United States will present even serious technical difficulties. It only asks the opportunity to prove itself sound, practical and altogether good.

#### FRANCE.

In France, which stands with Germany at the head of the nations as regards thoroughness of forest policy, the large extent of government and other public forests is in excellent condition. The struggle for their care and preservation, the necessary antecedent of their present favorable situation, has a history which reaches back far beyond the time when the United States became a nation. Says M. Boppe, in the introduction of his *Traité de Sylviculture*:<sup>1</sup>

"In early times, during the Middle Ages, and until the beginning of modern times, the knowledge of the specialists was summed up in certain practices of lumbering put together in a way to satisfy needs which were purely local. The wood was cut methodically, but without much care as to the manner in which it would grow again; that was the business of Dame Nature. Speaking of France alone, it is known that towards the middle of the sixteenth century, in spite of the fact that lumbering was restricted by limited demand (since, in the absence of the more powerful means of transportation, the wood must be put in use almost where it was felled); in spite of the repeated intervention of royal authority, the lack of foresight and abuses of all sorts resulted in the notable

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<sup>1</sup> Paris, 1889.



impoverishment of our forest domain. It was then that a man of genius, Bernard de Palissy, called the carelessness of his times in respect to the forests 'not a mistake, but a calamity and a curse for France.'

"Henry IV made every effort to put an end to the destruction, but it was reserved for Louis XVI, or rather for his minister, Colbert, to reconstruct on a solid basis the foundation of forest ownership. The law of August, 1669, which is in itself a whole forest code, will remain a legislative monument from which we cannot too much draw our inspiration."

The history of forestry in France continued to be associated with illustrious men in more recent times, among whom Recamier, Duhamel and Buffon were the first to "define the first principles of a rational forest management, based on the knowledge which had been gained of vegetable physiology."

France differs from Germany in the unity of her forest law. The Forest Code,<sup>1</sup> which closed in 1827 the series of forest enactments since the time of Colbert, is still in force. Its provisions, altered but little by the political changes which have passed over them, are valid for the whole of France.

In accordance with them certain classes of forest property are to be administered directly by the State forest service, along the lines which it marks out. These are the woods and forests which formed part of the domain of the State, those of communes and sections of communes, those of corporations and public institutions, and finally those in which the State, the communes or the public institutions have joint rights of property with individuals.

The area of forest owned by the French government reaches a total of 2,657,944 acres, or about one-ninth of the whole wooded area, which itself covers 17 per cent. of the country. Considerably more than

<sup>1</sup>Consult *Code de la Legislation Forestiere*, per A. Puton, Paris, 1883.



half of the Government forests stand on hilly or mountainous land. The forest administration to which their care is entrusted is attached to the Department of Agriculture, and the Minister of Agriculture is president of the Forest Council. This body includes the Director of the Forests and three administrators, the first of whom is at the head of the Bureau for Legal Matters, Forest Instruction, Records and Acquisitions; the second of the Bureau of Working Plans and Utilization, and the third of that for Reforesting the Mountains, Public Works, Replanting and Clearing.

The personnel under the general direction of this council consists of 36 conservators, who are the higher inspecting and controlling officers; 225 inspectors, who are in administrative charge of divisions called *inspections*; 242 assistant inspectors, the executive officers, each of whom personally directs the work in his *cantonment*, and 328 officers of lower rank, called *gardes généraux*, whose work, in many cases similar to that of the grade above them, is difficult to define. Besides the 834 members of this superior branch of the service, there were in 1885 some 3,532 forest guards of various grades. It is safe to assume that the force of the protective staff has remained substantially the same.

The system of training for the service of the superior staff differs widely from that which we have seen in Germany. There is but one higher forest school, that at Nancy, in place of the numerous institutions of the Germans, and until very recently the whole course of preparation required of candidates for the government service consisted in the two years of study which it offered. At present entrance



to the forest school is open only to graduates of an agricultural institute in Paris, but this innovation had its rise rather in political than in educational grounds. The fact remains that the French forester, with a course of training only from a fourth to a third as long as that of his German colleague, has produced results whose admirable educational and intrinsic value stands unquestioned.

All French government forest officers must pass through the school, and the demands of the vast territory under their care are supplied by an annual list of graduates, which does not in general exceed ten or twelve.

Such facts make the task of national forest administration seem lighter as we look forward to the time when it must be begun.

There is a professional school at the *Domaine des Barres* for men of the higher grade of forest guards who have shown the ability and the ambition to rise to the lower rank of the superior staff. There were last year twelve students in attendance.

The management of the wood lands of communes and public institutions, which cover together an area of 4,715,124 acres, has been already shown to rest with the State forest service. These facts are made the subject of special provisions in the Forest Code, of which the following are the most important:

The communes, corporations and other public bodies may make no clearing in their forests without an express and special permit from the President.

Communal forests can never be divided among the inhabitants.

A quarter of the forests belonging to communes and other public bodies shall always be placed in



reserve when these communes or public bodies shall possess at least ten hectares (24.7 acres) of forest.

The choice of forest guards, made by the class of proprietors in question, must be approved by the Government forest service, which issues their commissions to the guards. These last stand in all respects on the same footing as the guards of the State forests.

The sale of wood is made under the direction of the State forest officers, and in the same way as for the State forests. The amount of wood needed for actual use by the members of the community is reserved at the time of sale, and the distribution is made among them with the family as the unit.

In return for a fixed tax all the operations of conservation and management in the woods of communes and public bodies are carried out by the members of the State forest service without further charge.

The object of the reserved quarter (*quart en réserve*) of the forests of communes and public institutions, mentioned above, is to provide for emergencies and special demands upon the treasury of their proprietors, such as damage by fire or flood, the building of a church, a school-house or a public fountain.

Except when silvicultural reasons may require it to be cut, such extraordinary necessities alone justify a draught on this simple kind of reserve fund.

The great majority of the forests owned by the class of proprietors just mentioned are managed under the system of "coppice under standards," a name which literally reproduces the French *taillis sous futaie*. This method of handling a forest implies an upper and a lower store of growth. The basis



of the treatment is a cutting over of the coppice shoots or sprouts which spring up from the old stumps at regular intervals of from fifteen to forty-five years. In order to make the return annual and fairly uniform it is only necessary to divide the whole forest, if it be small, or each of its units of management, if it be large, into as many compartments of equal productive power as there are years in the rotation of the coppice, and to cut over one such compartment each year.

At each cutting the best of the young seedlings which may have grown up among the coppice, or of the coppice shoots themselves if the seedlings are wanting, are left to grow on for two, three, four or even five rotations of the underwood. Being thus comparatively isolated these standards produce wood very rapidly, while, at the same time, their number is so restricted that they do not seriously interfere with the growth of the coppice by their shade. The disadvantages of the treatment are the large proportion of low-priced firewood which it yields, and the severe demands which it makes upon the soil. But this "national French treatment," as it has been called, has very many qualities which recommend it. It is the form of treatment which yields the highest per cent. of return on the capital invested, as well as the highest absolute volume of wood (if we except the high forest of coniferous trees). According to the forest statistics of 1878, the most recent source of information, the average yield of coppice under standards in France, under State management, was fifty-nine cubic feet of wood per acre per annum, about one-fourth of which was lumber and the rest fuel, hoop-poles. etc. A net annual return of 5 per



cent. may be set as the upper limit of production of this class of forest, and therefore far beyond that of other forms of treatment.

In 1878 the average net revenue of all the State forests was 32.00 francs per hectare per annum, or about \$2.50 per acre. The return on the capital which they represented was stated at  $2\frac{1}{2}$  per cent. As an illustration of the general financial situation of forestry in France, the budget of the forest service for 1891 may be cited. It provides for expenses in the round sum of fifteen and a half million of francs, and anticipates a gross revenue of twenty-five million. If we subtract the cost of re-foresting the mountains, managing the Algerian forests, which, as yet, cost more than twice as much as they bring in, and similar items which are not directly connected with the current expenses of forest management, we reach a total of ten million francs in round numbers. Subtracting similarly the Algerian income we find that the net revenue is expected to reach the sum of fourteen million francs. Forest management on this basis is very far removed from sentimentalism and the philanthropic forest protection whose watchword is "Hands off."

The provisions of the code concerning private wood lands are substantially as follows:

No private owner may root up or clear his wood lands without having made a declaration of his intention at least four months in advance. The forest service may forbid this clearing in case of the maintenance of the forest is deemed necessary upon any of the following grounds:

1. To maintain the soil upon mountains or slopes.



2. To defend the soil against erosion and flooding by rivers, streams or torrents.

3. To insure the existence of springs and water-courses.

4. To protect the dunes and seashore against the erosion of the sea and the encroachment of moving sands.

5. For purposes of military defense.

6. For the public health.

A proprietor who has cleared his forest without permission is subject to a heavy fine, and may be forced in addition to replant the area which he has cleared.

The area of forest in France has certainly passed its lowest point. The following figures, compiled in 1889, will serve to illustrate this statement:

No government forests have been sold since 1870, while their area since 1872 has been increased by 190,462 acres. Private owners have been allowed to clear an area amounting to 960,849 acres since 1828, or 10,225 within the last five years, while the clearing of communal forests since 1855 and 1885, respectively, has been 24,826 acres and 598 acres. It should be added that an unknown quantity of land has been cleared without leave, and that on the other hand private owners have been in the habit of getting permits to clear their land as a means of enhancing its selling value and then leaving it still under forest.

Perhaps the most brilliant work of the French foresters has been accomplished in the correction of the torrents in the Alps, Pyrenees and Cevennes, in the course of which over 350,000 acres have been rewooded under difficulties which seem almost insurmountable. Its picturesque character, its thorough



success and the sharpness of the moral which it serves to point have rightly made this branch of forestry in France a favorite subject for writers and speakers on forest reform. There is, then, the less need to do more than add that of the total cost to the French government, some 50,000,000 of francs, about one-half was consumed in engineering works whose direct object was to make the replanting of the drainage areas of torrents possible. "The forest thus restored to its natural place is alone able," says M. Demontzey, the eminent French authority, "to maintain the good, but precarious, results of the works of correction in the water-ways themselves." The disappearance of this forest in the first place may be traced in most cases directly to mountain pasturage, and the whole story of *reboisement* in France is full of the deepest interest in comparison with the present state and probable future of our mountain forests.

The planting of the dunes and the Landes, the first of which especially was an achievement of which any nation might well be proud, remain to be mentioned, but the information available to the writer at the moment is neither recent nor complete, and these matters must be left untouched in the present paper.

#### SWITZERLAND.

I pass now to Switzerland, a country where the development as well as the actual condition of forest policy may well claim our attention. The history of forestry in the Swiss republic is of peculiar interest to the people of the United States, because in its beginnings may be traced many of the characteristics of the situation here and now, and because the Swiss,



like the Americans, were confronted by the problem of a concrete forest policy extending over the various states of a common union. The problem has been brilliantly solved, and not the least result of its solution is the fact that the people of Switzerland have recognized the vast significance of the forests in so mountainous a country, and a full and hearty appreciation and support of the forest policy of the Confederation fills every nook and corner of the land.

The history of the forest movement in Switzerland has not yet been fully written, but you will allow me to quote from an unpublished sketch of it by Professor Landolt, who, more than any other man, has contributed to make that history of which he writes. As an example set by a republic to a republic, as the brilliant result of the work of a few devoted men, crowned by a public opinion which they created, and rewarded by the great and lasting blessing which they have brought to their country, I believe that the advocates of forest reform in America can set before themselves no better model and take encouragement from no worthier source.

"Soon after the middle of the last century," begins Professor Landolt, "certain intelligent, public spirited men of Zurich and the canton of Bern (which then included Waadt and a great part of Aargau), turned their attention to the situation of agriculture and forestry in Aargau. Their object was to gain a knowledge of the conditions involved and their surroundings, and to remove the most pressing evils.

"In the years between 1780 and 1790 the cantons, following the lead of Bern, succeeded in appointing forest officers, whose first task was to become conversant with the actual management of the State and large communal forests, and to make suggestions for their future treatment. Partly at this time, partly earlier, a large proportion of the State and a few communal forests were surveyed and a few of them were marked off into compartments on the ground, a measure of vital importance to conservative management.



"The appointment of State forest officers is to be regarded as the beginning of regular forest management. Great numbers of forest regulations bearing on the most various subjects—tree planting among others—had been promulgated in former centuries. They had been often renewed, but without forest officers they could not be enforced.

"Forest regulations were now made by Bern, Zurich, and for the Jura by the bishop of Basel, who also had appointed forest officers.

"The treatment of the State and of a few of the larger communal forests made very satisfactory progress until 1798. Then came the revolution, and with it war and times of great disturbance and political excitement. It is true that even then forestry was never wholly neglected; but the progress made, where it existed at all, was of very minor importance. But as times grew quieter and the condition of the government more orderly, the interest in forest matters revived; the cantons Neuenburg, Freiburg, Solothurn and Aargau passed forest laws of more or less comprehensive scope, appointed forest officers, and in general sought to promote the cause of forestry.

"Until about 1830 forestry in the less mountainous parts of Switzerland developed slowly, but still in a satisfactory manner. New laws appeared, the number of forest officers increased, the wood lands of communes and public institutions attracted more attention, and the future reforestation of the country became gradually the centre of greater effort. In public forests other than those of the State, progress was in general slow, although a considerable number of forest surveys were carried out.

"The mountain forests, however, with few exceptions, were in complete disorder. But the following years brought new life not only into politics, but also into national economies and the status of the forest, which last was materially improved by the floods which spread in 1834 over the greater part of the Alps. The damage which they caused was so severe that the philanthropic and scientific societies set themselves the task of searching out the cause of inundations, which became more frequent as time went on. They concluded that it was to be found largely in the improvident destruction of the mountain forests. To the fear of a wood famine, which had hitherto been the chief incentive to the advancement of forestry, there was now added another, which, if not wholly new, still had been formerly little insisted on. It was the influence of forests on rainfall and the phenomena of nature in general. The societies did not fail to direct attention to this question, and with excellent result. The less mountainous cantons with imperfect legislation made new laws or amended and completed the old ones, saw to the appointment of



foresters, and took the organization of the felling, planting and care of their timber seriously in hand. But the chief gain lay in the fact that the mountain cantons applied themselves to the work. St. Gallen, Luzern and Freiburg had already begun, and now went vigorously forward. Graubunden, Tessin and Wallis passed forest laws and appointed forest officers, partly at once, partly later; but still the progress made was slow. The cities everywhere made important contributions toward a better system by the introduction of a wiser treatment and by the appointment of foresters of their own, and so set a good example to the cantons and private forest proprietors. Those cantons of the plains also which had formerly given scant attention to their communal forests, as was here and there the case, now supervised and managed them better.

"Taken as a whole, Forestry has made satisfactory progress as regards legislation, the improvement of forest management and the increased number of forest officers, from the beginning of the 40's on. In 1865 the Swiss Forest School was established (as a fifth department of the Polytechnicum at Zurich), and provision was thus made," says Prof. Landolt, "for a forest staff of our own, educated with special reference to our own conditions.

"The Swiss Forestry Association was founded in 1843. Through frequent agitation, and by setting forth what action was necessary, it has rendered great service to the cause of forest protection. It has moved successfully, among other things, for the foundation of a forest school, the examination of the higher mountain forests, the passage of a new forest law, and the correction of the torrents.

"In 1854," continues Prof. Landolt, "I called the attention of the Association to the investigation of the mountain forests. In 1855 I was entrusted with the preparation of a memorial to the Federal Assembly, which was approved and presented in the following year. In 1858 the Federal Assembly appointed a commission of three men with authority to study and report upon the Swiss Alps and the Jura in regard to geology, forestry and police regulations, bearing on water supply. From the appearance of the final report of this commission in 1861, the improvement of Swiss forestry has been kept steadily before the Confederation. In 1875 a federal forest inspector was appointed, and a year later the first Swiss forest law was passed. This law does not extend to the whole of Switzerland, but only to the Alps and the steeper foot-hills. More recently attempts have been made by the cantonal government and the Forestry Association to extend its influence to the Jura or to the whole of Switzerland, but the need of such action is not yet clearly apparent."



The passage of the federal forest law was followed almost everywhere immediately by the appointment of trained forest officers, and all the cantons whose forest legislation was defective amended or completed it. At the same time federal and cantonal regulations bearing on watercourses were being revised.

"Our forest laws," Prof. Landolt goes on, "are intended to work more through instruction, good example and encouragement than by severe regulations. This method is somewhat slower than one which should involve more drastic measures, but the results achieved are the more useful and lasting. When forest proprietors do something because they are convinced of its utility, it is done well and with an eye to the future; but what they do under compulsion is done carelessly and neglected at the first opportunity. What they have come to learn in this way, and have recognized as good, will be carried out, and that better and better from year to year.

"All our laws require the same treatment for the forests of the State, the communes and public institutions. Still, progress in the treatment of State forests and those of the larger communes is more rapid than in those of corporations and the smaller villages. In the first more money is available, the forest officers are better trained, and there is a more intelligent grasp of the situation. But still the condition of the smaller forests is now satisfactory.

"The oversight of private forests is less strict. Their owners may not reduce the area of their wood lands without the consent of the cantonal government, must plant up the land cut over which is without natural growth, and are bound to take proper care of the growing stock, but they are not held to a conservative management.

"The regulations which bear upon the protection of wood lands, and the harmful external influences to which they are exposed, are equally binding upon them; but in return they enjoy the protection which the law provides for the forest.

"In protection forests, on the other hand, the timber that may be cut by private owners is marked by government officers, so that reckless lumbering may be prevented. The regulations which look to the formation of new protection forests must also be conformed to by private proprietors, or they must allow themselves to be expropriated. In these matters the Confederation and the cantons work in unison. The consent of the Federal Assembly is necessary to the clearing of private land in protection forests."



The Federal forest law, of which Prof. Landolt writes, is binding over nearly two-thirds of all Switzerland. Its chief provisions are the following:

The supervision of the Confederation is exercised, within the forest area over which it has special jurisdiction, upon all protection forests, and furthermore upon all State, communal and corporation wood lands, even when they do not fall under that head.

The cantons must appoint and pay the number of suitably educated foresters necessary for the execution and fulfillment of the forest law.

All forests which fall under Federal supervision must be demarcated on the ground within five years from the passage of the law.

The burdening of the wood lands with new prescriptive rights of certain kinds is forbidden.

The State, communal and corporation forests are to be surveyed, their management regulated, and working plans for them must be drawn up.

The federal machinery for the enforcement of this law is contained in the office of the Inspector-General of Forests, whose sphere of action extends over all the wood lands in question. Each canton has its own forest organization,. The Federal Forest School, of which Prof. Landolt was founder, and in which he still teaches the forest sciences, remains in Zurich.

After what has been said it need hardly be added that the forests of Switzerland are for the most part in admirable condition. Systematic forest management has probably been known there as long as anywhere in Europe, and nowhere can finer individual examples be found. I have seen nothing, even in Germany, which seemed to me to be so workmanlike as the management of the Sihlwald, a forest belong-



ing to the city of Zurich; and I am the bolder in my opinion because the Sihlwald has been called the most instructive forest of Europe by one who is perhaps the most experienced forester of the present day. It may not be out of place to quote certain details of its history and management from a paper of the writer's which appeared in *Garden and Forest* in July and August, 1890.

The ownership of the city of Zurich in its forest is of very old date. Evidences of the care which the burghers bestowed upon it are found in a series of ordinances which, beginning in 1309 with a rule that no forester might cut wood in the Sihlwald—clear proof that a forest police existed at that early date—continued in unbroken succession to that of 1417, under which the foundation of the present organization was laid, and finally, in 1697, reached the first technical working plan. It is curious to note, as an evidence of the view of the nature of its interest held by the city, that the policy of adding to the public forest property by purchase, recently inaugurated by the Legislature of the State of New York, was begun by the free city of Zurich nearly two centuries before the discovery of America.

“In the organization of a normally stocked forest the object of first importance is the cutting each year of an amount of timber equal to the total annual increase over the whole area, and no more. It is further desirable in any long settled community that the forests be so managed as to yield a measurably constant return in material. Otherwise difficulties in the supply of labor and the disposal of the produce make themselves felt, and the value of the forest to its owner tends to decrease.

“In order to attain this steadiness of yield it is obviously necessary that a certain number of trees become fit to cut each year. The Sihlwald has accordingly been so “regulated” that areas of equal productive capacity are covered by stocks of every age, from



last year's seedling to the mature tree. These age-gradations succeed each other in a series so regular that in an hour's walk one may pass from the area just cut over through a forest of steadily increasing age to the trees which have reached the limit of the rotation of ninety years. Three such units of management are present in the Sihlwald, but . . . it will be necessary to speak of only one of them. The working plan for the Lower Sihlwald, then, prescribes for the forest which it controls the operations of what Dr. Schlich has called in his *Manual of Forestry* 'The Shelter-wood Compartment System.' It may not be without interest to follow the life history of a compartment in which this system is carried out.

"After the mature trees had been felled and removed from the area which furnished the yield of the Lower Sihlwald last year the thick crop of seedlings which had grown up under their shelter was finally exposed to the full influence of the light and air. The felling and rough shaping of the timber, the piling of logs and cordwood and the trampling of the men had combined with the crisis of exposure to destroy the new crop in places and create a few small blanks. Here, as soon as the disappearance of the snow had made it possible, groups of the kinds of seedlings necessary to preserve the mixture or destined to increase the proportion of the more valuable species were planted. The operation, necessarily an expensive one, is justified by the greater resistance of a mixed forest to nearly all the calamities which may befall standing timber. Simultaneously with the planting the willows, hazels and other worthless species were destroyed, as well as the 'pre-existing seedlings,' whose larger growth, according to the disputed theory held at the Sihlwald, would damage their younger neighbors more by their shade than their greater volume would increase the final yield of timber. The incipient forest, then, practically uniform in age and size and broken by no blanks which the growth of a year or two will not conceal, is fairly started on the course of healthy development which it is to continue undisturbed until it reaches the age of fifteen years.

"At this point occurs the first of a series of thinnings (or more exactly, 'clearing' at first and thinning later), which follow each other at intervals of seven or eight years, until the trees have entered the last third of their existence. There is, perhaps, no silvicultural question more in dispute than this of the time and degree of thinning which will yield the best results in quality and quantity of timber. The method pursued at the Sihlwald, consecrated by habit and success, gives ample space for the healthy development of the crown from a very early age without admitting



light enough through the leaf-canopy to sustain an undergrowth until the trees are nearly ready to give place to their descendants. Such shrubs or seedlings as still appear, thanks to a shade-bearing temperament, are systematically cut out. It may be strongly doubted whether such a policy might safely be applied on soil less moist than that of the Sihlwald; but here, at least, the trees reach the age of sixty years, tall, straight, clean-boled, and in condition to make the best of the last part of the period of maximum growth, which a large number of measurements have shown to occur in general between the ages of seventy and ninety years. A heavy thinning now comes to the assistance of the best specimens of growth, and they are left to profit by it until seven years before the date fixed for their fall. Then begin the regeneration cuttings, whose object is to admit through the leaf-canopy an amount of light, varying with the temperament of each species, whose mission is to give vitality to the seedlings which the trees, stimulated themselves by their more favorable situation, now begin to produce in considerable quantities. To this end the light which falls from above has a powerful auxiliary in that which the system of felling each year in a long, narrow strip admits from the side, and so admirable is this double method that the time which elapses between the beginning and the end of a regeneration is but half the average for less favored localities. This applies only to the deciduous trees. The time required by the conifers is much longer, and the incomplete regeneration which they furnish is supplemented by planting in the blanks already mentioned. But for the self-sown seedlings of both classes the amount of light is gradually increased, the trees which sheltered them are at length wholly removed, and the cycle of growth repeats itself.

“With an average stand of timber of 2,800 cubic feet per acre, the annual yield of wood, almost half of which is from thinnings alone, reached last year 377,023 cubic feet, an amount which may be taken as slightly above the average.

“Under the management of Forstmeister Meister the 2,400 acres of the Sihlwald gave last year (1889) a net return of something over \$8 per acre, or a total contribution to the treasury of the city of about \$20,000. This sum, large as it is in relation to the area of forest which produced it, promises to be materially increased.

“But with the climate of northern Europe indicated by a mean temperature of forty-eight degrees Fahrenheit, and with the conditions of soil and moisture which it enjoys, the exceptional productiveness of the Sihlwald would still remain partly unexplained were it not possible to add that the land which it covers has been uninterruptedly under forest for something over a thousand years. That



precious condition of the surface which the French and Germans unite in describing as 'forest-soil,' so slow in forming and so quick to disappear wherever the full sunlight is allowed to reach the ground, has here been produced in perfection by centuries of forest growth. It is perhaps to this factor, next to the abundance of humidity, that the high annual yield of wood in the Sihlwald is due."

It has been remarked already that there are reasons which give the study of forestry in Switzerland peculiar value—a value which, in the opinion of the writer, far surpasses that of the more refined German forest organization. For the fundamental difference of political training in the German and Swiss forester works itself out in the character of forest management with perfect clearness. "The first," says Forstmeister Meister, one of the most eminent of Swiss or of European forest officers, in summing up the matter to the writer, "has always before his eyes a forest organization regulated down to the minutest detail. It is with this organization that he is to deal as best he may. The Swiss (or the republican) standpoint, on the other hand, requires the forester to reach the best result which is possible at the moment by an intelligent application of the general principles of forestry through the medium of forest organization, "which is imperfect and incomplete." It seems hardly necessary to point out along which of these lines the work of the American forester must be shaped, or from which point of view he must approach it. It is an admirable training to become thoroughly at home in the details of the most complete forest organization, but it is a far more practically useful thing in the United States to be able to do without it.



## AUSTRALIA.

Before touching on the matter of forest management in certain of the English colonies, it is of interest to note the relations of timber import and export throughout the British Empire. These are given by Dr. Schlich<sup>1</sup> for the average of the five years from 1884-88 as follows:

Imports—United Kingdom.....	£15,000,000
British Colonies.....	1,466,000
Total.....	£16,466,000
Exports—Dominion of Canada .. . . .	£ 4,025,000
Other Colonies.....	713,000
Total—.....	4,738,000

Excess of imports over exports £11,728,000, or \$56,800,000.

It should be noted that this table is not quite complete, but it will answer all the purposes of illustration, and the light which it throws on the general timber supply of the world is exceedingly interesting, even if it be not alarming.

Forest legislation in Australia is still in a transition state. It has already had time to correct some of its earlier mistakes, and the course which it is following will certainly lead to a satisfactory forest policy in the end.

In the colony of South Australia an act was passed in 1873 dealing, as such preliminary legislation generally has dealt in recent times, with the encouragement of tree planting. A forest board was established in 1875 and a conservator of forests in 1877; and in 1882 "The Woods and Forest Act" became

<sup>1</sup>Lecture before the Royal Colonial Institute on March 11, 1890. My information on the forest policy of the Australian colonies is derived from the same source.



law. It entrusts the charge of all forest estates to the Commissioner of Forest Lands, and gives him power to grant licenses and make regulations for cutting timber, bark, or other forest produce, and he may levy fees upon stock pasturing in forest reserves. It provides also that all forest reserves heretofore declared such shall remain so, and empowers the governor to add to their area; makes provision for encouraging tree-planting, and for the leasing of forest lands under certain conditions. The appointment of conservators is authorized, and the issuance of regulations for the management of the forest, the disposal of the timber, and the prevention of fires. The financial result of this policy during the thirteen years ending with 1889 was a net surplus of over \$40,000.

In the colony of New South Wales the forest law dates from 1884, and makes provisions which are partially similar in character to those of the act just mentioned. In accordance with them an area of five and a-half million acres had been declared State forests and timber reserves in 1887.

Victoria, the smallest of the Australian colonies, is perhaps the most interesting from the forester's point of view. From certain reports made to the Secretary of State for the colonies it appears that in the year 1875 Victoria was suffering from a condition of affairs strongly suggestive of our own at present. "The amount of timber is diminishing owing to clearings for settlement, ordinary home consumption and bush (i. e. forest fires). . . . As early as 1866 attention was called . . . to the wastefulness and improvidence of the prevailing system."



Only the prime parts of trees were utilized. Immense numbers of standing trees were killed, owing to the practice of stripping from them large sheets of bark to cover, perhaps, a mere temporary hut. The committee called attention to the growing scarcity of timber for props for mining purposes and the necessity of measures to secure a permanent supply.

"In 1876 an act was passed, called the State Forest Act, which provided, first, for the appointment of local forest boards, which were to have the care of reserves and other Crown lands; secondly, for the appointment of foresters by local forest boards; and thirdly, for the promulgation by the Governor in Council of regulations prescribing the duties of these boards. In 1884 this act was superseded by a new one, which deals with the formation of State forests and timber reserves and their management, and with the management and disposal of timber and other forest produce not included in the State forests and timber reserves.

"The forests generally are worked under the license system, regulated by rules made under the act. There are licenses for felling, splitting, clearing undergrowth, the erection of saw-mills, grazing, the removal of bark, etc."

Unfortunately, this law, which has much to recommend it, has not resulted as well as was hoped, and the reasons for its failure have been defined as follows:

"The immediate causes of this failure are the bad license system, the ill-arranged classification of State forests, timber reserves and Crown lands, the absence of professional foresters to direct operations, and the neglect to reserve the best natural forests."

Dr. Schlich has formulated the requirements of the situation, as follows: First, the engagement of a thoroughly competent forest expert to be the head of the Victorian Forest Department; secondly, the selection, demarcation and legal formation of a sufficient area of reserved State forest, suitably distributed over the country, systematically managed, and efficiently protected; thirdly, the protection and disposal of forest



produce on Crown lands not included in the reserved State forests.

#### INDIA.

Perhaps the closest analogy to our own conditions in the magnitude of the area to be treated, the difficulties presented by the character of the country and the prevalence of fire, and the nature of the opposition which it encountered, is to be found in the forest administration of India, and that in spite of the tropical climate with which it has to deal. The history of the movement is comparatively fresh, and the fact that many problems remain as yet unsolved will scarcely detract from the interest and sympathy with which we may be led to regard it.

Systematic forest management was begun in India about thirty-five years ago, under difficulties not unlike those which confront us now. An insufficient or a wrong conception of the interests involved, the personal bias of lumbermen, the alternating support and opposition of the men in power, were the chief obstacles with which it had to contend; and against them were pitted the splendid perseverance and magnificent administrative powers of one man. The victory was brilliant, conclusive and lasting, and India has to thank Sir Dietrich Brandis for benefits whose value will go on increasing from age to age.

It is extremely interesting, in view of the beginning of State forest management, which must eventually and ought at once be made in the United States, to note that its success in India, in its early stages, was very largely due to the fact that it furnished a net revenue from the very start.



It is also instructive to recall that a large share of the prosperity of Rangoon, whose merchants protested in 1856 that to restrict the teak lumbering was to destroy the growth of their city, is due to-day to the steady business in this very timber which a conservative forest policy has secured.

"History has proved," says Dr. Schlich,<sup>1</sup> "that the preservation of an appropriate percentage of the area as forests cannot be left to private enterprise in India, so that forest conservancy in that country has for some time past been regarded as a duty of the State.

"Of the total area of government forests, which may perhaps amount to some 70,000,000 of acres, 55,000,000 have been brought under the control of the Forest Department. Of this area 33,000,000 are so-called reserved State forests, that is to say, areas which, under the existing forest law, have been set aside as permanent forest estates, while the remaining 23,000,000 are either protected or so-called unclassified State forests. These areas together comprise about 11 per cent. of the total area of the provinces in which they are situated. Rather more than half the area, or about 6 per cent., are strictly preserved and systematically managed forests."

The formation of these reserved State forests was the first step in systematic forest management, and it was carried out along lines which are typical. The forest areas were first selected, following standards which cannot be enumerated here, then surveyed and demarcated on the ground, and finally established as reserved State forests by an act which provided, first, for the presentation within a certain time of all claims against the State forests as demarcated; secondly, for their hearing and definite settlement; thirdly, that no prescriptive rights could accrue in reserved State forests after their declaration as such under the act; and fourthly, for the special treatment of forest offences.

These forests have been gradually brought under simple but systematic methods of management, which

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<sup>1</sup>*Manual of Forestry*, Vol. 1, London, 1889.



aim at effective protection, an efficient system of regeneration, and cheap transportation, the whole under well-considered and methodical working plans.

The forest staff charged with carrying these plans into effect draws its controlling officers from England.

Until quite recently it had been the custom to send the young men selected for the Indian forest service to be educated on the continent of Europe, at first in France and Germany, but more lately altogether at the French school in Nancy. The arrangement was not satisfactory, however, and in 1885 the school at Cooper's Hill, near Windsor, was established as part of the Royal Indian Engineering College. It is an institution whose excellence is directly due to the admirable management of Dr. Schlich, formerly Inspector-General of Forests in India, and now its principal professor of forestry. The course, which in its general features resembles that of other forest schools of similar excellence, has recently been enlarged to cover three years, and includes as its final work an excursion of three months in the forests of the continent of Europe under the guidance of Sir Dietrich Brandis. The writer was fortunate enough to accompany the English students during the last one of these excursions, and can testify to its admirable educational value.

For the executive and protective work it is necessary to employ natives, since they alone are equal to the physical labor in so warm a climate. Their technical education is provided for by the Indian forest school, at Dehra Dun, in connection with which is the Dehra Dun State forest. Quite recently its first working plan has been completed for this forest, and while the management of no one forest can be taken



as a type of Indian forestry, it may not be without interest to sketch briefly its chief points. Each of the six ranges which the forest contains is divided into twenty compartments, or, in the Indian terminology, coupes, among which the fellings follow a regular sequence, so that each coupe is cut over once in twenty years. The period of work in each coupe really embraces three years, so that different stages of the operations are going on in three of them at the same time. During the first year the tropical creepers which interfere with the lumbering are cut through, and the trees which are to be taken out are selected, marked with the government hammer and girdled. The trees selected are sal (*shorea robusta*) which are unsound, or which would not improve during the next twenty years, trees of inferior species which will still furnish timber, and trees of other inferior kinds which are injuring by their shade the young sal seedlings. The timber trees which have been marked are sold by auction to a contractor, the unit of sale being the square mile, and are removed during the second year. In the third year the less valuable and the injured trees are cut out, hauled to the roads and sold as firewood. This method of lumbering has rightly been called "improvement felling," since their object is to raise the general condition of the forest rather than to draw from it a large annual revenue at present. For minor forest produce a system of sale by tickets is in force, it is said, with admirable result.

The difficulty of coping with forest fires in India would be notably greater than in the United States were it not for the greater density of the Indian population. The method consists in cutting fire paths



through the forest of a width varying up to four hundred feet, removing all combustible matter from them, except the larger trees, and patrolling them through the medium of a regular fire organization. All holders of prescriptive rights are bound to assist in the event of fire. At Dehra Dun, for instance, a force of five hundred men is available, and a fire is never allowed to burn for more than a couple of days. Smoking in the forest is strictly forbidden, and the building of fires by camping parties and others is very severely regulated.

The results of this thorough and far-sighted forest policy are conspicuous not only in the great fact that the forests yield, and will permanently yield, the supply of timber and forest produce which the population requires, but also in the beginning which has been made toward regulating the water supply in the mountains, and in the increasing capital value and annual net revenue of the State forests.

"So far," says Dr. Schlich,<sup>1</sup> "the government has good reason to be satisfied with the financial results of its forest administration. The net revenue, after meeting all expenses of the department, has been as follows since 1864, the year in which the department was first established as a general State department:

1864 to 1867.	Average annual net revenue....	£106,615
1867 to 1872.	" " "	.... 133,929
1872 to 1877.	" " "	.... 212,919
1877 to 1882.	" " "	.... 243,792
1882 to 1887.	" " "	.... 384,752

"There is little doubt, if any, that 25 years hence the net surplus will be four times the present amount if the government of India perseveres in its forest policy as developed in the past. Indeed it would not be going too far to say that the increasing forest revenue bids fair to become a substantial off-set against the expected loss of the opium revenue."

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<sup>1</sup> Loc. cit.



There are two other facts resulting from the foreign policy of India which are of special significance to us as citizens of a country where any interference by the government with private rights would be so vigorously resented, and where private enterprise must consequently play so conspicuous a part. First, a body of efficient and experienced officers of all grades has gradually been formed in the State forests whose services are available for the management of private forests, and of communal forests when the time shall come to form them. Secondly, the example set by the well managed State forests and the steadily increasing revenue which they yield, has induced native and other forest proprietors to imitate the State.

The trained foresters, without whom so laudable a purpose must fail, are at hand, and the whole situation argues most favorably for the future prosperity of the country.

#### SOUTH AFRICA.

The organization of the Forest Service at the Cape of Good Hope is of comparatively recent date. It consists of one superintendent, three conservators, four assistant conservators, and the necessary staff of forest guards. Practically nothing had been done in the eastern half of the colony when Mr. Hutchins, the present conservator in charge of the Eastern conservancy, was called from India to the Cape. The method which he followed and its results are of interest both from the principles which they embody and from the success of his wise and energetic effort for the protection of the forest in the face of



popular and legislative neglect. The system of indiscriminate depredation which is so familiar to us in the United States was in full vogue when he arrived. His first work was to survey the boundary lines of the forest. He then succeeded in getting a bill through the Colonial Parliament, claims against the government forest area as he had surveyed it were heard and decided, and the lines of the State reserve were definitely fixed. He was now ready to regulate the management, which was accomplished on the following basis: The whole area, 150 square miles, was divided into a number of units called series (from a French forest term), and each series was again cut up into forty coupes, in one of which the cutting is localized each year. The system may be called, from a partial translation of its French name, "localized selection." It is a modification of what Dr. Schlich has called "the shelter-wood selection system." The beat of a guard is coextensive with a series, and within this area the felling passes over the same ground once in forty years. The faults of the present selection system are that the per cent. of the valuable timber trees is rapidly diminishing in a country where fire-wood is not saleable, and that it exposes the forest unduly to the attacks of fire, its chief enemy there as here. For these reasons the present treatment is to be gradually converted into regular high forest.

The volume and character of the trees marked to fall in each year are entered in a book, and from it the purchases are made. The buyer presents his felling license to the guard of the coupe in question, and cuts and removes the timber himself.



Excellent results are said to have followed a system of temporary permits to "forest cultivators," who are allowed to take up a certain area of land at the edge of the forest for agricultural purposes. In return, they are responsible for the police of the forest in their vicinity, and any unreported depredations mean to them the loss of their permit. Very often their contract demands the planting of a certain area with oak in lieu of a cash payment of rent.

The English oak and American cottonwood and the *Eucalyptus globulus* are extensively planted throughout the Cape and South Africa generally.

#### OTHER COUNTRIES.

It has been impossible more than to glance at the chief points of forest policy, in a few of the many lands which teem with interest in this respect. I would gladly have called attention to Austria, where an excellent forest service upholds the general principles which we have seen exemplified elsewhere, and to Italy, where the sale of government forests, forced on the State by the pressure of financial necessity, is beginning to bear evil fruit. A circle of lands around the Mediterranean might have been cited to instance the calamitous results of deforestation, and from some of them still further proof might have been adduced to show at what a cost such errors must be repaired. But the countries which have distanced us on the road toward a rational forest policy might better have claimed our attention.

Without passing out of the limits of Europe, it would have been worth while to glance at Sweden, whose government has recognized its obligations as



a forest proprietor, and to Russia, which has recently turned its attention to forest matters, and has passed a law (in 1888), of which the following are the more notable features: Clearing is forbidden in protection forests, and is only permitted in others when its effects "will not be to disturb the suitable relations which should exist between forest and agricultural lands." In standing timber all working which tends "to exhaust the standing crop, prevent the natural regeneration of the forest, and change the areas cut over into wastes" are forbidden. The government prepares working plans of protection forests without cost to their owners, and together with areas which have been replanted, these forests are free from taxes. Finally, private owners are forced to replant areas cut over which are without natural regrowth, and on their failure to do so, the work is carried out by the government foresters at their expense. All this in a country which has still 36 per cent. of wood land left.

Nor is it European nations and white colonists alone who have shown a far more intelligent comprehension of the significance of the forest than the United States. Japan has done so most conspicuously. To quote from Heinrich Semler:

"Japan,<sup>1</sup> whose total area includes in round numbers 94,900,000 acres, possesses forests of 28,700,000 acres in extent. This people furnishes a shining example in the matter of forestry. Even the old feudal lords were penetrated with the value of the wood lands, as they showed by the enactment of vigorous protective laws. When in the recent civil war the government of the Mikado destroyed the feudal system, it declared the forests, as far as they had belonged to the feudal lords, to be the property of the State, and promulgated a forest law which was valid for the whole kingdom. Accordingly the forests of Japan are about equally divided between

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<sup>1</sup>Semler, *Tropische und Nordamerikanische Waldwirtschaft und Holzkunde*. Berlin, 1888.



the State and private owners. The former manages its wood lands through a forest service with headquarters at Tokio, where is also the forest school. Founded within the last ten years, the school has an average attendance of about 150, and has quite recently been under the charge of Dr. Mayr, whose work on *The Forests of North America* has made his name familiar to the advocates of forestry in the United States. Only a part of the pupils expect to enter the government service.

"The forest service does not rest satisfied with the present proportion of wood land, but busies itself actively with planting, in connection with which the introduction of foreign species has been attempted.

"There is a notable export of wood from Japan to China, and, on the other hand, an import from North America to Japan; which last, however, the Japanese soon expect to be able to do without."

Dr. Schlich's statement of the destructive tendencies of private forest ownership in India might with equal truth have been made as a general proposition. It is the salient fact which the history of the forests of the earth seems to teach; but nowhere have the proofs of its truth taken such gigantic proportions as in the United States to-day. We are surrounded by the calamitous results of the course that we are now pursuing. In fact, it seems as though there were almost no civilized or semi-civilized country in either hemisphere which cannot stand to us as an example or a warning. To this great truth they bear witness with united voice: The care of the forests is the duty of the nation.



The Present Condition  
OF THE  
Forests on the Public Lands.

BY  
EDWARD A. BOWERS.



# The Forest Condition of the Public Lands



## The Present Condition of the Forests on the Public Lands.

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BY EDWARD A. BOWERS,  
Secretary of the American Forestry Association,  
(Formerly Inspector of the Public Land Service.)

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I shall try to outline what the legal and physical condition of this great and necessary element of our national wealth is at the present time, touching only incidentally upon remedies, as you will hear another upon that subject.

The American Forestry Association must recognize at the outset that little improvement need be expected either in the legal protection or the physical condition of the public forests until there is a radical change in the theory held with respect to public forest lands and a complete revision of existing laws relating to them. On the contrary, we must expect, year by year, to see these forests steadily destroyed and injured to such an extent that their renewal and preservation will become less possible, even with our best efforts, and it may be that over large sections no forest covering can be made to take the place of that which is now being destroyed.

I shall take as my text, therefore, this: *The laws provide neither an adequate method for the protection of the public timber, nor for its disposition in those regions where its proper use is imperative.*



First, what are our existing laws; second, what are the general characteristics of the timber region to which these laws apply; and, third, what is their effect upon the forests?

The foundation of our protective system rests upon an act passed March 1, 1817, which authorized the Secretary of the Navy to reserve lands producing live-oak and red cedar "for the sole purpose of supplying timber for the navy of the United States," and, an extension of this law, made by the passage of the act of March 2, 1831, which provided that if any person should cut live-oak or red cedar trees, or *other timber* from the lands of the United States, for any other purpose than the construction of the navy, such person shall pay a fine not less than triple the value of the timber cut, and be imprisoned for a period not exceeding twelve months. Upon this old law, having the construction of a wooden navy in view, the government of the United States has to-day chiefly to rely in protecting its timber throughout the arid regions of the West, where *none* of the naval timber, which the law had in contemplation, is to be found. Can it be wondered that this act does not meet present conditions?

By the act of June 3, 1878 (20 Stats., 88), timber can be taken from public lands, not subject to entry under any existing laws except for mineral entry, by *bona fide* residents of the Rocky Mountain States and Territories and the two Dakotas. The Land Office regulations in reference to this act provide that such timber cannot be exported, that none less than eight inches in diameter may be cut, and that in cutting the timber must not be wantonly wasted or destroyed.

The timber and stone act, passed the same date,



applies only to the Pacific States and Nevada. Under this act land chiefly valuable for timber and unfit for cultivation if the timber is removed, can be purchased for \$2.50 per acre under certain restrictions.

The act of June 15, 1880, permitted timber trespassers to purchase the land on which they had committed their depredations, at the usual price, but as that applies only to trespasses committed prior to March 1, 1879, it is of little importance now.

By the act of March 3, 1875, all land grant and right-of-way railroads are authorized to take timber from the public lands adjacent to their lines, for *construction* purposes only; in addition to which the Denver and Rio Grande railroad has the right to cut also for repairs.

The various appropriation bills, authorizing the employment of special timber agents, by implication recognize their authority to protect the public timber.

The settlement laws, under which a settler may enter lands valuable for timber as well as for agriculture, furnish another means of obtaining title to public timber. None of our timber-bearing lands should be subject to such entry, for reasons that will appear later in this address.

With the exception of the timber culture act, designed to stimulate the planting of small areas of trees upon the treeless plains, the above is the only legislation of consequence affecting the public timber lands, or aiming to promote or preserve forests. In no other way than under some one of the above laws can a citizen of the United States use the public timber.

Of the results of the timber culture act it may be well to point out that of the 38,000,000 acres of



public lands entered under it, less than 1,000,000 acres have been patented to the entry-men for compliance with the law. That is, not over 50,000 acres have been successfully covered with young tree plantations.

Before considering the effect of these laws, it may lead to a better comprehension of the subject to outline the general location, character and condition of the public timber lands.

Of all those magnificent forests that covered the fertile lands of the middle West and surrounded the Great Lakes, which were originally the property of the government, almost none belong to it now. For this priceless forest treasure the government received nothing, the land alone being regarded as valuable. These forests were attacked with fire and axe, as obstacles to civilization to be disposed of as rapidly as possible, and the government did not interpose the slightest objection to prevent this destruction.

Here and there in the Southern States there are still considerable timber areas belonging to the United States, but these are relatively unimportant, both in extent and for climatic and other reasons. At present the forest bearing lands of the United States are situated either high up on the sides of the great mountain chains that form the back-bone of the continent, or along the slopes of the northern half of our Pacific Coast. These forests are generally remote from settlement, but are becoming less so every year, as the tide of population sweeps over the west and absorbs vast quantities of the more desirable portions of the public domain.

In their natural conditions these regions differ widely. The central mountain region is arid, con-



taining unknown quantities of mineral wealth, with an inferior quality of forest for lumbering, but absolutely necessary for use locally in the absence of better timber. Owing to the general aridity of this region these forests are invaluable as a cover to the mountains from which the water supply is drawn for the extensive irrigation that now exists on the lower lands. These forests are in much greater danger from fire than are those on the Pacific Slope, where the enormous rainfall protects, and has protected during the centuries of their growth, those wonderful forests. In the Rockies the removal of the forest by cutting or by fire means its destruction in very many cases, as there is not sufficient moisture in the soil and air to induce reforestation by natural methods. On the contrary, along the Pacific Slope, a renewal of the forest cover may be reasonably expected. Thus we see that where our public forests are most needed, both for the actual forest product as well as for climatic and agricultural reasons, they are most likely to be destroyed and most difficult to renew.

The great rainfall of our northwestern Pacific Coast is well known, and the unrivalled timber growing there is world-renowned.

A single tree of the immense fir and cedar varieties in that region is often worth a hundred to a hundred and fifty dollars, and many tracts of a square mile are estimated to contain 100,000,000 feet board measure, worth, in the form of lumber, a million and a half of dollars. The United States must still own many hundreds of square miles, worth for the timber alone \$20,000 per square mile. Yet the government sells this land for \$2.50 an acre, or at \$1,600 per



square mile. These lands contain little mineral wealth, but are in some cases valuable for agriculture.

One of the most serious obstacles to be overcome in the arid region is fire. It has been stated that more timber is annually burned in the Rocky Mountain region, where every tree is precious, than is used in five years. I have been told, over and over, by men familiar with the region, that it is useless to try to prevent forest fires there. With this I do not agree. To be sure, the population through those regions is sparse, and cannot be collected so readily to extinguish a forest fire as in more settled localities, but this also is an element of protection, in that there are fewer people to fire the forests. In many places the Rocky Mountains are cleft by steep rocky gorges, which in themselves would form fire-breaks, and a series of safety-lanes could be cut through the mountains, separating the timber into comparatively small bodies, so that the fire in one body could not reach that in any adjacent one. The timber thus cut out to form the safety-lanes might not unreasonably be expected to pay all the costs of carrying out this plan. The lumbermen, of course, in stealing timber, take only the best, and leave large quantities of brush and the poorer portions of the tree to furnish food for the first fire which comes along. The Indians still practice their ancient custom of firing the forests to drive out the game on their hunting expeditions. Before the days of the mill-men, these annual or frequent burnings apparently did not produce serious conflagrations in the forest area; but now, by this combination of wasteful millman and hunting Indian, fires rage every year through large tracts of timber in the



Rocky Mountains, and it is no one's business or interest to prevent and stop these conflagrations when once started.

I recollect one August being in the vicinity of the Bighorn Mountains of Northern Wyoming for several weeks, and as I first approached them nothing could be seen at a great distance but a vast cloud of smoke. During the whole period of my stay there this cloud of smoke hung over the mountains, gradually working its way northward, and thus marking the movement of the fire. No one of the many settlers or inhabitants of the towns in the vicinity of these mountains paid the slightest attention to this fire which was destroying millions of property, and changing the future condition of their water supply, on which the whole region depended for irrigation. Apparently it was a matter of such common occurrence that they took no interest in it.

Then there is no more effective way of concealing the cutting of the better portion of a forest than by firing what is left after the timber depredator has carried off his material.

In 1887 I made as careful an estimate of the loss by fire in the destruction of public timber as the insufficient data obtainable permitted, and placed the annual loss to the government at \$8,000,000, in the value of wood-material destroyed. This made no account of the secondary and resultant loss from the destruction of the forest protection by floods, drouth, the ruin of the soil and young forest growth, which, though very great, is immeasurable.

Large areas of the finest pine lands have been disposed of by the government in Minnesota and elsewhere, under the settlement laws. There was no



other way by which the timber could be acquired, and so lumbermen hired hundreds of choppers who, in addition to their regular work, were required to enter a tract of 160 acres under the pre-emption or homestead laws, and after a nominal compliance with the law, to deed the land to their employers. After stripping the timber from the land it was abandoned, and over great areas once located for homes one can pass now without finding an occupant, the dead trees and barren stumps or an occasional cabin alone attesting the former occupancy of man. Settlements upon timber lands are rarely made in good faith—that is, to establish a home—because the public lands upon which timber is now growing are almost entirely unfit for agriculture, and the system puts a premium upon perjury and wastefulness. For what desire has such a settler to husband the resources of his land? He wants to cut and sell the best portions of his timber, and be off before his fraud is discovered. Or if he sells, the lumberman who buys pays an entirely inadequate price, so that neither the government nor the settler gets the benefit. This great profit goes into the pockets of the wealthy lumberman, who can afford to waste the poorer portions of the timber, as he has paid a price much below the real value of the timber. If he had to pay the approximate value of the timber, this waste would be materially reduced, and the forest thus far preserved. Even when the land is valuable for agriculture, the pioneer who settles upon it to make a home is eager to remove as soon as possible the forest which for him only cumbered the ground. He wastes thoughtlessly the products of centuries, and rejoices in the fall of every



forest monarch. Occasionally it happens that after he has profusely supplied his own needs, he can sell the surplus to some lumberman, and thus prevent its complete waste.

For all of these reasons no timber bearing lands, now the property of the United States, should be subject to entry under settlement laws.

Let us now consider how the laws which I have previously mentioned operate. Under the act of June 3, 1878, applying to Colorado and the Territories, settlers and others were permitted to cut timber for mining and agricultural purposes from *mineral* land. Before cutting timber for local use the settler can hardly be expected to sink a shaft or hire a chemist to determine whether the land is in fact mineral or not. He cuts where most convenient for him, without knowing what the character of the land is, and takes the chance of being prosecuted. Not one acre in thousands throughout the region to which this act applies is known to contain minerals, but it is the only act under which timber may be taken by settlers and miners in this great region. Consequently this whole population is forced to steal one of the necessities of life. The community has become demoralized with reference to this question. The paramount and absolute necessity to obtain timber for use overrides all considerations of right. To the miner and settler of that region the use of timber from local supplies is as absolutely necessary as the use of the water that flows by him, or of the air that surrounds him, and no plan of management which fails to recognize this necessity can ever hope to be successful. In reference to this the Commissioner of



the General Land Office, in his last annual report, says:

"It is useless to enact laws to prohibit the use of an article of absolute necessity, upon a judicious use of which the growth and prosperity of our country largely depend. If the exportation of timber and the destruction of trees and undergrowth upon the mountain slopes can be prevented, and other public timber left free and open to all subject to proper restriction, there will, in my opinion, be far less destruction and waste than is now going on through unlawful appropriation and forest fires.

"The laws now in force are discriminating and unjust. Under them the owner of a mine in Arizona, from which he may be receiving an income of \$100 a day, can procure all of the timber necessary in developing and operating said mine from the public mineral lands without cost, except for the felling and removing, while the owner of a farm in Minnesota, upon whose labors we are depending for our daily bread, cannot procure a stick of timber from any public land 'with intent to use or employ the same in any manner whatsoever'—not even to build a fire with which to keep the warmth of life in his body if he be freezing—without violating the law.

"The necessity for a general law to remedy this evil cannot be too strongly urged upon Congress."

The settler, after taking a piece of government land in the vicinity of the mountains, finds immediate use for timber for the construction of his buildings and fences, and he naturally helps himself to whatever he desires. The prospector and miner and the great mining companies have the right to cut timber growing on the mineral lands about them; the railroad supplies itself from the adjacent timber, and the settler can hardly be blamed for doing the same. Oftentimes, as a community of settlers becomes sufficiently large to support it, a small saw-mill springs into being, and the wants of this little community are supplied by the local mill, drawing its timber from the government land without any authority whatever. Both of these classes, the settler



and the local mill man, are then criminals under the law, and are also liable in a civil action for damages. The special agents employed by the General Land Office to protect the public domain from timber depredations are supposed to collect such testimony as is necessary to sustain a prosecution, and to superintend this prosecution in behalf of the government, the government being represented by the United States district attorneys. Do I need to tell you that before a local jury such prosecutions almost invariably fail.

The sympathies of the entire community are always with these depredators of the public timber, and quite often the jurors themselves have been freely using such timber. Indeed it is a matter of the greatest difficulty to induce a grand jury to indict persons who have confessedly been cutting government timber for years to supply their saw-mills, the product of which is used quite likely by the very members of the grand jury. In the rare cases where a verdict for damages is rendered for the government it will be for merely nominal damages.

"In nearly every public land State and Territory, poor hard-working laboring men, who have been compelled to cut timber to procure the means of a bare subsistence for themselves and families, have been arrested, convicted, fined and imprisoned for cutting and removing timber from vacant, unappropriated and unreserved non-mineral public land in violation of section 2461, U. S. Revised Statutes."

"It is true that in some localities the sympathies of the people are so strong and in other localities the timber is an article of such public necessity, that it is impossible to convict a man for violation of said section, even if caught in the very act and the proof is overwhelming; so that to some minds the retention of that law upon our statutes is deemed quite immaterial." (Commissioner's Report, G. L. O., 1890.)



As conclusive of the futility of the present system, I need only to tell you that during the seven years from 1881 to 1887, inclusive, the value of the timber reported stolen from the government land was \$36,719,935, and the amount recovered was \$478,073.

The cost of this service for the special agents alone was \$455,000. To this expense must be added all of the costs of the trial, such as the District Attorney's and witnesses' fees.

In the Annual Report of 1890, the Commissioner of the General Land Office says:

"A careful examination has been recently made of the annual reports of this office, covering the years from July 1st, 1881, to June 30th, 1889, inclusive, for the purpose of ascertaining what has been accomplished during that time, through legal proceedings, in the way of enforcing the laws for the protection of public timber. The result of that examination is conclusive upon two points:

"First. That the most valuable timber on the public lands is being rapidly exhausted.

"Second. That the several laws relating to public timber now in force are utterly inadequate to properly protect either the public forests from unlawful appropriation or the interests of the settlers engaged in developing the country, to whom the use, to a certain extent, of public timber is essential."

During the past year, in the protection of public timber, fifty-five timber agents were employed, whose services were of such irregular and brief periods as to equal only the employment of twenty-nine agents for one year. These special agents reported 310 cases of timber trespass, involving public timber and its products valued at something over \$3,000,000. The government recovered only, from settlements of suits, through legal proceedings and by sales of timber and lumber, \$100,940.32. On July 1st, 1890, there were 282 civil suits pending for the recovery of approximately \$14,800,000, for timber reported to have been



unlawfully cut from the public land, and 306 criminal prosecutions for violation of the timber laws were also pending. The effect of this system has been to place almost the entire population in opposition to the government in its efforts to protect the public timber, and it is all the more difficult now to gain their coöperation. It will be necessary to educate the people up to the belief that this legislation for the protection of public timber is for their benefit, and for their children's, that it is to preserve their country, and to prevent its becoming an arid waste. To attempt a harsh and stringent punishment of unintentional offenders will be to arouse the hostility of all the inhabitants, and probably lead to acts of revenge in firing the forests that would do incalculable harm.

The railroads have cut timber right and left to meet their requirements, and many of them under their charter rights had such privileges in the matter of cutting timber for the construction of the line that it is difficult to determine whether their cutting has been lawfully or unlawfully done. Along those lines of road which had alternate sections of government land granted them, where these lands are unsurveyed, it is, of course, impossible to say whether the land on which the railroad employés are cutting is a section granted to the railroad or a section reserved by the government. The Supreme Court has held that these grants of land are grants *in present*; and that the title to lands so granted vests at once in the railroad upon its fulfilling the conditions of the grant—that is, when it is constructed. That these lands are unsurveyed is not the fault of the railroads—they could not survey them, in any event—consequently the government cannot complain if they



continue their cutting in unsurveyed regions. For this reason a large amount of cutting is done at the present time, which may or may not be legal; it is impossible to say.

One of the difficulties in effecting the conviction of timber thieves is the difficulty of placing the responsibility upon the right man. Oftentimes a band of irresponsible foreigners, who scarcely speak the language, will go into the mountains to cut ties for a railroad, for which the railroad is to pay when delivered at certain points on its line. The ties are cut and perhaps are in condition to be floated down to the railroad. Information comes to some government timber agent of this cutting, and he goes to the scene of it. Upon his arrival he finds that the men who cut it are mere employés, and that the responsible parties have decamped, in anticipation of his presence. There are no written contracts, and it is not possible to show the connection between the cutting and the railroad. The railroad has not yet received or paid for the ties. All the agent can do is to seize them, which he does, to find that his only customer is the same railroad that is really responsible for the cutting, and the chances are that he gets a much less price for them than the men who cut them had contracted for, so that his action inures to the benefit of the railroad that ought to be punished. The poor tie-cutters, who have been hard at work in the woods, perhaps for weeks, are the sufferers, losing all their wages; oftentimes without knowing that they had not a perfect right to cut the timber which they were engaged to do by the agent of the railroad. It is manifest from what has been said before, that no



local jury would convict these men criminally, or bring a verdict against them for damages.

That this condition of affairs is not the fault of the General Land Office, which has charge of the public timber lands, is evident from the fact that ever since 1879 the Public Land Commissioners and the Secretaries of the Interior have, in annual report after annual report, called attention to their impotence in the matter of protecting government timber, and asked Congress repeatedly for such legislation as would remove this stain upon their administration. Notwithstanding these earnest appeals Congress fails to take any action. The annual appropriation for protective service has been hardly sufficient to keep an average of twenty-five timber agents in the field, and they were supposed to cover and protect 70,000,000 acres of public timber lands. These figures show the utter absurdity of the prevailing system. The officers in charge of the work seemed to have despaired of accomplishing any really beneficial results, and so these places have come to be regarded as political spoils to be distributed among faithful party workers, who, in accepting them, do so with the idea that they are to have a sinecure. The character of the men appointed in this way you can readily imagine. I have seen men sent from cities to superintend the protection of the public forests who probably had never before seen a forest, who were totally unfamiliar with methods of lumbering or estimating the damage done by the cutting of an area of timber, who were not lawyers, and who had no ability whatever to collect testimony on which the district attorney could successfully prosecute.



Many of the honest timber agents find themselves unfit for the work, but have not the frankness to admit it, or the wisdom to resign. Of the dishonest ones, of whom there are too many, I need only say that their position offers them many chances for blackmail, to which the mill-men will submit rather than undergo the cost and anxiety of prosecutions, although they may feel that the prosecutions will be fruitless. A mill-man complained to me on one occasion, that he had no objection to there being a timber agent in the country, as he had found it a cheap way of securing protection, but that recently there had been so many changes made in timber agents that he began to find it too expensive.

The call for some legislation by which timber can be honestly cut from the public lands and paid for is earnest among the mill-men supplying the local demands for lumber in the arid region.

On the Pacific Coast the conditions are entirely different. There the timber is cut principally for export, and not for local use. Unquestionably the finest body of timber anywhere now existing in the United States lies between the Coast Range and the Pacific Ocean, and there milling is pursued on such a large scale that the comparatively small methods of the Rocky Mountain region would not meet their requirements. So, in 1878, what is known as the timber and stone act was passed. By means of this any citizen of the United States, or head of a family, can take up 160 acres of timber land, and by paying \$2.50 for it obtain title to the land. There was some attempt in the act to limit its operations by requiring that the would-be purchaser should make affidavit that the land was entered exclusively for his own use and



benefit, and by not allowing any association of individuals to enter more than 160 acres, nor could any member of such association make an individual entry. But under this act a very large percentage of the entries made have been made by laborers in the employ of mill companies for those companies, and in one case which came under my observation it was the practice of a lumber company to hire the entire crew of any vessel which might happen to touch at any port to enter pieces of timber land and deed them to the company at once, the company paying all expenses and giving the entryman \$50 for his trouble. By such methods have our unequalled red-wood forests been absorbed by foreign and resident capitalists.

From this statement of the condition of the public timber lands of the United States but one conclusion can be drawn; that is, a new departure in the management by the government of its forest property *is imperative*. The time now seems ripe for the introduction of some intelligent policy in the management of our public timber lands. Some of the very men who have been the devastators of our finest forests begin to see the folly of their course, and fear that soon there will be no material for the lumber trade. They are ready and willing to pay the government a reasonable price for timber which can be properly sold, and aver that some system by which they can cut under authority of law is a necessity, being desirous of doing away with the subterfuges of the past. The more intelligent pioneers of the arid regions realize that the regular flow of the streams throughout the whole season, furnishing the water for irrigation through the summer drouth,



is changing into torrents of a few weeks' duration in the spring, which carry destruction by their flood and wash away the more fertile soils, and then subside and disappear when most needed. When settlers, lumbermen and miners alike call out for reform, what opposition need we expect? What is to be overcome but the *vis inertiae* that stands in the way of all reform? One or two cannot accomplish the result which we all desire. Of one thing be assured, only by constant agitation can there be effected a more thorough appreciation by the people of the whole country of the perilous condition of our forests and what their destruction means to our national prosperity. From this alone will remedial legislation spring.



Practicability  
OF AN  
American Forest Administration.  
BY  
B. E. FERNOW.



# American Forest Administration

by G. B. Wood



## Practicability of an American Forest Administration.

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BY B. E. FERNOW,

Chief of Forestry Division, Department of Agriculture, Washington, D. C.

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The title of the paper assigned to me should have been made, by preference, to read: "The difficulties attending the introduction of forest management in the United States," for the negative elements in the problem are still so numerous as to make a positive result, at first sight, at least, doubtful.

If we can understand the reasons for the absence of forest management in the United States, we shall at once understand some of the difficulties retarding its introduction and be able to weigh the possibilities of overcoming them.

In Europe, thanks to a certain feudal conservative system, large forest areas were preserved, more or less intact, in strong, controlling hands, until the territory was gradually covered by a dense, stable population which necessitated conservative utilization of all resources and careful adjustment of private and communal interests.

In this country, on the other hand, a small but energetic and progressive population took possession of and spread itself over an immense territory, boundless in resources, with no check, borne by historical and economic development, which would



restrict expansive and favor intensive management of resources.

As is natural under such conditions, individualism has developed itself in proportion to opportunities for its expansion—individual interests and rights are considered foremost, while, with a more or less unstable population, communal interests are but imperfectly recognized and considered, and communal spirit hardly awakened because less necessary.

It is relative density of population, then, which accounts largely for the many differences, social and economical, between the Old and New Worlds, and most certainly for the difference in the use of all resources, the forest resource included.

Private interest in natural resources is concentrated upon present gain, and where this gain can be secured by utilizing only the best of the natural growth, then abandoning the old and opening up a new field, the incentive to management of the resource for continuity is absent.

We may then say that in the United States the absence of forest management from considerations of private interest is due to the fact that there is still a large area of virgin timber left, which can be worked advantageously for present gain by simply utilizing the best natural growth without the necessity of economical management.

That this state of affairs may change in a few decades is no consideration for the present workers of the resource. Their interest lies only in the immediate present, while forest management means curtailment of present revenue for the sake of continued future returns or benefits.



There are some localities in the United States, and some conditions where even now forest management from private considerations is practicable, *i. e.*, profitable, namely, such as are situated with reference to the markets favorably enough to be able, in spite of the increased cost of management, to compete with the virgin supplies shipped from more distant resources, and where density of population permits a fuller profitable utilization of inferior material.

For instance in the Adirondack region, with large, compact holdings, tolerably well stocked and easily made accessible to market, it could be shown that increased profits would result from rational forest management.

Some minor difficulties which would have to be overcome in introducing private forest management, among which the momentum of habit is perhaps the greatest, I may not discuss here.

While, then, the introduction of private forest management, which is based upon considerations of profit, depends almost entirely upon the progress of general development, which we cannot control, there are communal interests involved in the management of certain parts, at least, of the forest areas which make it necessary to weigh considerations of present as against future and continued advantages; to weigh direct value as against indirect value, of the forest resources.

It has been shown, over and over again, that one incontrovertible influence of forest cover exists, namely, upon the regularity of water-flow and soil conditions of mountainous territory; that, therefore, in such territory utilization of existing forest resources must be carried on in such a manner that the



forest cover be not interrupted and be reproduced as part of it is removed, if we regard the interests which are dependent upon the existence of the forest cover.

Under such conditions it is quite evident that the community must step in to guard against a destruction of the forest cover. This can be done either by controlling private owners in the use of their property or by placing such areas under a government administration.

The first method is not only unsatisfactory and distasteful, but as it means reduction of private gain, unjust; and, hence, except in special cases, the object would be only partially attained.

We are then driven to consider the second alternative, namely, communal ownership and administration of such areas, which alone insures permanency.

In such an administration the primary consideration, it stands to reason, is not the direct profitableness of the management, but the most economical attainment of the object for which the administration was undertaken, namely, to insure a continuous forest cover.

The consideration of the practicability of such forest management then may be confined to a discussion of the administrative features and the possibility of securing the object in view, while yet satisfying other demands upon the forest cover.

There are, in every State in the Union almost, forest areas which an intelligent communal policy would place under communal administration; but there is, perhaps, no part of the country more in need of immediate government action than those



western mountain States in which the larger part is still in the hands of the United States Government.

What the present conditions of this government property are has been fully explained by Mr. Bowers, who speaks from intimate knowledge, and may be found more detailed in various reports of the Departments of the Interior and of Agriculture.

Considered merely as a piece of property, without more than ordinary value, the manner in which it is needlessly wasted without benefit to any one, would stamp its present administration as the most impractical of which thinking man is capable, if "practical" means that which can be done with good reason and to some useful end, that which a practical man would do with his property. It is inconceivable how any management could be more puerile, more devoid of good sense, more absolutely in defiance of all reason and demands of statesmanship, than the present management of the public timber lands.

For not only is this property not protected against theft and fire, but by incongruous, shortsighted and unjust regulations, these two destructive agencies are especially invited and the resident population is forced to resort to theft and fraud in order to supply their present wants, at the same time endangering their future needs and interests.

Any practical and practicable administration of these lands must keep in view not only the peculiar natural condition of these forests, but also the peculiar social conditions of the communities adjoining them. The problem to be solved by such an administration is, while insuring protection against fire and illegitimate use, to provide for the satisfaction



of the legitimate wants of different classes of population in the simplest manner without impairing the continuity of forest cover and of reforestation.

In the Fiftieth Congress a bill (H. R. 6045) was introduced, which proposed and outlined in full detail the working of a forest administration for the United States Government timber lands. To see whether and how far such an administration is practicable, it might be best to scrutinize the provisions of this bill. These are briefly as follows:

1. The temporary withdrawal of all timbered land from private entry, and the reservation, after examination, of the areas which are not agriculturally useful, and which ought to be kept in forest growth.

2. The districting of the reserved area and the organization of a force for its administration, which comprises—

- (a) A central directive office consisting of a commissioner and four assistant commissioners, in either the Department of the Interior or of Agriculture.

- (b) As many local resident managers or inspectors as there are districts.

- (c) A force of guards or rangers to protect the property against fire and theft, and to supervise the cutting of timber.

3. Regulations under which wood supplies are to be obtained, under licenses, which take due regard of the different needs of the resident population.

4. Such penal provisions as will make the execution of the administration effective. These will have to be altered to suit the new conditions, due to the creation of new States, by which the United States have lost the right of penal legislation on most of this territory.



The objections made against such legislation may be divided into those which flow from private interest, and those which concern themselves with the principles involved and the practicability of the proposed plan.

The first class of objectors we may dismiss by merely mentioning them; they are those who carry on a nefarious trade without legal status, which would be stopped by a proper surveillance. Unfortunately their cries "that the rights of the pioneers would be curtailed and the development of the country impeded by such a system as that proposed, and that nothing practical could be done to preserve the forest areas," are sufficiently boisterous to influence legislators against change of existing conditions; and while we may neglect them in this discussion, they are an important factor not to be underrated when the passage of such legislation is attempted.

All fair-minded citizens of the West will be found of one opinion, namely, that existing conditions are not desirable and ought to be remedied.

The first objection, based upon principle, comes from the believers in unrestricted individualism. They object to the holding of the land by the government. They contend that such timber lands are in better hands, and will be taken care of more easily and efficiently by private holders, and should be disposed of to them. While this position may be correct as regards other classes of lands and under stable conditions of society, experience has proven it wrong under our conditions, and especially with timber lands.



It is well known that agriculture is carried on in the United States without system or regard to continued fertility in those parts of the country where a thin population permits easy territorial expansion of the individual; that is to say, the ground is worked for what it will yield in the natural state and then abandoned for new fields. But agricultural soils are easily recuperated, while impairing the forest cover on steep mountain sides, especially in such dry regions as we have in the West, which are not readily reforested by nature, imperils far-reaching interests forever, as Europeans have learned to their cost.

Furthermore, timber lands have been and are being disposed of to private individuals on the Pacific Coast, and the consequences are as disastrous and unsatisfactory as they have been elsewhere.

It is also well known that in all parts of the country where timber land and non-agricultural soil is sold to individuals it relapses to the State for non-payment of taxes; for with the valuable timber taken from the tracts the interest of the individual is gone in this kind of property.

But the interest which the community has in the forest cover, especially in mountain regions, is transcendent, for the protection of the forest cover is of importance to the continued welfare of the community, and hence the State, which is not only the representative of communal interests as against individual interests, but also of future interests as against present, can alone be trusted with the ownership of such lands.

The objection to government holding is good only as long as the government does not take proper care



of its holdings, as at present; but this is the very thing to be remedied by the proposed legislation.

It might still be asked what part of the community had best be intrusted with the care of these lands, whether it should be the county, the individual, State or the general government.

It may be argued that the community making up the county has necessarily the most interest in the preservation of favorable conditions and can best guard its own interests. Yet there are often conflicts of interests arising which can be better adjusted under State ownership, and before a well settled county administration exists State ownership would be preferable.

But even State ownership, while perhaps desirable at a certain stage of development would not be expedient now, and ownership by the general government for the present is preferable.

My reasons for this preference are:

First. The general government does own the lands, and the difficulties and complications attendant upon wholesale transfer of the property can as well be avoided. If such transfer were to be effected it would necessitate almost a revolutionary change of the existing land policy of the government, which at present seems neither necessary nor advisable.

Second. The States with a scanty population as yet, and with all parts of their economy still to build up, had better not burden themselves with this additional duty of forest conservation, except so far as they can aid it without cost to them.

Other political considerations, which need not be elaborated here, lead to the same conclusions; so that altogether the expediency of retaining the public



timber lands in the hands of the general government for the present is conceded by the unbiased students of the question, provided the general government will do what is necessary to preserve and keep in permanent forest condition this property.

If we agree that the administration of these lands is best left to the present owner of them, namely, the United States Government, the next question concerns practicable methods in their administration.

The first need is a proper classification of the remaining public lands, and the withdrawal from entry and permanent reservation of the forest lands.

The withdrawal of these lands might be done by gradual reservations of single parks, of which we have several—based, however, upon other considerations, than those of a rational forest policy—but if the withdrawal is deemed necessary at all it would be wiser to reserve all that is necessary and desirable to reserve at once, while still in the hands of the government and not entirely devastated.

The practical method of withdrawing the lands to be reserved is one of gradual exclusion, requiring those entering public lands for occupancy under homestead and other laws, to make affidavit to the effect that the lands so entered are chiefly valuable for agricultural pursuits, and not for the timber mainly. Meanwhile examination of all entries so made as well as of unentered sections, will gradually make known the character of the land and furnish a basis for the determination of the extent of the reserve. The final survey of these lands also can be made gradually and without much extra expense.



There is next to be provided:

1. Protection against fire over a large mountainous territory, with a scattered population, more difficult because of the coniferous growth and dry climate.

2. Means of supplying wood material for the various needs of the population in a legal manner and in such a way as not to destroy the forest cover.

3. Reforestation, if possible, by natural seeding and recuperation of the areas which have been despoiled so far.

Fire is the great bane of American forests. These conflagrations are due largely to bad habits and loose morals; hence it will not be possible to stop them altogether and at once. But it is practicable to reduce them in frequency and extent. This cannot, however, be done by paper legislation, but only by proper policing. For this it is necessary to divide the territory into districts of suitable sizes, differing according to local, social and topographical conditions; to have officers each in charge of one district and responsible for its protection; to have these officers clothed with sheriffs' power, and in every way capacitated to enforce regulations, apprehend and at once bring to court offenders, and shorten the processes of legal procedure in cases where *prima facie* evidence is at hand.

As we do not expect to have every thief prevented or caught, we cannot expect to have every fire prevented or incendiary apprehended.

But with a responsible guard for a given district, always on the alert, fires will be discovered early after they are started, and be confined, and put out.

To assist in confining fires, it is also proposed to burn over safety strips at the proper season, so that



any running fires will be checked and a chance given to fight the fires from these safety strips as a basis.

In regard to the methods of supplying wood material, it is to be kept in view that, in a country which is as yet partially settled and developed, requirements are of a different nature from those of the more densely populated Eastern States. This has been recognized by devising different classes of licenses under which timber supplies may be obtained, namely, one for the settler and one for the prospector, each to supply his immediate wants on a designated area upon payment of a small annual fee, and a further license to the local lumberman, who supplies the smaller communities, upon payment of additional acreage and stumpage fees.

To satisfy the requirements of the lumber business, a business which must exist in every developed community, special licenses are provided, to cover larger areas, with a longer time for cutting, with higher acreage and stumpage fees, and other necessary restrictions and regulations.

It may be stated in passing, that this system of selling stumpage and allowing the cutting by the purchaser, under control, is not the most desirable, and is one to be gradually changed as changing conditions permit, but it seems to be the only practicable one under present conditions.

The third object to be attained by the proposed administration, namely, natural reforestation, and continuity of forest cover, is the only one in which forestry as a science is involved.

To discuss what should or should not be done in this direction, would mean a discussion of the prin-



ciples upon which technical forest management is carried on. This would lead too far.

I can only say that this object is attained mainly by the manner in which the cutting is done, but it cannot be accomplished by following the simple popular direction to cut the ripe timber.

This is a matter which cannot be determined either by the legislator or the professor *ex cathedra*, a matter that requires a different answer for different conditions, which cannot be given from intuition, but must be evolved from experience. And since the cutting is to be done by licensees, who must be controlled in the manner of cutting, in order to insure proper reforestation, we see at once that here we have reached the real difficulty of the problem, namely, the difficulty of finding the men who combine with the needful organizing and administrative faculties sufficient knowledge of forestry matters to undertake the direction of a forest administration. *In fact, the whole difficulty is one of men, rather than of measures*, and, if it were expected to create all at once a fully developed forest administration, this difficulty would appear almost insurmountable.

Such expectations can rarely be realized in human affairs, and in the proposed forest administration we will also have to be satisfied to find our way through mistakes and partial failure to improved methods, at least, in the technical part of the administration.

So little knowledge of forestry matters exists in this country that it will be utterly impossible to expect such from the many forest guards to be employed. Nor will it be possible to command district officers, with more than the teachings of woodcraft



from the lumber camp, yet capable of learning forestry principles. But the directive administration should command experts capable of preventing, from the start, misdirection in technical detail, and of evolving in time a suitable system of forest management, gradually educating the whole force to its teachings. Such expert advisers, if they cannot be found in this country, can be had abroad, and some will be found among us here by the time they are needed.

There is one other objection to the practicability of the proposed administration urged on the score, not of measures, but of men.

Here, again, we can discern between the real and the imagined difficulty.

To do efficient service—and none other is desirable—I estimate that for, say, 50,000,000 acres of government timber lands, from one to two thousand active, reliable guards, and 500 resident managers, all men of special capacity and sound judgment, are necessary. Can they be found? I believe that, if paid in proportion to the service rendered, and not, as is the rule with government service in general, expected to be satisfied with eking out their income by outside work and incidental favors, they can be found.

The imagined difficulty, and the objection raised upon it, comes from those who imagine the government as something outside and inimical to themselves, and every government officer a leech upon the public treasury, an obstacle between themselves and their individual happiness, an element of friction. For a self-governing American, such objection, while containing an element of truth, seems rather morbid



and puerile, and is really directed, not against a possible forest administration, but against existing methods of filling offices.

As long as offices are filled for political favors, held as temporary make-shifts, bringing neither honor, adequate pay nor assurance of continuity, this objection may not be without foundation, but it is hoped that the spirit of reform may have gathered strength enough to change conditions by the time this administration is to be organized.

To meet any objections against the practicability of such an administration on the score of expense, a rough consideration of this question, based, to be sure, on slender facts, may be in place: Allowing 50,000,000 acres of timber land reserved, I find that a tolerably efficient administration may be provided for a round \$2,500,000, or five cents per acre.

It would be satisfactory, of course, if only this expense be covered by the revenue. While the annual growth of wood per acre on the reserved area would exceed in value the assumed cost of administration, the consumption is restricted. But when we consider that the present saw-mill capacity of the region affected is over three billion feet B. M., and the resident population three million, requiring at least fifty cubic feet of wood material per capita, sufficient margin is assured even if only half of these amounts are furnished from the government timber lands.

While, then, from a business point of view a national forest administration is entirely practicable, from a governmental and legislative point of view such difficulties exist as withdraw themselves from the discussion of the uninitiated. Personal considerations and considerations of expediency offer such obstacles to



the enactment of thorough legislation as that proposed, that there is but little hope for it.

It takes a giant, or rather two giants combined, strengthened by the courage of conviction that this is an urgent matter to be acted upon, to carry through the flood of legislative streams any measure involving radical changes in the existing land policy. It is the tremendous momentum of bad habits, unfair usage, and personal politics, that must be overcome, to make a rational forest policy possible.



## APPENDIX.

### PROPOSED BILL

*For the Protection and Administration of Forests on the Public Domain.*

#### DESIGNATION OF FOREST LANDS.

SECTION 1. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That all lands now owned or controlled, or which may be hereafter owned or controlled by the United States, and which are now or shall hereafter be devoted to forest uses, are, for the purposes of this act, declared to be public forest lands.

#### WITHDRAWAL OF FOREST LANDS FROM ENTRY.

SEC. 2. That the unsurveyed public lands of the United States, embracing natural forests, or which are less valuable for agricultural than for forest purposes, and all public lands returned by the public surveys as timber lands, shall be, and the same are hereby, withdrawn from survey, sale, entry or disposal under existing laws, and shall be disposed of only as provided in this act, and as Congress may hereafter prescribe.

#### PREVENTING ENTRIES UPON FOREST LANDS.

SEC. 3. That every person applying to make an entry or filing of public lands under any law of the United States before the classification and survey of the public forest lands, as provided in this act, shall be made, shall file with his application an affidavit, under oath, corroborated by witnesses, stating that the land applied for is not exclusively or mainly forest land, is not situated near the headwaters of any stream, and is more valuable for agricultural or mining purposes than for the timber growing thereon, and each such applicant shall state particularly his means of information and his personal knowledge of the facts to which he testifies, and upon a certificate from the Commissioner of Forests constituted by this act the lands so entered may be disposed of under existing laws; and every person swearing falsely to any such affidavit shall be deemed



guilty of perjury and liable to the penalties thereof; and all illegal entries of timber lands shall be absolutely void, and, upon satisfactory proof, shall be subject to summary cancellation by the Commissioner of the General Land Office.

#### INSTITUTING A COMMISSIONER OF FORESTS.

SEC. 4. That there shall be in the Department of the Interior (or Agriculture) a Commissioner of Forests, who shall be appointed by the President, by and with the advice and consent of the Senate; and shall have the care, management and control of all the forest lands owned or controlled by the United States. He shall be a suitable person, versed in matters of forestry, and shall be entitled to a salary of five thousand dollars a year, with such allowances for assistance and expenses as will insure a proper execution of the provisions of this act, and as Congress may from year to year provide. Before entering upon his duties he shall give bonds with sureties to the Treasurer of the United States in the sum of fifty thousand dollars, conditioned to render a true and faithful account to the Treasurer, quarterly, of all moneys which shall be received or expended by him by virtue of the said office.

#### APPOINTMENT OF FOUR ASSISTANT COMMISSIONERS.

SEC. 5. That the President shall also appoint four Assistant Commissioners. The Assistant Commissioners shall act as a forestry board or council to the Commissioner of Forests in all matters pertaining to the administration of public forest lands, as provided for by this act, and each shall have special charge of one division of the forest reserves, which he shall personally inspect at least once every year. Each of the Assistant Commissioners shall receive a salary of three thousand dollars.

#### CLASSIFICATION OF FOREST LANDS.

SEC. 6. That the forest lands on the public domain shall be arranged in three general classes, namely: First, lands distant from the headwaters of important streams, covered by timber of commercial value, more valuable for forest purposes than for cultivation; second, lands partially or wholly covered by timber, but suitable for homesteads and more valuable for agricultural purposes than for timber; third, mountainous and other wood lands, which, for climatic, economic, or public reasons, should be held permanently as forest reserves.

#### ESTABLISHMENT OF FOREST RESERVES.

SEC. 7. That it shall be the duty of the Commissioner of Forests to examine and classify, with the advice and assistance of the



forestry board, the forests and public timber lands of the United States, and to determine, subject to the approval of the Secretary of the Interior, what portions of such forests and timber lands should be permanently retained in reservations for climatic or other economic or public reasons, and what portions may be disposed of without disadvantage to the public interests. He shall cause to be prepared connected maps or diagrams showing the approximate situation and areas of public timber lands in each State and Territory, and the President shall, by proclamation, designate the permanent forest reserves as the same shall be selected and approved as herein provided; and it shall be the duty of the Secretary of the Interior to cause exterior boundary lines thereof to be run and marked by durable monuments; and no further survey of any timber lands of the United States shall be made until the permanent reservations herein provided for are established.

#### RESTORING FOREST LANDS.

SEC. 8. That lands of the second class, when reported to the Secretary of the Interior by the Commissioner of Forests, shall be restored to homestead entry or sale; but a special appraised price of the timber thereon shall be paid by the person entering such lands in addition to the usual price and fees for the land, provided that the timber of five acres shall be allowed to the applicant free of further charge, on the payment of the settler's license fee of two dollars, as hereinafter set forth, and provided also that at least five acres of land shall be cleared and put into crops within one year from the time when a grant shall be made to the applicant, and that a habitable dwelling be erected thereon within one year.

#### DISPOSAL OF TIMBER.

SEC. 9. That the timber on the lands of the first and third classes shall be disposed of according to the regulations of this act as hereinafter provided.

#### DOMESTIC LICENSES.

SEC. 10. That the disposal of timber for domestic purposes shall be made by means of licenses as follows, namely: First, a prospector's license shall be granted to any applicant by the local (district) inspector upon the payment of two dollars. Such license shall confer the right to prospect for minerals upon land falling under the provisions of this act, and also the right to cut without waste and under the general regulations of the forestry board and the supervision of the rangers, timber for the first construction of shanties, prospecting shafts and other necessary structures,



from the territories nearest to the prospector's claim or claims. Such license shall be good only for the district in which it is taken out, and shall end at the expiration of one year from the time of its issue, or whenever, sooner than that, the claim is perfected or the prospecting is abandoned. Second, a settler's license shall be granted to any bona fide settler having no timber on his claim, by the local (district) inspector upon the payment of two dollars. Such license shall confer the right, for one year, to cut, for the licensee's own use only and for domestic purposes, timber, fuel and fence material, without waste and under the general regulations of the forestry board, upon an area of five acres, which the licensee may designate near his settlement. Third, a timber license shall be granted to any bona fide settler or mine operator or manufacturer, for the purpose of allowing him to supply himself or others with timber, fence material or fuel upon the payment of a license fee of five dollars and the further payment, before beginning to cut any timber, of a sum equal to one dollar for each and every acre embraced in his license, and, in addition, a stumpage of not less than one cent per stump, actual count, before the removal of the timber. Such license shall be granted for one year and shall confer the right to cut the timber on not less than forty nor more than eighty acres, the same to be selected by the applicant and the selection to be approved by the local officer.

SEC. 11. That all licenses provided for in section ten shall be in printed forms, and shall be issued, upon an order from the district inspector, by the receivers of public money upon the payment of the license fee. Licenses shall be numbered in succession, as applications for them are made, and priority of application shall determine the order in which they are granted. The district inspectors shall receive applications for license on certain days of each week, to be published and made known by them. They shall keep open books, in which shall be recorded in proper order applications for license and the action taken upon them, with the names and residence or post office address of the applicants. The inspectors shall also notify the rangers of each license granted in their ranges, and the rangers shall be required to aid licensees in locating their claims. No unused "settler's license" or "timber license" shall be renewed unless good cause is shown for its not having been previously used, nor shall any license be granted to any person who in the use of a previous license has not complied with the regulations of the forestry board. No licenses of any kind shall be transferred from one company to another and continue to be valid unless the transfer of the same is authorized by the forestry board.



## LUMBERMEN'S LICENSE.

SEC. 12. That timber on lands of the first-class, which is not needed for mining or agricultural development in the neighborhood, shall be disposed of to lumbermen or others, as it may be applied for under a "lumbermen's license," in quantities not less in amount than that standing or being on one section nor more than that standing or being on twenty-five contiguous sections. Such license shall be granted upon the payment of a fee of twenty-five dollars, by the Commissioner of Forests with the approval of the Secretary of the Interior, under the conditions set forth in section thirteen of this act, and shall confer the right to cut timber and sell the same from as many sections or acres as have been located and paid for. The licensee shall also pay one dollar per acre for the whole number of acres covered by this license, before he may begin operations and not later than six months after the granting of said license. And a further charge of not less than one cent per cubic foot shall be paid by the licensee after the timber has been cut and before the same is renewed. Such license shall be good for two years, and in all cases in which not more than ten sections of timber are embraced in the license it shall not be renewed unless reasons satisfactory to the forestry board are shown why the same could not have been used and its privileges exhausted during the period for which it was first given, nor in any case shall such license be renewed more than once or for a longer term than two years. Where the license embraces more than ten sections of timber the same rule shall apply in regard to its renewal as in the case of licenses for a less amount of timber, except that for every five above ten embraced in the license there may be a renewal of the license for one additional year. No licensee shall be authorized to apply for or take out a second "lumberman's license" until he shall have cut and disposed of three-fourths of the timber to which he is entitled by the license previously given.

SEC. 13. That all applications for "lumberman's license" are to be made to the Commissioner of Forests and must be accompanied by a statement of the location and approximate amount of the timber sought by the applicant, together with a certificate of the local forest inspector to the effect that the lands on which such timber is situated are of the first-class and not covered by any of the local licenses as provided in section ten, nor presumably needed for such within a reasonable time. Such applications shall be considered in the months of August and September only, and no license shall be granted before at least three months have expired from the date of application and the same has been advertised three times in three local papers, if there be so many,



of the district in which the licensee intends to locate. If the same location is sought by more than one applicant priority of application shall not rule as to applications made in the same month, but the application for the smallest location shall, in such case, receive first consideration. And wherever a survey of the location is necessary the applicant shall pay half of the expense of such survey, and whenever the licensee begins operations upon his location he must notify the local forest inspector, and all cutting and disposal of the timber and other forest products shall be done under the supervision of the local inspector and in accordance with such regulations as the Commissioner of Forests shall prescribe.

#### DUTIES OF FOREST COMMISSIONER.

SEC. 14. That the Commissioner of Forests shall properly subdivide and arrange into divisions and districts of proper size, such forest lands as shall constitute the forest reserves and forest lands remaining under his control, shall organize a forest service, and appoint inspectors and rangers for the protection and proper administration of said forests, and establish a practicable system of forestry. He shall make reasonable rules and regulations for the prevention of trespass on said lands and for their protection from fire or injury from other causes, and for the conservation of the forest growth, and he shall be empowered, if necessary, on account of any threatened detriment to the forestry interest, and, if the local demand warrants, to have cut and to dispose of any timber which is not taken under the licenses herein provided. The Commissioner of Forests shall have the power to regulate pasturage and any occupancy whatsoever upon the forest lands, and he shall make such other regulations, with the approval of the Secretary of the Interior, as may appear necessary to carry into effect the purposes of this act. He shall make to Congress annually a full and detailed report of his proceedings and those of the assistant commissioners, and all moneys received from the sale of timber or any other privileges he shall pay into the Treasury of the United States.

#### CO-OPERATION WITH OTHER OFFICERS.

SEC. 15. That the Commissioner of the General Land Office, surveyors-general, registers and receivers, and other federal officers connected with the public lands, are directed to co-operate with and assist the Commissioner of Forests to the extent of their power in the selection, classification and management of the public forest lands.

#### CO-OPERATION WITH STATE BOARDS.

SEC. 16. That whenever any of the States in which public forest lands are situated shall have instituted and provided for a forest



commission or other forest management of the forest lands belonging to the State, it shall be in the discretion of the Commissioner of Forests, with the approval of the Secretary of the Interior, to co-operate with such forest commission and to allow the same to act as agents for the United States, under his direction, for the purposes of this act.

PROVISIONS AGAINST UNLAWFUL CUTTING.

[To be amended by reference to State laws.]

SEC. 17. That it shall be unlawful to cut, remove, or destroy, or cause or procure to be cut, removed, or destroyed, or aid, counsel, or assist in cutting, removing, or destroying any timber on lands of the United States, except as provided for and permitted by this act, or to wantonly burn, injure, tap, or girdle such timber, or to export, transport, purchase, or dispose of the same, or any lumber, charcoal, pitch, turpentine, or other product manufactured therefrom; and every person violating the provisions of this section shall be guilty of a misdemeanor and shall be liable to a fine of not less than one hundred dollars and not more than one thousand dollars for every such offense, and imprisonment for not more than one year; and every person engaged in such depredation upon timber or timber lands of the United States, whether as principal, agent, employee, carrier, mill owner, manufacturer, vendor or vendee, shall moreover be liable in an action of trespass for the full value of the timber or timber product at the place of delivery; but nothing contained in this section shall prevent any agriculturist or miner from taking from his claim the timber necessary for domestic purposes or the support of his improvements. And whenever there exists a right, previously established by law to cut timber on the public lands, every person or corporation exercising such right must comply with the rules and regulations prescribed by the Commissioner of Forests and approved by the Secretary of the Interior. And all persons acquiring rights to cut timber or any rights of use and occupancy of the forests under the provisions of this act, whether at public sale, by license, or in any other way, are to have and to hold such rights on condition of compliance with the rules and regulations of this act and of the Commissioner of Forests. And a failure to comply with all the rules and regulations so prescribed and approved in regard to the manner of using and occupying the public forest lands shall constitute a misdemeanor punishable as provided in this section.

OCCUPANCY OF FOREST LANDS.

SEC. 18. That it shall be unlawful for any person, firm or corporation knowingly to erect, establish or maintain upon public lands of



the United States, without authority from the Commissioner of Forests, any saw-mill or manufactory of lumber or other timber products, or to be engaged or be employed in the manufacture of lumber, charcoal, pitch or turpentine upon public lands, or to use at any such mill, manufactory, or works any timber cut or removed from public lands; and any person violating this section shall be liable to a fine of not less than five hundred and not more than five thousand dollars, in addition to the penalties hereinbefore prescribed; and all mills, manufactories and works so erected and maintained upon public lands shall be absolutely forfeited to the United States.

#### PENALTIES FOR TRANSPORTING AND HANDLING ILLEGALLY CUT TIMBER.

SEC. 19. That if any master, owner or consignee of any vessel, or any officer or agent of any railroad company, shall knowingly receive for shipment any timber, lumber, or timber product taken without authority from timber lands of the United States, with intent to transport the same to any port or place within the United States, or to export the same to any foreign country, every such master, owner, consignee, officer, agent or railroad company shall be liable to the penalties prescribed in the seventeenth section of this act; and the vessel on board of which any such timber, lumber or timber product shall be taken, transported or seized, shall be wholly forfeited to the United States.

#### RESTRICTING QUALITY OF FOREST OFFICERS.

SEC. 20. That no person who is directly or indirectly engaged in the manufacture of lumber or timber products, or who is conducting any business which requires a large consumption of timber or wood, shall be qualified to serve as Commissioner of Forests under this act, or to serve in any official capacity in connection with the public forest lands.

#### REPEALING CLAUSE.

SEC. 21. That the acts of June third, eighteen hundred and seventy-eight, chapters one hundred and fifty and one hundred and fifty-one, and the first and second sections of the act of June fifteenth, eighteen hundred and eighty, entitled "An act relating to the public lands of the United States," and all acts and parts of acts inconsistent with this act, be, and the same are, hereby repealed.



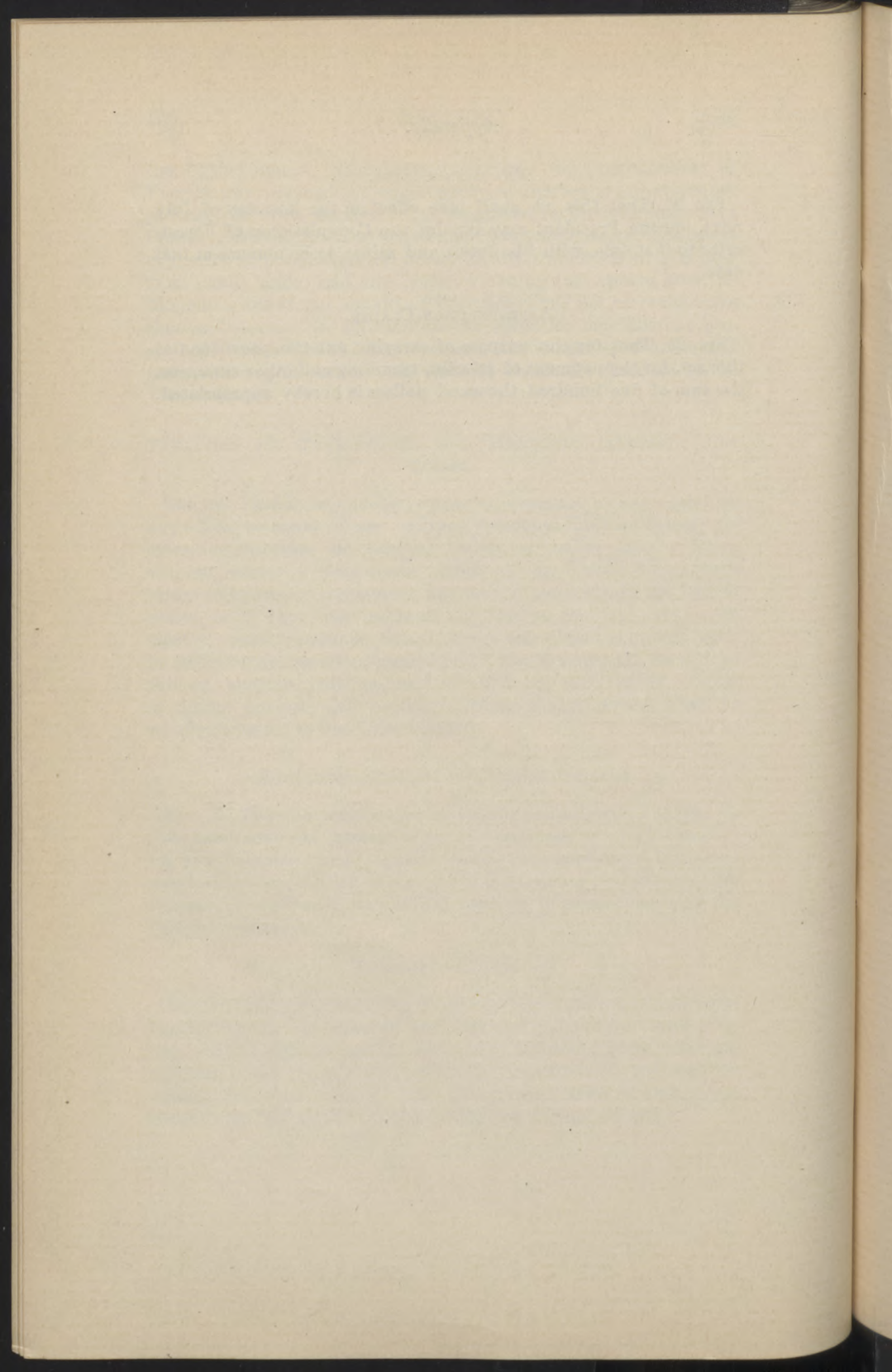
## ENACTING CLAUSE.

SEC. 22. That this act shall take effect on the first day of July next, but the President may appoint the Commissioner of Forests prior to that date, with his duties and salary to commence at that date.

## APPROPRIATION CLAUSE.

SEC. 23. That for the purpose of carrying out the provisions of this act, for the payment of salaries, traveling and other expenses, the sum of five hundred thousand dollars is hereby appropriated.







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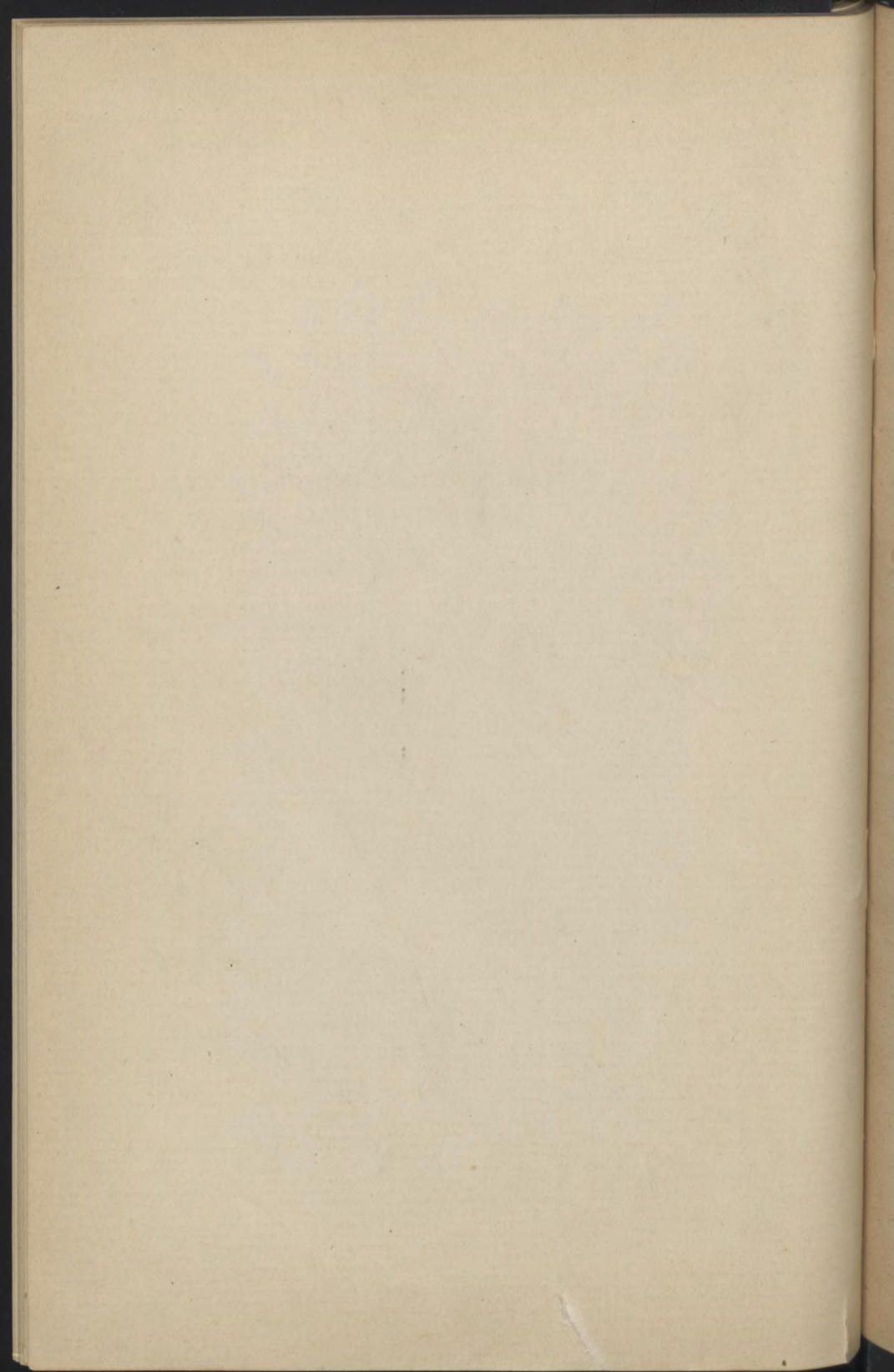
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IN THE SENATE OF THE UNITED STATES.

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REPORT

ON

INTRODUCTION OF DOMESTIC REINDEER INTO ALASKA,

WITH

MAPS AND ILLUSTRATIONS,

BY

SHELDON JACKSON.

GENERAL AGENT OF EDUCATION IN ALASKA.

1893.

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JANUARY 10, 1893.—Referred to the Committee on Appropriations and  
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LETTER OF TRANSMITTAL.

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DEPARTMENT OF THE INTERIOR,  
BUREAU OF EDUCATION,  
*Washington, January 9, 1893.*

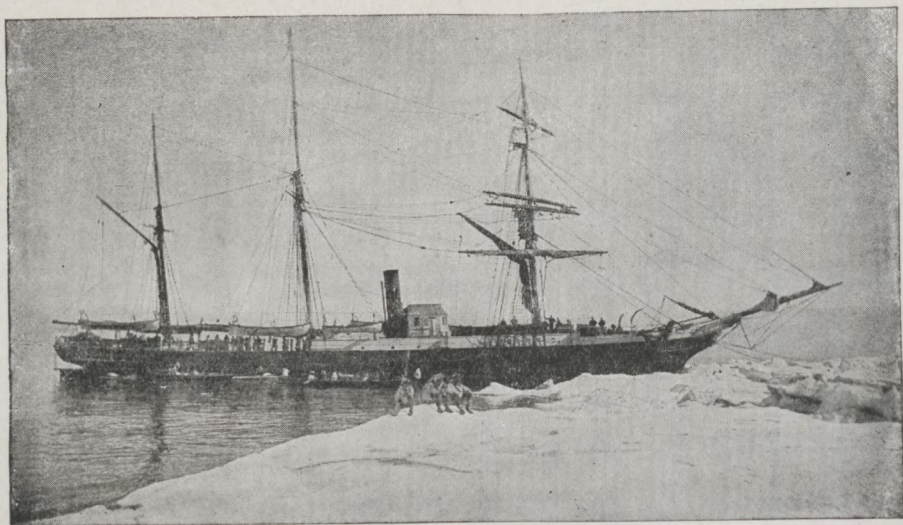
SIR: In compliance with a resolution of the Senate passed January 6, 1893, directing that the Commissioner of Education transmit to the Senate a copy of the latest report of Dr. Sheldon Jackson on the introduction of domesticated reindeer into Alaska, I have the honor to transmit said report herewith.

Very respectfully,

W. T. HARRIS,  
*Commissioner.*

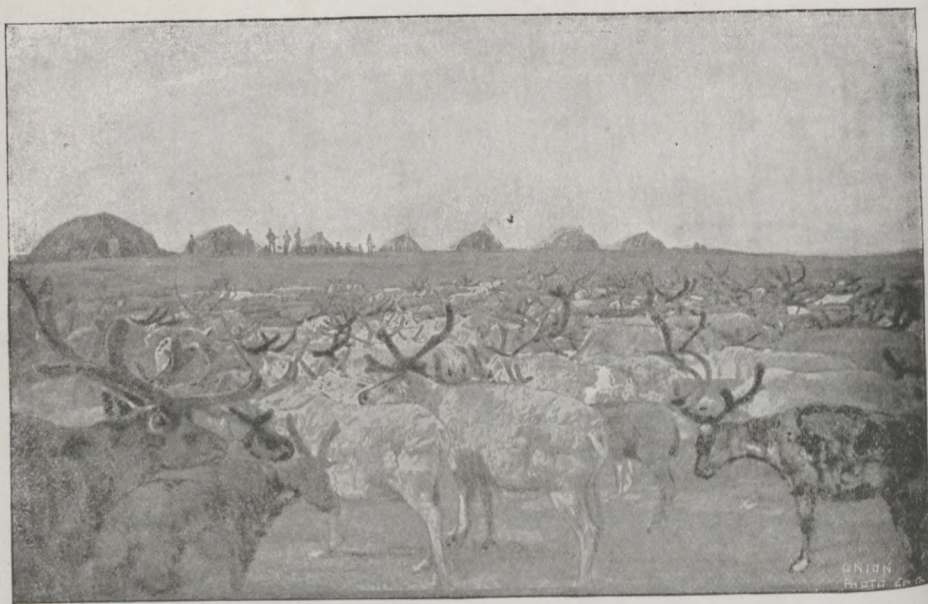
The PRESIDENT OF THE SENATE.





U. S. Revenue Cutter "Bear" Communicating with Siberian Deermen.

[Photo. by Dr. S. J. Call. From The Californian.]



Herd of Domesticated Reindeer, and Temporary Village of Siberian Deermen.

[Photo. by Dr. S. J. Call. From The Californian.]

[FRONTISPIECE.]



## INTRODUCTION OF DOMESTIC REINDEER INTO ALASKA.

DEPARTMENT OF THE INTERIOR,  
BUREAU OF EDUCATION, ALASKA DIVISION,  
*Washington, D. C., January 2, 1893.*

SIR: So many inquiries have been made since my return from Alaska concerning the present progress of the plan to introduce domesticated reindeer into Alaska, that it seems expedient to make a special report on that branch of the work of the office without waiting for the regular annual report on education in Alaska.

I have the honor therefore to submit the following report of progress on the introduction of domesticated reindeer into Alaska:

In the summer of 1890, in accordance with your instructions, I visited Northern Alaska and established schools for the Arctic Eskimo at Cape Prince of Wales, Point Hope, and Point Barrow. Through the courtesy of the Secretary of the Treasury and of Capt. L. G. Shepard, chief of the Revenue Marine Division of the Treasury Department, I was permitted to accompany the U. S. Revenue Marine Steamer *Bear*, Capt. M. A. Healy, commanding, on her annual cruise in Bering Sea and the Arctic Ocean.

In addition to conveying me to the points designated, Captain Healy was under instructions from the Secretary of the Treasury to visit the coast of Siberia, and distribute presents to the Koraks around Cape Navarin in return for shelter and food furnished shipwrecked American whalers. He was also under commission from Superintendent Porter, of the Census Office to take a census of the native population along the arctic coast of Alaska and the islands of Bering Sea, which population could not be reached by the usual enumerators.

The trip to Siberia enabled me to make a cruise of 700 miles along that little-known coast, and study somewhat the character of the native population under conditions corresponding with those under which life must be maintained in Alaska. I found them to be a hardy, active, and well-fed people, owning tens of thousands of head of domestic reindeer.

The taking of the census of arctic Alaska furnished me even more extensive facilities for studying the condition of the Eskimo of Alaska. I found them like their neighbors on the Siberian side to be a hardy and active people, but because they had never been instructed to depend upon the raising of reindeer as a support, unlike the Siberians, they were on the verge of starvation. The whale and walrus that formerly had constituted the principal portion of their food have been destroyed or driven off by the whalers; and the wild reindeer that once abounded in their country, have been killed off by the introduction of breech-loading firearms.

The thorough canvas of the native population for enumeration, necessitating a landing wherever even one or two tents were seen on the



beach, furnished unusual opportunities for observing the educational needs of that people and learning the great difficulties under which schools will have to be carried on.

Upon my return to Washington I had the honor on November 12 to address you a preliminary report of the season's work, emphasizing the destitute condition of the Alaskan Eskimo.

On the 5th of December this report was transmitted by you to the Secretary of the Interior for his information and on the 15th transmitted to the Senate by Hon. George Chandler, Acting Secretary of the Interior. On the following day it was referred by the Senate to the Committee on Education and Labor.

On the 19th of December, Hon. Louis E. McComas, of Maryland, introduced into the House of Representatives a joint resolution (H. R. No. 258), providing that the act of Congress, approved March 2, 1887, "An act to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July 2, 1862, and of the acts supplementary thereto" and an act approved August 30, 1890, entitled "An act to apply a portion of the proceeds of the public lands to the more complete endowment and support of the colleges for the benefit of agriculture and the mechanic arts, established under the provisions of an act of Congress approved July 2, 1862," should be extended by the Secretary of the Interior over Alaska, with the expectation that the purchase, improvement, and management of domestic reindeer should be made a part of the industrial education of the proposed college.

The resolution was referred to the Committee on Education, and on the 9th of January, 1891, reported back to the House of Representatives for passage. (See Appendix A.)

It was, however, so near the close of the short term of Congress that the resolution was not reached.

When it became apparent that it would not be reached in the usual way, the Hon. Henry M. Teller, on the 26th of February moved an amendment to the bill (H. R. No. 13462) making appropriations for sundry civil expenses of the Government for the year ending June 30, 1892, appropriating \$15,000 for the introduction of domestic reindeer into Alaska, which was carried. The appropriation failed to receive the concurrence of the conference committee of the House of Representatives.

Upon the failure of the Fifty-first Congress to take action, and deprecating the delay of twelve months before another attempt could be made, with your approval, I made an appeal in the Mail and Express of New York City, the Boston Transcript, the Philadelphia Ledger, the Chicago Inter-ocean, and Washington Star, as well as in a number of the leading religious newspapers of the country, for contributions to this object. The response was prompt and generous; \$2,146 were received. (Appendix B.)

As the season had arrived for the usual visit of inspection and supervision of the schools in Alaska you were kind enough to direct that in addition to my regular work for the schools, I should continue in charge of the work of transplanting domesticated reindeer from Siberia to Alaska. As the natives of Siberia, who own the reindeer, know nothing of the use of money, an assortment of goods for the purpose of barter for the reindeer was procured from the funds so generously contributed by benevolent people in answer to the appeal through the newspapers.

The honorable Secretary of the Treasury issued instructions to Cap-



tain Healy to furnish me every possible facility for the purchase and transportation of reindeer from Siberia to Alaska. The honorable Secretary of State secured from the Russian Government instructions to their officers on the Siberian coast, also, to render what assistance they could, and on May 25th, 1892, I again took passage on the revenue cutter Bear, Captain Healy in command, for the coast of Siberia.

The proposition to introduce domesticated reindeer into Alaska had excited widespread and general interest. In the public discussions which arose with regard to the scheme a sentiment was found in some circles that it was impracticable; that on account of the superstitions of the natives they would be unwilling to sell their stock alive; further, that the nature of the reindeer was such that he would not bear ship transportation, and also that even if they could be purchased and safely transported the native dogs on the Alaskan coast would destroy or the natives kill them for food. This feeling, which was held by many intelligent white men (Appendix C), was asserted so strongly and positively that it was thought best the first season to make haste slowly, and instead of purchasing a large number of reindeer to possibly die on shipboard, or perhaps to be destroyed by the Alaskan dogs (thus at the very outset prejudicing the scheme), it was deemed wiser and safer to buy only a few.

Therefore, in the time available from other educational duties during the season of 1891, it seemed important that I should again carefully review the ground and secure all possible additional information with regard to the reindeer, and, while delaying the actual establishment of a herd until another season, that I should determine the correctness of the objections that the natives would not sell and the deer would not bear transportation by actually purchasing and transporting them.

The work was so new and untried that many things could only be found out by actual experience.

First. The wild deermen of Siberia are a very superstitious people, and need to be approached with great wisdom and tact.

Upon one occasion, when Capt. Healy purchased a few reindeer for food, the following ceremonies were observed: When getting ready to lasso the deer the owner's family seated themselves in a circle on the ground, where probably some rites connected with their superstitions were observed. Upon attempting to approach the circle, I was motioned away. After a short time the men went out and lassoed a selected animal, which was led to one side of the herd. The man that was leading him stationed himself directly in front of the animal and held him firmly by the two horns. Another with a butcher knife stood at the side of the deer. An old man, probably the owner, went off to the eastward, and placing his back to the setting sun seemed engaged in prayer, upon the conclusion of which he turned around and faced the deer. This was the signal for knifing the animal. With apparently no effort, the knife was pushed to the heart and withdrawn. The animal seemed to suffer no pain, and in a few seconds sank to his knees and rolled over on his side. While this was taking place the old man before mentioned stood erect and motionless, with his hand over his eyes. When the deer was dead he approached, and taking a handful of hair and blood from the wound, impressively threw it to the eastward. This was repeated a second time. Upon the killing of the second animal, the wife of the owner cast the hair and blood to the eastward.

Since then I have often observed the man who was selling a deer pluck some hair from the deer and put it in his pocket or throw it to the winds for good luck.



If a man should sell us deer, and the following winter an epidemic break out in his herd, or some calamity befall his family, the Shamans would make him believe that his bad luck was all due to the sale of the deer.

Second. The Siberian deermen are a nonprogressive people. They have lived for ages outside of the activities and progress of the world. As the fathers did, so continue to do their children.

Now they have never before been asked to sell their deer; it is a new thing to them, and they do not know what to make of it. They were suspicious of our designs. And in reference to this state of mind I have found that being on a Government vessel has been of great assistance. It impresses the natives with confidence that they will be treated honorably and justly. This moral effect was so great that we secured results that otherwise could not have been obtained so easily.

Then, Capt. Healy, commander of the *Bear*, is well known for thousands of miles on both sides of the coast, and the natives have

confidence in him. With a stranger in command I am confident that but little would have been accomplished in the summer of 1891.

Purchasing reindeer in Siberia is very different from going to Texas and buying a herd of cattle. In Texas such a sale could be consummated in a few minutes or hours. But in Siberia it takes both time and patience.

Upon the anchoring of the ship in the vicinity of of a settlement the natives flock aboard, bringing skins and furs to exchange for flour, cotton cloth, powder, lead, etc.

Once aboard they expect to be fed by the captain, and bucket after bucket of hard bread is distributed among them. They know perfectly well that we are after reindeer, but nothing is said about it. They have to be feasted first. They are never in a hurry and therefore do not see why we should be.

After a little, small presents are judiciously

given to the wife or child of a leading man, and when everyone is in good humor a few of the leaders are taken into the pilot-house and the



Ran-en-ka.

[The first Siberian to sell a reindeer for the Alaska herd, 1891. Published by permission of the Californian.]



main subject is opened. After much discussion and talking all around the subject one man is ready to sell twenty and another perhaps only two. After all is arranged the leading men send their servants off after the deer, which may be in the vicinity or four or five days' journey away. Sometimes these delays consume a week or more at a place.

Another difficulty arises from the fact that they can not understand what we want of the reindeer. They have no knowledge of such a motive as doing good to others without pay.

As a rule the men with the largest herds, who can best afford to sell, are inland and difficult to reach.

Then business selfishness comes in. The introduction of the reindeer on the American side may to some extent injuriously affect their trade in deer skins. From time immemorial they have been accustomed to take their skins to Alaska and exchange them for oil. To establish herds in Alaska will, they fear, ruin this business.

Another difficulty experienced was the impossibility of securing a competent interpreter.

A few of the natives of the Siberian coast have spent one or more seasons on a whaler and thus picked up a very little English. And upon this class we have been dependent in the past.

It is very desirable that a native young man should be secured and trained as an interpreter who could be employed regularly, year after year.

However, notwithstanding all these difficulties and delays, Capt. Healy with the *Bear* coasted from 1,200 to 1,500 miles, calling at the various villages and holding conferences with the leading reindeer owners on the Siberian coast. Arrangements were made for the purchase of animals the following season. Then, to answer the question whether reindeer could be purchased and transported alive, sixteen were purchased, kept on shipboard for some three weeks, passing through a gale so severe that the ship had to "lie to," and finally landed in good condition at Amaknak Island, in the harbor of Unalaska, having had a sea voyage of over 1,000 miles.

Thus the results of investigations for 1891 were:

First. The cultivation of the good will of the Siberians.

Second. The actual purchase of sixteen head of reindeer.

Third. That reindeer can be transported with the same facility as other domestic cattle; they being safely loaded, kept on shipboard for three weeks, and landed in good condition a thousand miles away.

Upon my return to Washington in the fall of 1891 the question was again urged upon the attention of Congress, and on the 17th of December, 1891, Hon. H. M. Teller introduced a bill (S. 1109) appropriating \$15,000, to be expended under the direction of the Secretary of the Interior, for the purpose of introducing and maintaining in the Territory of Alaska reindeer for domestic purposes. This bill was referred to the Committee on Agriculture and Forestry, Hon. Algernon S. Packard, chairman. The committee took favorable action and the bill was passed by the Senate on May 23, 1892. On the following day it was reported to the House of Representatives and referred to the Committee on Appropriations. A similar bill (H. R. 7764) was introduced into the House of Representatives by Hon. A. C. Durbin and referred to the Committee on Agriculture.

On April 15, Hon. S. B. Alexander, of North Carolina, reported the bill to the House of Representatives with the approval of the Committee of Agriculture (Appendix D). The bill was placed on the calendar.



On the 2d day of May, 1892, I started for my third summer's work on the coast of Siberia and Arctic Alaska in the U. S. S. *Bear*, Capt. M. A. Healy commanding.

In accordance with your instructions, all the time that could be spared from the schools was given to the establishment of the experimental reindeer station.

Upon reaching Unalaska, May 22, I was much encouraged to learn that the reindeer left last fall on Amaknak and Unalaska Islands had wintered successfully and were in good condition with an increase of two.

We reached Cape Navarin, Siberia, on the 6th of June, and proceeding north called at various points on the coast. Our progress was greatly hindered by heavy fields of ice. The good ship had two anchors ground up and one of the blades of the propeller broken off by the ice. Upon several occasions, we were so surrounded that the propeller was stopped and the ship moored to the ice. A less staunch vessel would have been unable to stand the strain. However, during the season, five trips were made to Siberia, and 175 reindeer purchased, brought over, and landed at the head of Point Clarence, which being the nearest good harbor to Asia on the American side, and a central point for the distribution of deer, I had selected, June 29, as the location of the first reindeer station.

The first installment of deer, numbering fifty-three, was landed at the new station at 6 o'clock on the morning of the 4th of July.

Mr. Miner W. Bruce, of Nebraska, was appointed superintendent of the station and herd, with Mr. Bruce Gibson, of California, as his assistant. (Appendix H.)

Upon the establishment of the experimental reindeer herd at Port Clarence, it became important to gain information concerning the surrounding country.

To secure full and reliable information with reference to pasturage in the vicinity of Bering Straits I had the previous season employed Mr. W. T. Lopp, teacher at Cape Prince of Wales, to make two trips northward along the coast in midwinter (1891-'92), when the moss might be expected to be covered with ice and snow (see Appendix E), and in the fall of 1892 sent Mr. Bruce Gibson, assistant superintendent of the reindeer station, with a party of natives, to the northward of Port Clarence (see Appendix F), and a few weeks later Mr. Miner W. Bruce, superintendent of the station. (See Appendix G.)

These several reconnaissances proved both the abundance of moss and its accessibility for winter pasturage to the new station.

A comfortable house, 20 by 60 feet, was erected as a residence for the superintendent and his assistant, and also for the storing of the annual supply of provisions and barter goods.

Close to the main house two comfortable dugouts were built for the use of the herders. Four Siberians, well acquainted with the management of reindeer, were brought over and placed in charge of the herd. With the Siberians were placed a few young men from the Alaskan Eskimo, who are expected to learn the management and care of the herd. The present expectation is to increase the number of Alaskan boys, who shall become apprentices to the herders, and when they have sufficiently learned the business and proved their capability to take care of reindeer, a small herd will be given each one as his start in life. As from year to year the number of such young men is increased and a number of the natives become herders, the herds will naturally become more and more distributed throughout the country, until, eventually,

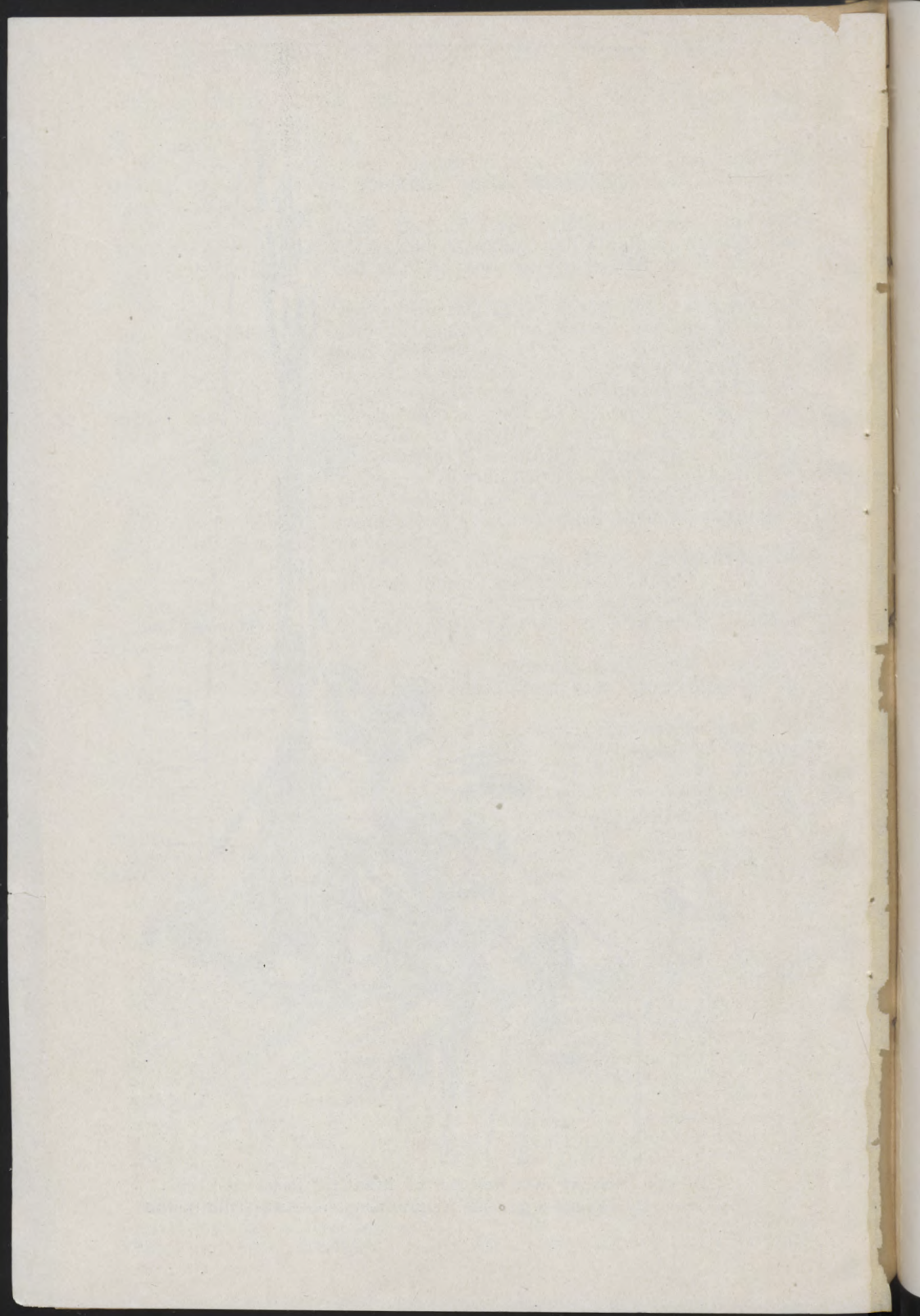




Hoisting in a Reindeer on Board the Bear

[From a photo. by Assistant Engineer A. L. Broadbent, U. S. R. M. Published by permission of The Californian.]







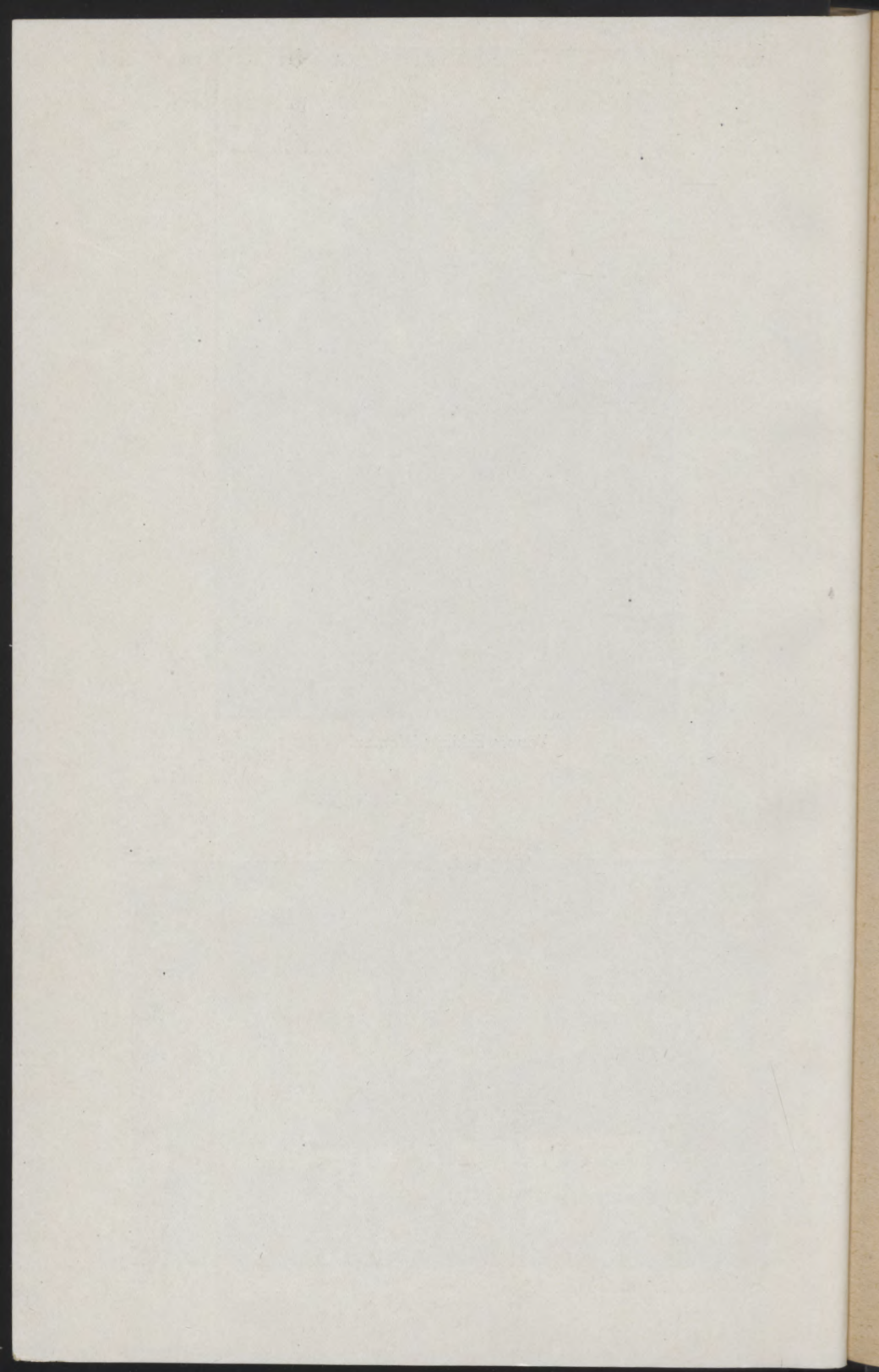


Young Eskimo Woman.



House at Reindeer Station, Port Clarence, Alaska.







that whole northern region shall be covered with them, as the similar regions of Siberia and Lapland are now covered. (Appendix J.)

With the accomplishment of this result several important objects will be attained.

#### PERMANENT FOOD SUPPLY.

In the first place, the population, which is now upon the verge of starvation, will be furnished with a permanent, regular, and abundant supply of food. As has already been stated the native supply of food in that region has been destroyed by the industries of the white men. (Appendix K.) The whale and the walrus that once teemed in their waters and furnished over half their food supply, have been killed or driven off by the persistent hunting of the whalers. The wild reindeer (caribou) and fur-bearing animals of the land, which also furnished them food and clothing, are largely being destroyed by the deadly breech-loading firearm. It will be impossible to restock their waters with whale and walrus in the same way that we restock rivers with a fresh supply of fish. But what we can not do in the way of giving them their former food, we can, through the introduction of the domestic reindeer, provide a new food supply.



Siberian deermen brought to Alaska with the first herd.

[From a photo. by Dr. S. J. Call. Published by permission of the Californian.]

Upon our return southward from the Arctic Ocean in the fall of 1891, Capt. Healy providentially called at the village on King Island, where we found the population starving. The appeal for food was so pressing that the captain detailed a lieutenant to make a thorough examination of the village, and invited me to accompany him. In a few houses we found that the families in their great distress had killed their sled-dogs to keep themselves from starving. In the larger number of families they were making a broth of seaweed, their only food supply. In all human probability, if the ship had not learned their condition, the following summer not a man, woman, or child would have been left alive to tell the story. A few years ago the same thing happened to three large villages on the Island of St. Lawrence, and when, the following season, the revenue cutter called at the village, the putrefying corpses of the population were found everywhere—on the bed plat-

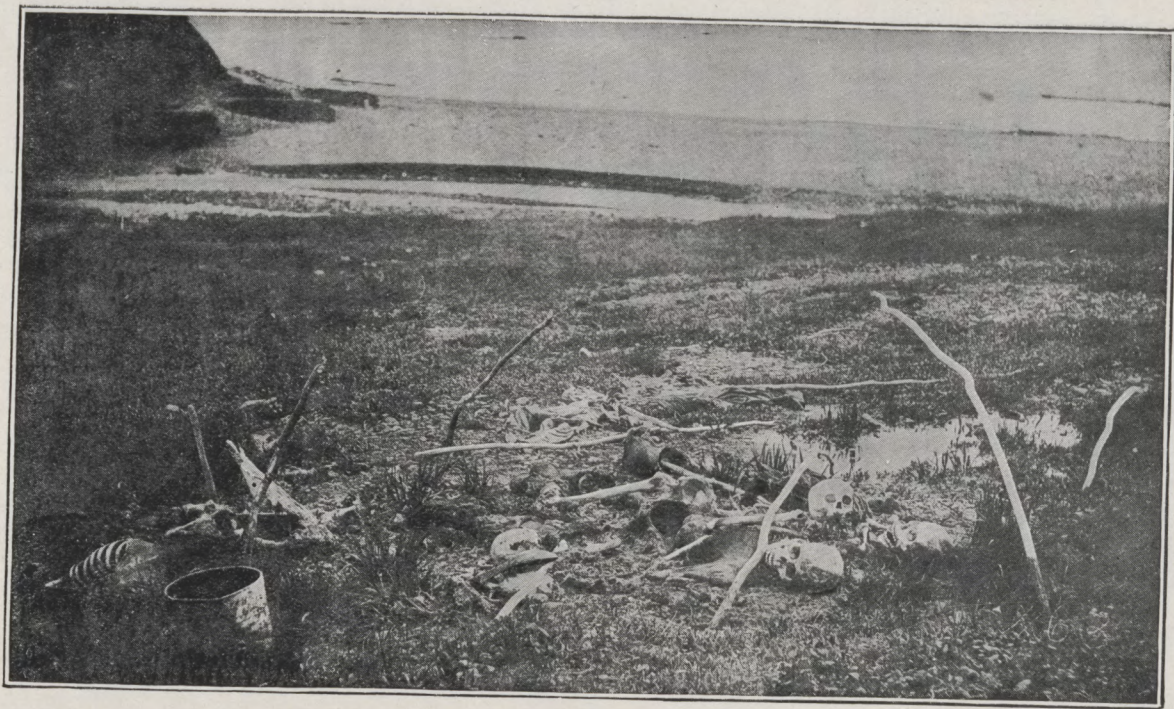


forms, on the floors, in the door ways, and along the paths, wherever death overtook them.

At King Island, having ascertained the condition of things, a purse was made up from the officers and a few others on board the ship, and the captain steamed some two hundred miles to the nearest trading post, and purchased all the provisions that could be obtained, which were taken back to the starving village. This supply sustained the population alive until seal and walrus came some months later around the village. The movement of the seal and walrus, since their numbers have become greatly diminished, is so uncertain that, while a village may have plenty to eat one season they will be on the verge of starvation another.

In the winter of 1890-'91 there was a sufficiency of food at Point Hope. In the winter of 1891-'92 the same population had to leave their village and make their way, in some instances hundreds of miles, to other villages to keep from starving. In 1891 one of the teachers on the Kuskowin River wrote me that the inhabitants of that valley had had but little opportunity during the summer of 1890 to provide a sufficient food supply of fish, that consequently starvation faced them all winter, and that it was with great difficulty that they survived until the fish returned the following season. A teacher on the Yukon River reported this past summer that some of the natives to the north of him had starved to death. This same scarcity of food exists across the entire northern portion of North America, so that now, under the auspices of the Church of England, subscriptions have been opened in London for a famine fund out of which to send relief to the starving Eskimo of Arctic British America. This condition of things will go on, increasing in severity from year to year, until the food supply of the seas and of the land is entirely gone, and then there is nothing left but the extermination of the native population. The general introduction of the domestic reindeer alone will change this entire condition of things, and furnish as reliable supply of food to that people, as the herds of cattle in Texas and Wyoming do to their owners, or the herds of sheep in New Mexico and Arizona. The reindeer is the animal which God's providence seems to have provided for those northern regions, being food, clothing, house, furniture, implements, and transportation to the people. Its milk and flesh furnish food. Its marrow, tongue, and hams are considered choice delicacies. Its blood, mixed with the contents of its stomach, forms a favorite native dish. Its intestines are cleaned, filled with tallow, and eaten as sausage. Its skin is made into clothes, bedding, tent covers, reindeer harness, ropes, cords, and fish lines. The hard skin of the fore legs make an excellent covering for snowshoes. Its sinews are made into a strong and lasting thread. Its bones are soaked in seal oil and burned for fuel. Its horns are made into various kinds of household implements, into weapons for hunting, fishing, or war, and in the manufacture of sleds. Then the living animal is trained for riding and dragging of sleds. The general introduction of such an animal into that region will arrest the present starvation and restock that vast country with a permanent food supply. It will revive hope in the hearts of a sturdy race that is now rapidly passing away. Surely, the country that sends shiploads of grain to starving Russians, that has never turned a deaf ear to the call of distress in any section of the globe, will not begrudge a few thousand dollars for the purchase and introduction of this Siberian reindeer, and the rescue of thousands of people from starvation.





A Sad Story.







## REPEOPLING THE COUNTRY.

In the second place the introduction of domestic reindeer into Alaska will not only thus arrest the present starvation, but will assist in increasing the population. With a more generous food supply this population will commence to increase in numbers. Occupying a region whose climatic conditions are so rigorous that but few white men will ever be willing to make their permanent home in it, it is important, if we would save it from being an unpeopled waste and howling wilderness, that we build up the people who through generations have become acclimated and who are as fervently attached to their bleak and storm-swept plains as the people of temperate and torrid zones to their lands of comfort and abundance.

They are a race worth saving. I find that public opinion, gained perhaps by a more familiar knowledge of the Eskimo of Greenland and Labrador, conceives of the Alaska Eskimos as of the same small type. But this is not true.

In the extreme north, at Point Barrow, and along the coast of Bering Sea they are of medium size. At Point Barrow the average height of the males is five feet three inches and average weight 153 pounds; of the women, four feet eleven inches and weight 135. On the Nushagak River the average weight of the men is from 150 to 167 pounds. From Cape Prince of Wales to Icy Cape and on the great inland rivers emptying into the Arctic Ocean, they are a large race, many of them being six feet and over in height. At Kotzebue Sound I have met a number of men and women six feet tall. Physically they are very strong, with great powers of endurance. When on a journey, if food is scarce, they will travel thirty to forty miles without breaking their fast. Lieutenant Cantwell, in his explorations of the Kowak River, makes record that upon one occasion when he wanted a heavy stone for an anchor a woman went out and alone loaded into her birch-bark canoe and brought him a stone that would weigh 800 pounds. It took two strong men to lift it out of the canoe.

Another explorer speaks of a woman carrying off on her shoulder a box of lead weighing 280 pounds. This summer, in erecting the school buildings in the Arctic, there being no drays or horses in that country, all the timbers, lumber, hardware, etc., had to be carried from the beach to the site of the house on the shoulders of the people. They pride themselves on their ability to outjump or outrun any of our race who have competed with them. They can lift a heavier weight, throw a heavy weight farther, and endure more than we. They are a strong, vigorous race, fitted for peopling and subduing the frozen regions of their home.

Arctic and subarctic Alaska cover an empire in extent equal to nearly all Europe. With the covering of those vast plains with herds of domesticated reindeer it will be possible to support in comparative comfort a population of 100,000 people where now 20,000 people have a precarious support. To bring this about is worthy the fostering care of the General Government.

## CIVILIZATION OF THE ESKIMOS.

Thirdly, the introduction of domestic reindeer is the commencement of the elevation of this race from barbarism to civilization. A change from the condition of hunters to that of herders is a long step upwards in the scale of civilization, teaching them to provide for the future by new methods.



Probably no greater returns can be found in this country from the expenditure of the same amount of money than in lifting up this native race out of barbarism by the introduction of reindeer and education.

#### ARCTIC TRANSPORTATION.

Fourthly, the introduction of the domestic reindeer will solve the question of arctic transportation. (Appendix L.) The present transportation of that region is by dog sleds. One load of supplies for the trader or traveler requires a second load of food for the two teams of dogs, and they make but short distances per day. This difficulty of transportation has been one great drawback to the development of the country. It has interfered with the plans of the fur trader; it has interfered with Government exploration. Only three years ago when the U. S. Coast and Geodetic Survey sent two parties to determine the international boundary between Alaska and British America the small steamer that was conveying the supplies up the Yukon River was wrecked, and it was with the utmost difficulty that the surveying parties were kept from starvation because of the difficulty of sending sufficient food 2,000 miles along that great valley by dog sleds. If reindeer had been introduced into the country there would have been no such difficulty in furnishing food. Bills have been before Congress for several years proposing to establish a military post in the Yukon Valley. If such a post is established it is not at all improbable that a combination of circumstances may arise some winter by which the forces that shall be stationed there will be reduced to starvation unless reindeer transportation shall have become so systematized that food can readily be sent in from other regions. The same is true with reference to the Government officials whom it may be found necessary to station in that region.

The same is true of the forty or more missionaries and their families that are now scattered through that vast region; also, of the teachers and their families whom the Government has sent into that country.

These are now separated from all communication with the outside world, receiving their mail but once a year. With reindeer transportation they could have a monthly mail.

During the past three years the whalers have been extending their voyages east of Point Barrow to the mouth of the Mackenzie River, and wintering at Herschel Island. To the owners of this property it would be worth tens of thousands of dollars if they could hear from their vessels in the winter before new supplies and additional vessels are sent out in the spring. But this can not now be done. Last winter letters were sent out from the field, overland, by Indian runners that ascended the Mackenzie, crossed over to the Porcupine, and descended the Porcupine and Yukon rivers down to St. Michael, on the coast. It was ten months before those letters reached their destination. It was a great satisfaction to the owners to hear of the welfare of their ships and crews, but the news was too late for business purposes. Millions of dollars' worth of property and thousands of lives are involved in the whaling business. With the introduction of domestic reindeer into that region it will be both feasible and perfectly practicable to establish a reindeer express during the winter from the Arctic coast down to the North Pacific coast of Alaska.

The southern coast of Alaska on the Pacific Ocean never freezes, and is accessible all the year around to vessels from San Francisco or Puget Sound.





From "Reindeers, Dogs, and Snow-shoes."

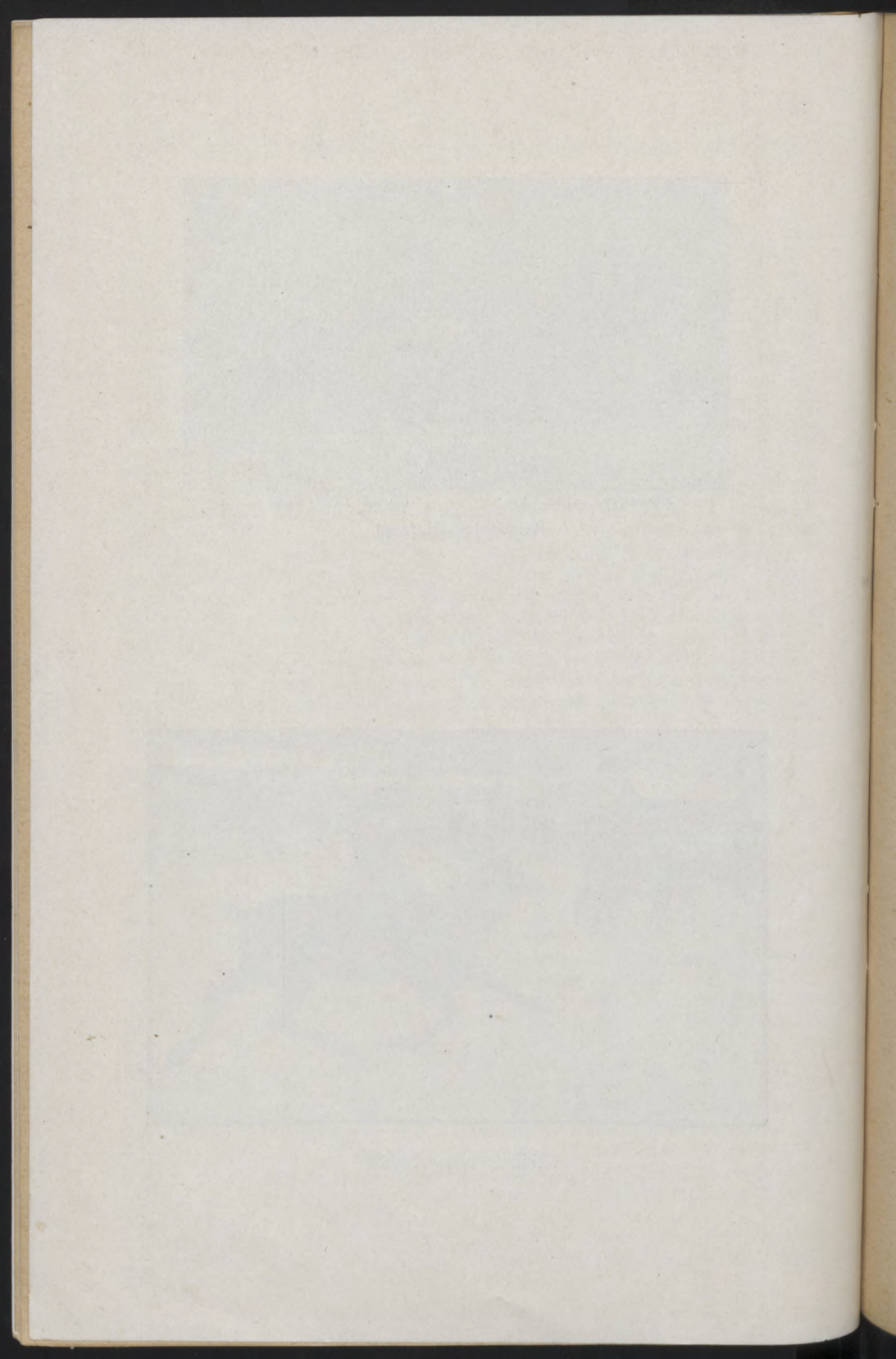
Copyright. 1871, by Harper & Brothers.

Reindeer in Harness.



Reindeer under Saddle.







A reindeer express across Alaska, from the Arctic to the Pacific Ocean, would have a corresponding commercial value to that section as the telegraph between New York and London to theirs. It would enable the owners of the whaling fleet to avail themselves of the latest commercial news and keep a more perfect control over their business.

#### COMMERCIAL VALUE.

In the sixth place, the introduction of domesticated reindeer will add a new industry to that country, which will go to swell the aggregate of national wealth. Lapland sends to market about 22,000 head of reindeer a year, the surplus of her herds.

Through Norway and Sweden smoked reindeer meat and smoked reindeer tongues are everywhere found for sale in their markets, the hams being worth 10 cents a pound and the tongues 10 cents a piece. There are wealthy merchants in Stockholm whose specialty and entire trade is in these Lapland products. The reindeer skins are marketed all over Europe, being worth in their raw condition from \$1.50 to \$1.75 apiece. The tanned skins (soft, with a beautiful yellow color) find a ready sale in Sweden, at from \$2 to \$2.75 each. Reindeer skins are used for gloves, military riding trousers, and the binding of books. Reindeer hair is in great demand for the filling of life-saving apparatuses, buoys, etc., and from the reindeer horns is made the best existing glue. One great article, smoked reindeer tongues, and tanned skins are among the principal products of the great annual fair at Nischnij Novgorod, Russia. In Lapland there are about 400,000 head of reindeer, sustaining in comfort some 26,000 people. There is no reason, considering the greater area of the country and the abundance of reindeer moss, why arctic and subarctic Alaska should not sustain a population of 100,000 people with 2,000,000 head of reindeer. In Lapland the reindeer return a tax of \$1 a head to the Government, so that they yield an annual revenue to the Government of \$400,000.

With the destruction of the buffalo the material for cheap carriage and sleigh robes for common use is gone. Bear and wolf skins are too expensive; but with the introduction of the reindeer their skins would to a certain extent take the place of the extinct buffalo.

The commercial importance of introducing domesticated reindeer in Alaska was so manifest that shrewd business men on the Pacific coast at once appreciated the great possibilities involved, and hastened, through their chambers of commerce and boards of trade, to take action urging their several delegations in Congress to do what they could to secure an appropriation of money for these purposes. (Appendix N.)

Under favorable circumstances a swift reindeer can traverse 150 miles in a day. A speed of 100 miles per day is easily made. As a beast of burden they can draw a load of 300 pounds.

The progress of exploration, settlement, development, government, civilization, education, humanity and religion, are all largely dependent in that region on reindeer transportation.

If there is any measure of public policy better established than another or more frequently acted upon, it has been the earnest and unceasing efforts of Congress to encourage and aid in every way the improvement of stock, and the markets of the world have been searched for improved breeds. The same wise and liberal policy will make ample provision for the introduction of the reindeer, which of all animals is the most serviceable and indispensable to man in high northern latitudes.

If it is sound public policy to sink artesian wells or create large water



reservoirs for reclaiming large areas of valuable land otherwise worthless; if it is the part of national wisdom to introduce large, permanent, and wealth-producing industries where none previously existed, then it is the part of national wisdom to cover that vast empire with herds of domestic reindeer, the only industry that can live and thrive in that region, and take a barbarian people on the verge of starvation, lift them up to a comfortable support and civilization, and turn them from consumers into producers of national wealth.

It will be noticed that the sum asked from Congress is only \$15,000. I hope that this will not be misunderstood and taken as a measure of the importance of the movement, for if the proposed results could not be obtained with any less sum an appropriation of hundreds of thousands of dollars would be both wise and economical.

But so small a sum is accepted on the ground of proceeding with extreme caution. It is the commencement of a great movement that will, if successful, extend its beneficial influences as long as the world stands. Therefore we move slowly and carefully at first in order to secure that success. Commencing in a small way, the first outlay of money is not large.

In 1891 the sixteen reindeer purchased average \$10.25 each. This last season the general average was brought down to \$5 each.



Superstitious ceremony connected with killing or selling reindeer in Siberia.

So far the purchase of the reindeer has been defrayed from the money contributed by benevolent individuals.

#### REVENUE MARINE SERVICE.

These gratifying results, however, could not have been attained without the hearty and active coöperation of the Revenue-Marine Service.

If this office had been required to charter a vessel for the transporting of the reindeer nothing could have been done with the small sum at our disposal.

But the Secretary of the Treasury directed that the revenue cutter *Bear*, in addition to her regular duties of patrolling the Seal Islands and the coasts of Bering Sea and the Arctic Ocean, following the whaling fleet and inspecting the Refuge Station at Point Barrow, should also give what time was possible to transporting the reindeer.

To the captain, officers, and crew of the *Bear* is due much praise for the hard work done by them.

Special thanks are due Capt. M. A. Healy for his earnestness and efficiency in doing his part of the work; also to Lieut. D. H. Jarvis, Surgeon S. J. Call, and Assistant Engineer Falkenstein, who were in charge of much of the shore work of loading and unloading the deer.





Sketch Map of  
**ALASKA**

Prepared for U.S. Bureau of Education  
By the U.S. Coast and Geodetic Survey

To accompany Reindeer Report by Sheldon Jackson, D.D.

U.S. General Agent of Education

in Alaska.

1893



## ILLUSTRATIONS.

I have the honor of inclosing an excellent map, prepared through the courtesy of the U. S. Coast and Geodetic Survey, also several illustrations kindly loaned by The Californian, Scribner's, and Harper's.

Also a few other photographs taken by Surg. Call and Assistant Engineer Broadbent, of the *Bear*.

The map and illustrations will greatly add to the interest of the report.

Hoping that Congress will provide the funds necessary for a further prosecution of the work, I remain, with great respect,

Yours, truly,

SHELDON JACKSON,  
*General Agent of Education in Alaska.*

Hon. W. T. HARRIS,  
*Commissioner of Education.*

S. Mis. 22—2



## APPENDIX A.

[House Report No. 3414, Fifty-first Congress, second session.]

Mr. McComas, from the Committee on Education, submitted the following report (to accompany H. Res. 258):

The Committee on Education reports favorably House joint resolution 258, with sundry amendments recommended by the committee.

Congress has passed several acts encouraging the establishment of agricultural schools and experiment stations in the different States and Territories.

These several acts require the assent of the legislatures of the several States and Territories before their provisions become available; but as Alaska has no legislature, it is the only Territory which is unable to avail itself of the benefits and provisions of these acts.

This bill proposes to extend to Alaska the benefits and provisions of the agricultural acts through the Secretary of the Interior, in like manner to the other Territories. The acts are recited in the preamble to the joint resolution.

There has been very wide divergence of views with regard to the agricultural and horticultural capabilities of Alaska, or whether it has any agricultural capabilities at all.

This bill would secure the establishment of an experimental station in southern Alaska, which has a temperate climate, and test the question of what can and what can not be raised to advantage.

This would be of very great service, both to the natives, who, through the Government schools, are coming into our civilization, and to the white settlers who may locate in that vast region, which embraces about 580,000 square miles.

There are hundreds of thousands of square miles of area within the Arctic regions of Alaska that, there is no question, can never be adapted to ordinary agricultural pursuits, nor utilized for purposes of raising cattle, horses, or sheep; but this large area is especially adapted for the support of reindeer.

This bill will enable the Secretary of the Interior, through the Government industrial schools, to make the stock-raising of reindeer the great industrial feature of that region.

This will utilize hundreds of thousands of square miles of territory, will build up a large and profitable industry, and above all, will provide a comfortable support for the native population of that region.

This is the more important at the present time, because the American whalers have practically destroyed and driven out the whale and the walrus from the waters adjacent to the coast of Alaska.

The destruction of the whale and walrus has taken away three-fourths of the ordinary food supply of the Eskimo population, and that population to-day on the Arctic coast of Alaska is on the verge of starvation. The large canneries will soon take away the fish supply.

The introduction of tame reindeer from Siberia into Alaska thus has a two-fold importance:

- (1) As the establishment of a profitable industry.
- (2) As a relief of a starving people, a relief that will become more and more valuable as the years roll round, a relief that once established perpetuates itself.

This project is wiser than to pauperize the people of Alaska.

The revenue from that country warrants this attempt to make these people self-sustaining.

The lease of the Seal Islands by the United States Treasury Department to the North American Commercial Company, on the basis of 100,000 skins, ought to yield a revenue of about \$1,000,000 annually. Under the old lease the revenue was \$317,500 annually.

The extending to Alaska of the benefits of the agricultural bill approved August 30, 1890, would give for the year ending June—

1890-----	\$15, 000
1891-----	16, 000
1892-----	17, 000
	48, 000



From the act establishing agricultural experiment stations approved July 2, 1862, the sum of \$15,000.

The joint resolution would therefore carry for the year ending June 30, 1892, \$93,000, and for the following year, \$33,000.

The committee report therefore this joint resolution with the following amendments and recommend that it pass.

In line 4, page 2, after the word "to," insert "give any assent required by either of said acts, and to."

In line 4, page 2, after the word "benefits," insert "and provisions."

In line 6, page 2, after "Territory," insert "of Alaska."

In line 7, page 2, after the word "acts," add "in like manner as for any other Territory."

## APPENDIX B.

## LIST OF CONTRIBUTIONS TO THE REINDEER FUND, 1891.

1891.		
May	15. Miss H. S. Benson, Philadelphia.....	\$200. 00
	John N. Brown, Providence, R. I.....	200. 00
	Jane N. Grew, Boston.....	30. 00
	Mary P. Gardner, New York.....	10. 50
	Sarah B. Reynolds, Kingston, N. Y.....	10. 00
	Mrs. H. B. Otis, Roxbury, Mass.....	10. 00
	M. A. & S. H. Foster, Portsmouth N. H.....	10. 00
June	10. Boston Transcript from various persons.....	289. 00
	E. G. Read, Somerville, N. J.....	10. 00
	Effe V. V. Knox, New York.....	10. 00
	Mrs. N. Williamson, Brunswick, N. J.....	10. 00
	E. E. B., 140 Lanvale street, Baltimore, Md.....	1. 00
	Helen B. French, Beloit, Wis.....	10. 00
	Mary Ellen Smith, Philadelphia, Pa.....	10. 00
	Judge E. R. Hoar, Concord, Mass.....	10. 00
	C. H. Barstow, Crow Agency, Mont.....	15. 00
	M. E. D., per Boston Transcript.....	1. 00
	A. F. Allyn, Chelsea, Mass.....	1. 00
	R. P. Wainwright, Asheville, N. C.....	10. 00
	M. A. Haven and Annie W. Davis, Portsmouth, N. H.....	10. 00
	Mary Hemingway, Boston, Mass.....	100. 00
	The Mail and Express.....	500. 00
	Mrs. William Thaw.....	50. 00
	Five children in one family, one reindeer each.....	50. 00
	Mrs. F. L. Achey.....	20. 00
	M. E. P.....	50. 00
	The young ladies of Rye Seminary, Rye, N. Y.....	50. 00
	Mary L. Parsons.....	20. 00
	Y. P. S. C. E., Reformed Church, Mount Vernon.....	13. 65
	Three ladies of East Orange, N. J.....	12. 00
	G. K. Harroun.....	10. 00
	H. G. Ludlow.....	10. 00
	Mrs. H. G. Ludlow.....	10. 00
	Mrs. R. C. Crane.....	10. 00
	Mrs. Edwin G. Benedict.....	10. 00
	Mrs. M. C. Cobb.....	10. 00
	E. M. Chadwick.....	10. 00
	Augusta Moore.....	10. 00
	Rev. Wm. T. Doubleday.....	10. 00
	E. M. Eames.....	10. 00
	Chas. H. Wells.....	10. 00
	A. R. Slingushard.....	10. 00
	James M. Ham.....	10. 00
	Mrs. James M. Ham.....	10. 00
	Mrs. Robert I. Brown.....	10. 00
	William Rust.....	10. 00
	Mrs. Levi S. Gates.....	10. 00



*List of contributions to the Reindeer fund, 1891—Continued.*

1891.		
June 10.	Bethlehem Chapel Mission School.....	\$10.00
	Mrs. Richard L. Allen .....	10.00
	Miss M. I. Allen .....	10.00
	E. Holman .....	10.00
	C. and family, East Orange, N. J. ....	10.00
	J. Van Santwood .....	5.00
	James F. E. Little .....	5.00
	Frederick W. Stoneback .....	5.00
	J. H. Charles .....	5.00
	V. Thompson .....	5.00
	W. T. Bliss .....	5.00
	Howard Wilson .....	5.00
	G. H. Fleming .....	5.00
	W. S. Quigley .....	5.00
	J. Lantz .....	5.00
	From friends .....	2.60
	Mrs. L. E. Hastings .....	1.20
	A. E. Barnes .....	1.00
	Amelia J. Burt .....	1.00
	W. A. Deering .....	5.00
	L. F. Golding .....	5.00
	J. A. Hennessy .....	5.00
	R. H. Stoddard .....	5.00
	William R. Worrall .....	5.00
	H. W. Dourmett .....	5.05
	Betty Deming (a child) .....	10.00
	John Deming (a child) .....	10.00
	Anonymous .....	10.00
	Little Lights Society .....	5.00
	Mrs. Edmund T. Lukens .....	5.00
	W. S. ....	5.00
	Cuttenden Hull, A. ....	10.00
	Mrs. Clinton B. Fisk .....	10.00
	W. U. A. ....	20.00
	Thomas Harrington .....	10.00
	E. ....	10.00
June 18.	Mrs. Debbie H. Parker, Charlottesville, Ind. ....	5.00
	Gen. E. E. Whittlesey, Washington, D. C. ....	10.00
1892.		
Feb. 1.	Miss Mary Burroughs, Philadelphia, Pa. ....	5.00
	11. A. D. Simpson, Christiansburg, Va. ....	10.00
	Total .....	2,146.00

Of the above amount \$1,158 was collected through the Mail and Express, of New York.

## APPENDIX C.

*TENT LIFE IN SIBERIA.*

By GEORGE KENNAN.

[Published by George P. Putnam's Sons. 1870. Page 116.]

Among the many superstitions of the Wandering Koraks and Chookchees one of the most noticeable is their reluctance to part with a living reindeer. You may purchase as many dead deer as you choose, up to 500, for about 70 cents apiece; but a living deer they will not give to you for love nor money. You may offer them what they consider a fortune in tobacco, copper kettles, beads, and scarlet cloth for a single live reindeer, but they will persistently refuse to sell him. Yet, if you will allow them to kill the very same animal, you can have



his carcass for one small string of common glass beads. It is useless to argue with them about this absurd superstition. You can get no reason for it or explanation of it, except that to sell a live reindeer would be "atkin" (bad). As it was very necessary in the construction of our proposed telegraph line to have trained reindeer of our own we offered every conceivable inducement to the Koraks to part with one single deer; but all our efforts were in vain. They could sell us 100 dead deer for 100 pounds of tobacco, but 500 pounds would not tempt them to part with a single animal as long as the breath of life was in his body. During the two years and a half which we spent in Siberia no one of our parties, so far as I know, ever succeeded in buying from the Koraks or Chookchees a single living reindeer.

#### APPENDIX D.

#### DOMESTICATED REINDEER IN ALASKA.

[House Report No. 1093, Fifty-second Congress, first session.]

Mr. Alexander, from the Committee on Agriculture, submitted the following report:

The Committee on Agriculture, to whom was referred the bill (H. R. 7764) to secure the introduction of domesticated reindeer into Alaska, report the same with a favorable recommendation. This bill does not properly come within the jurisdiction of the Committee on Agriculture, but should have been considered by the Committee on Appropriations. At the suggestion of the chairman of the Committee on Appropriations the Committee on Agriculture, having heard the testimony of the missionaries from Alaska, the Commissioner of Education, and others in regard to the merits of the bill, have considered it and recommend its passage.

The testimony showed that there are no reindeer in Alaska; that Alaska could support many times enough reindeer to furnish the inhabitants with food and clothing, and that the reindeer skins are indispensable for clothing; that the whale and walrus, the principal supply of food, have been destroyed to such an extent as to cause much suffering for food; that dogs are used for transportation, and in many places the supply of food is becoming so scarce that the natives are compelled to eat their dogs, thus depriving them of the means of hauling their supplies; that for the development of the country the domesticated reindeer is absolutely indispensable; that the domesticated reindeer can make a speed of 19 miles an hour, and that a fair average rate of speed is 12 miles per hour; and this means of transportation is necessary to develop the gold fields of the interior, which can only be worked from two to two and one-half months a year; that the reindeer would be distributed at the Government schools, the native youths taught to herd and raise them, the increase to be given to worthy students and native teachers for services rendered; that this will induce the natives to become herders, be self-supporting, and not a charge upon the Government; that the natives have no vessels that can transport the live reindeer from Siberia to Alaska; that the vessels from San Francisco to Alaska leave the 1st of May to the 1st of June, none later than the last date mentioned, and that if anything be done this year it is absolutely necessary to get the appropriation in time to send the goods for the purchase of the reindeer by the revenue cutter that leaves San Francisco the 1st of June.

The description given by the missionaries and others of the country, the habits of the natives, etc., was interesting. The distress caused by the continued failure of the food supply shows plainly that the natives will not be able to sustain themselves, and will become a charge upon the Government. For these and other reasons the Committee on Agriculture urge the passage of this bill.



## APPENDIX E.

## MR. W. T. LOPP'S RECONNOISSANCE ALONG THE COAST NORTH OF BERING STRAITS.

CAPE PRINCE OF WALES, ALASKA,  
January 20, 1892.

DEAR SIR: According to your instructions, I have made two expeditions up the coast north of here, and submit you the following report:

In November employed Eskimo, dogs, and sled, and explored west shore of Lounge Inlet or Lake, just north of Cape Prince of Wales, up to its head, where Grouse River empties into it. The mountains (see chart inclosed) were sloping and rolling, not sharp and rocky, and covered with moss. Portions of these hills were covered with 3 to 5 inches of snow, but all the exposed portions were free from any snow. This inlet is about 30 miles long and has two outlets to the sea. Along the banks of Grouse River are acres of bushes (3 to 6 feet), hundreds of ptarmigan, and nice-sized fish in the river.

On December 27 started with boy, dogs, and sled for Ke-gik-tok. Had fine weather—short days—visited about 300 people. Some settlements had plenty of oil, seal meat, and fish, and others had little or none. All were very anxious to have deer introduced. Most of them seem to doubt that ownership would ever pass into their hands. They complain that they have to pay exorbitant prices to Cape Prince of Wales chiefs for deer skins. They reported moss very plentiful. At that time there was so little snow that it would be unnecessary to graze deer on the mountain side. I could see that the smooth expanse of country from coast to mountain was covered with only 3 or 4 inches of soft snow, no crusts or ice. (Unlike last winter, there have been no thaws this winter, consequently no ice crust on snow.) These coast people live on seal meat, oil, fish, ptarmigan, and squirrel. They are not a trading people, have had little or no intercourse with ships: are honest, industrious, and healthy.

Found a very prosperous settlement at Ke-gik-tok of eighty people. Asked me to bring the school up there, etc.

I think several hundred deer could be grazed along the hills from Cape Prince of Wales to Ke-gik-tok. I am satisfied from what I have seen and heard that there are hundreds of acres of good grazing land extending from the coast back to rivers flowing into lakes back of Port Clarence and those flowing into Kotzebue Sound. Settlements are so distributed along the coast from Cape Prince of Wales to Kotzebue Sound that deer-men along the mountains could easily be supplied with seal oil and meat. And if inclosures are ever necessary there are plenty of bushes in small rivers to make them. I think these coast people are better situated and adapted for herding than any other Alaskan people.

They are all superstitious and are great cowards after dark. Perhaps it will be necessary to have them stand watch at night in pairs until they become accustomed to the darkness. (One Eskimo never goes any place after dark if he can help it. He see ghosts; but is all right with a companion.)

Hoping and trusting that we may sometime have occasion to make use of knowledge obtained on these two little expeditions, I am,

Very truly yours,

W. T. LOPP.

Dr. SHELDON JACKSON,  
Washington, D. C.

## APPENDIX F.

## RECONNOISSANCE NORTH OF PORT CLARENCE BY BRUCE GIBSON.

REINDEER STATION, PORT CLARENCE, ALASKA,  
August 2, 1892.

SIR: I respectfully submit herewith report of expedition made by Mr. Gibson into interior, north of station, for the purpose of ascertaining probable condition of grazing for reindeer during winter months—copied from his notes, as follows:

"I started on expedition July 27, leaving station at 12 o'clock, noon; taking with me as guide Charley, as expert on pasturage, Chief Herder Pungen, and



five natives to pack tent and supplies. Traveled in a northwesterly direction, and for about 4 miles found good feed and several small lakes. I then changed my course to north for about three-quarters of a mile and found scarcely any feed, it being very rocky and barren; I then went west again for 7 miles and camped at a river about 30 feet wide. The first quarter of a mile of this last course was very rocky, boulders from 4 to 6 feet through being plentiful; the remainder of the distance being good feeding-grounds.

"The next day started north and traveled in that direction for about 9 miles and found good pasturage on east side most of the way, and wild flowers and berries grew in places; the west side of river is barren and very perpendicular in several places. I then traveled to west and for a short distance on a small river found some feed, but after traveling for 1 mile I retraced my steps and went to northeast for about 3 miles; when men began to complain of being tired and I ordered a halt for the night on a small stream running toward the east. To northeast I saw good indications of feed.

"The next morning I got an early start, taking with me the guide and herder and leaving the others behind to try and find a place to camp that night, having to go without fire the previous night and this morning. I crossed the small river and traveled north; for the first 2 miles there was but a small quantity of feed, having passed over some very rocky ground. The next  $3\frac{1}{2}$  miles there is good pasturage, being plenty of grass and considerable moss. I crossed two small streams in this course. Traveled east to get around some large hills; at about one-half mile came to a large mound of slaty rock—mound about 30 feet high and 150 feet across. For 1 mile east found good pasture; crossed a small stream running southeast. Changed to north and for 1 mile found good grazing ground; halted at a large cluster of rock for lunch and shelter from rain; found a white surface on one of the rocks, and I made the following inscription:

"B. Gibson, July 29, 1892, 12 m., from Reindeer Station.' Resumed march to north and for 2 miles found good pasturage; crossed a small stream running to south. About 1 mile south is a lake. Changed course to east for 3 miles, crossed one stream, and found good feed in abundance. The land was of a rocky nature. Started to return to camp and traveled southwest for 7 miles to where I gave orders for camp to be located, but found they had gone farther east. I crossed over good feeding ground of a boggy nature, similar to that surrounding station. The herder said it was the best seen since starting on expedition; it was mostly lowland and some low rock hills. I found the camp 2 miles east of where I expected it to be.

"The fourth day I started east and traveled for 4 miles over low hills, the surface being of a broken nature and containing abundance of feed; coming to high hills, changed course to southeast for  $2\frac{1}{2}$  miles, finding fair pasturage and ground slightly rocky. Sent packers on to river to find suitable camping grounds for night. I traveled 5 miles to northeast, finding good pasturage of a boggy nature; crossed one small stream. Changed to southeast 1 mile and south 1 mile, finding good pasturage on low hills; changed to southwest over low, hilly, and rocky land in some places slightly boggy; the feed on this last course was abundant and of a good quality.

"*Fifth day.*—It stormed hard last night and blew the tent down about 3 o'clock. I broke camp about 7 o'clock and started for the station, taking a southwest course. After traveling for about 5 miles I crossed a small stream running very rapidly toward the northeast. The land was low hills and furnished abundance of feed. I traveled 2 miles farther in same direction and crossed a large stream with swift current and running northeast; the feed and land the same as passed earlier in the day. Continuing in same direction, but a little more to west for 4 miles I traveled over low hills; good pasturage and plenty of moss. I crossed large hill to north of station; found it barren and very high and rocky. It is about 1 mile from bottom of hill to open land, and from there on to station is good grazing land. I arrived at station at 4:15 in the afternoon. It had stormed hard from the time I left until my return, raining and blowing hard.

"In closing, I will say the herder told me the ground passed over was very good and equaled and in places excelled the pasturage in Siberia; he further stated that the pasturage surrounding station was sufficient for a year, providing that in the winter there was not over 1 foot of snow nor over  $1\frac{1}{2}$  inches of icy crust on top. If the ice comes first and the snow later, it is impossible for the deer to dig out the feed.

"I noticed in my travels that the feed was on low hills and lowlands, the high hills being barren.

"The guide, Charley, said that for a long distance into the interior the low-



lands were the same as passed over, thus showing that, should it be necessary to go to the interior this winter, there will surely be plenty of feed for the reindeer."

Very respectfully,

MINER W. BRUCE,  
*Teacher.*

Rev. SHELDON JACKSON,  
*General Agent of Education in Alaska.*

#### APPENDIX G.

#### RECONNOISSANCE EAST OF PORT CLARENCE, BY MINER W. BRUCE.

##### REINDEER STATION, PORT CLARENCE, ALASKA.

*August 19, 1892.*

SIR: In your letter of instructions for the government of this station, dated July 4, ultimo, you suggest, among other things, that two expeditions be sent out for the purpose of ascertaining the prospects for winter grazing for the reindeer, should the country in this immediate vicinity become covered with ice or deep snow, thus preventing the deer from pawing through it for food.

One route designated by you was to the north for the station, in the direction of Kotzebue Sound; and in accordance with your instructions Mr. Gibson, on the 27th ultimo, made a trip in that direction, lasting four days and a half, the result of which I communicated to you officially on the 2d day of the present month.

On the 3d instant I started on a trip to the northeast, with an oomeak and seven natives, expecting, if my health permitted, to be gone ten days or two weeks.

Our route lay through Grantley Harbor into Imnrock Lake, and having a fair wind, we made a splendid day's sail, taking us about half way through the lake, and camping the first night on the west side.

I wish especially to call your attention to the route from Grantley Harbor into Imnrock Lake, as it affords, in the event of severe storms, unusual shelter for the deer.

A narrow passage, probably 6 miles in length, connects these two beautiful bodies of water, and as it winds its zigzag course along the line of bluffs on each side, which commence immediately on leaving Grantley Harbor, is unbroken until Imnrock Lake is reached. The passage seems to be of nearly an uniform width, and will not exceed, at its widest part, one quarter of a mile. The bluffs on both sides are about 200 feet high, and there appears to be water sufficient to float an ocean vessel.

At several places along the route I left the oomeak, and with the Siberian herder went to the top of the bluff and found the country to the north a gently undulating table-land, and with my glasses I could see that for several miles this character of country did not seem to change.

On the south side the same aspect of country appeared, but 4 or 5 miles to the south the country became more broken, and took in what appeared to be low mountains.

The whole surface of the country on both sides was covered with a luxuriant growth of low bushes, occasional patches of grass, having the appearance of blue joint, and what was certainly red-top grass and mosses.

Even on this table-land the surface of the country was very uneven, being in places hummocky, and the little spots between seemed to be marshy and often filled with water.

The Siberian herder seemed much pleased with the character of the feed, and frequently pointed out the different kinds of grasses or shrubbery that the deer were fond of, and always designated the moss as choice winter grazing.

From the natives in my party I learned that the snow in this passage does not reach a depth of over one foot, and usually less; also, that when one side of the passage is covered with snow, the other is lightly covered. If this be true, it would appear that the deer, if it becomes necessary to move them from the station, can find good grazing either one side or the other of the passage; and in severe storms a refuge may be had behind the high walls of the bluffs.



On the morning following our first day's sail I took the herder to the top of the hill just back of our camp. It is probably four or five hundred feet high and runs out to a point into Imnrock Lake. From its top a splendid view of the country in every direction is had. The general contour, as far as I could see, was the same as that observed from the bluffs along the narrow passage. My position commanded a view to the northwest, north, and northeast, and for a distance of 25 miles at least the same character of country prevailed. As far as the eye could reach not a mountain was visible and not a speck of snow was seen.

To the west there were several miles of what appeared to be a marsh, or a very low land, covered with little patches of water back from the lake. These gradually disappeared in the north, where the land became higher and of the same general character I found farther to the south.

From my position I could see the faint outline of the north end of the lake, probably 12 or 15 miles away, and I thought I could discern the winding course of a river coursing through the table-lands to the north, and if so, it was probably the Agee-ee-puk River.

On the sides and top of the hill from which I was making my observations there was a thick growth of the same kind of grasses and shrubbery found the day before. I was surprised to find along the route to the top of the hill patches of low willow and elder bushes, from the branches of which twittered and flitted small birds, and every few paces we advanced aroused ptarmigan in large numbers.

There was nothing in the appearance of the country, so far as I could see, that would suggest anything like what one would expect to find bordering on the Arctic circle. On the contrary, the vegetation, much of it, was such as is found in temperate climates, and the birds and insects of the same variety that abound in country where the mercury never ranges lower than zero.

From my position on the top of the hill I could see what appeared to be a break in the range of mountains on the south side of the lake, and as the wind was blowing from the north, thus preventing farther advance in the present state of the weather, I concluded to sail to the other side and investigate the country in that direction.

The distance across was about 4 miles, but the wind died out when about half way across, and we were compelled to paddle the rest of the way, a very slow process of travel in an oomeak.

On reaching shore we went into camp, and after dinner I started with the natives for the mountains. My purpose was to simply get an idea of the country between the shore of the lake and the foot of the mountains that day, and take all of the next for determining the extent of the pass.

All the afternoon we traversed the lowlands towards the mountains and found the same general growth of vegetation as that found before. It could not well be of thicker growth or to all appearances more nutritious. If anything there was more moss, and perhaps the low bushes hung fuller with blueberries than any found before. There were several small mountain streams leading across to the lake, and if they were supplied from melting snow it was far up or hidden between narrow gorges, as none were seen from where we traveled.

It was after 6 o'clock when we returned to camp, and before retiring the natives understood that on the morrow we were going to try to find a passage into the interior.

Accordingly, by 7 o'clock we were ready to begin our tramp. We took with us an ax, spade, field glass, and two hard-tack apiece. Our course lay across the lowlands towards what appeared to be a break in the mountains, and it was at least 7 miles from camp across to the entrance. Part of the distance lay over comparatively smooth land, and a considerable portion over hummocky ground. There did not appear to be any difference in the thickness of the vegetation or the variety in these two different surfaces, but the rough ground was the most tedious I have ever attempted to travel over. The little ridges or hummocks are too wide to step over, and too shaky to stand upon, so that our trip over this section was a series of ups and downs, mostly the latter.

At our stops for rest I had holes dug with the spade and was surprised to find a black, sandy soil, from 1 foot to 3 feet deep, in nearly every instance. Sometimes we could not dig more than a few inches on account of encountering stone or slabs of rock, but this was not the rule. I thought I discovered the secret of such a heavy and luxuriant vegetation here, from the rich class of the soil and the abundance of water.

In our way towards the break we passed through two groves of elder and willow trees that were dense, of from 2 to 4 inches in diameter near the butt and



from 10 to 15 feet high. It was evident that a little grubbing and thinning out would have improved the size of these trees materially.

Our journey up the side of the mountain near what appeared to be a pass was a tedious one, for the nature of the ground was more or less hummocky. I find that this class of land is as liable to occur on high or table land as upon low and marshy ground.

It became apparent as we ascended the mountain that the break or pass which appeared to extend through the range was a false one, and when near the top it appeared to be a sort of blow-out which came to an abrupt perpendicular at the end of a sudden break ahead. From the top of the mountain we had ascended, although not the highest by considerable, we could see that the country to the south was a succession of mountains of perhaps 2,000 or 3,000 feet high, and that there was no pass into the interior unless following the course of some river.

Accordingly, we commenced our descent about 2 o'clock, and varied our course somewhat. It took us farther to the east along the base of the mountains and then straight to camp.

On our way back we passed over a section of country that was a complete bed of moss. We could rake it up in armfuls, and in a few minutes, during a spell of rest, we gathered sufficient to feed, as our Siberian herder declared, our whole herd of about 150 head of deer for one day.

If his estimate was correct, I feel assured that in this particular section a half-dozen men with hand rakes and pitchforks could, in one week, gather enough to feed our herd the coming winter.

At different times during the day, as had occurred during the day before, the Siberian herder gave me to understand that a trip in search of winter grazing was a useless expenditure of time; that what might appear to be good feeding ground now, when winter set in might be covered with a thick crust of ice or deep snow; that nothing could be told from the lay of the land whether feed could be gotten at by the deer or not; that a locality which was all that could be desired this winter would be totally inaccessible next; that it was the practice on the Siberian side to select what appeared to be a good section for winter grazing, and if it became covered with thick ice or deep snow, to move the deer to some locality where feed could be had.

This was the same information Mr. Gibson had gathered from our chief Siberian herder, whom he had with him, and I partly resolved, if the wind was not favorable for moving north the following morning, to retrace my steps and return to the station.

I had left rather against my judgment, for my work of late had told on me and I needed rest. On my return to camp that evening I was completely worn out, and during the night experienced a slight chill.

The morning broke rainy, and I was feeling miserably. The judgment of the Siberian that it was a useless trip was a strong argument in my present condition, and when, an hour later, a strong north wind settled the matter of progress towards the north against us, at least for that day, but was a fair wind for the station, I ordered everything packed, and, after about fourteen hours' sail, reached the station.

As we must in a considerable measure depend upon the judgment of the four Siberian herders, who have spent all their lives in the rearing and care of reindeer, it seems to me that in the present state of affairs at the station, with so much to do and so little time before cold weather will set in, when the presence of myself and Mr. Gibson is required, further exploration in search of winter feed ought to be abandoned, or at least postponed until later in the fall.

From this view of the matter, I would respectfully ask a modification of your instructions upon this point.

I have the honor to be, very respectfully,

MINER W. BRUCE,  
*Teacher.*

Rev. SHELDON JACKSON,  
*General Agent of Education in Alaska, Washington, D. C.*



## APPENDIX H.

## INSTRUCTIONS FOR GUIDANCE OF REINDEER STATION.

ON BOARD U. S. REVENUE MARINE STEAMER BEAR,  
*At anchor off Port Clarence, July 4, 1892.*

SIR: During the months of August and September, 1891, I purchased in Siberia and landed (September 21) at Unalaska sixteen domestic reindeer. Having no herder to take charge of them, I turned them loose on the small island of Amaknak, where they successfully wintered.

The landing this morning at this station from the U. S. Revenue Marine steamer *Bear* (Capt. Michael A. Healey, commander) of a band of fifty-three domesticated reindeer from South Head, Siberia, together with four herders, marks the establishment of the first herd of the kind in Alaska.

This is an event of far more than ordinary importance. If successful, it will create throughout northern and central Alaska a new food supply in place of the whale, the walrus, and the fur-bearing animals that are yearly becoming scarcer and more difficult to obtain.

Furnished a better and surer food supply, the native population, now decreasing in numbers, may reasonably be expected to increase.

Changing them from mere hunters to herdsmen, it will be the first upward step in their civilization.

With the increase in civilization of the natives and the general introduction of domestic reindeer, the vast, bleak, frigid, and now comparatively useless plains of Arctic Alaska will be reclaimed and become a source of wealth and prosperity to the land.

The realization of this desirable condition of things is largely in your hands. The friends of the movement and the National Government, which has been asked to extend it, will be encouraged to go forward or led to withdraw from further effort as the herd now intrusted to your care prospers or comes to naught.

With so much at stake, you will make the care and welfare of the herd your first and most constant care. Everything else is of secondary importance.

## WINTER GRAZING.

The most trying season will be next winter, when the food that now abounds everywhere will be largely covered up with snow and ice. In Siberia I am informed that the winter grazing is sometimes from 100 to 150 miles away from the summer grounds, the herd being driven back and forth spring and fall.

It is essential, then, that you take early steps to find a good location for winter. To this end I would advise that as soon as your house is inclosed you take Charley and the most experienced of the Siberian herders and make a thorough exploration of the surrounding country. I would make one trip through Grantly Harbor, Yoks-hook River, Imrock Lake, to the headwaters of Agee-ee-puk and Cov-vee-arak rivers; also, on the trail from Grantly Harbor towards Unala Kleet and St. Michael. I would also advise a trip into and through the mountains north of the station. Charley will be a good guide, and perhaps the Siberian will know by the lay and general appearance of the land the most suitable place to winter.

I feel great solicitude with regard to this. A mistake may result in the loss of our herd by starvation. The natives around Port Clarence affirm that, while there is not much snow on the plains between the hills and the sea, yet it is covered with a hard, icy crust which the deer can not break through for food. They further say that, years ago, when the wild reindeer frequented the coast, they were only found in summer—that in winter they migrated towards Norton Sound.

It may prove that the winter grazing grounds that shall be selected may be too far away; that it will become necessary to close up for the winter the present house and establish temporary headquarters in the vicinity of the deer. If this necessity arises, I would suggest that you build a log house (if in a timber country) or a dugout for winter use.

## PROTECTION FROM DOGS.

Another danger to the herd arises from the attacks of strange dogs. You will, therefore, require one of the herders on watch to be armed, and instruct



him to shoot down any dog attacking the herd and report the same to you for settlement. When a dog is thus killed you will send for the owner, explain to him the necessity for the step, express your regret at his loss, and then make suitable payment for the dog.

When any visiting natives come into your neighborhood have them notified at once that they must keep their dogs tied up. Deal firmly, justly, kindly, and patiently with the natives, and thus secure their good will.

Once a month you will count the herd, and if any are missing or have been killed note it down, with cause (if known), and report same with all the circumstances to the Bureau of Education.

If any exigency arises by which it becomes necessary to kill a deer for food, you will first use any surplus among the geldings, and after that from among the bulls. None are to be killed, however, except in cases of extreme necessity.

#### HERDERS.

The herders consist of two classes:

1. Experienced men from Siberia.
2. Native Alaskans who may wish to learn the management and care of reindeer.

The Siberians, being away from their friends and among a strange, selfish, and at times jealous and suspicious people, need your special care and protection. Take pains to make them feel that you have a fatherly interest in them. I hope their treatment will be such that they will choose to remain with us permanently.

The second class should be picked young men (one or two from a settlement), who are expected to take a two-years training in the care of the herd and thus become fitted to take charge of future herds in the neighborhood of their own homes. At the close of their two-years course, if they have been faithful to their duties and mastered the business, it is proposed to give them the deer as their start in life. This class will need constant watching. Anyone persistently refusing to obey necessary rules, shirking his duties on watch, or otherwise showing a want of interest in this work, or anyone that proves too dull to learn is to be dismissed from the service and sent away from the station.

The second class are to be subdivided into classes corresponding with the number in the first class.

For instance, if you should have twelve in the second class, and, as now, four in the first class, you will place three of the second class under the tuition and oversight of each of the four of the first class; and whenever he goes on watch they shall accompany him and be subject to his direction. It will then, as a general rule, be necessary for only one of the Siberians to be with the herd at a time. In case of sickness of one of the Siberians his pupils will be assigned duty with the others until the sick one recovers and returns to duty.

After conference with the Siberians you will be able to systematize the hours of watch. In this I would defer largely to the method pursued in Siberia.

When the seasons of watch are determined upon you will see that each watch promptly relieves the preceding one at the proper time.

The herders of both classes are to be housed, clothed, fed, and cared for at the expense of the station.

#### SHELTER.

At the home station, when off duty, have the herders construct comfortable dugouts for their own use. If you can spare the large dugout already commenced that can be turned over to the herders.

If it becomes necessary to have the herd a large distance off, buy some walrus hides for a covering, and let the herders make a small tent that can be moved from place to place.

You will make an inspection of the dugouts every Saturday, and require them to be kept as cleanly as possible. Allow no slops or offal to be thrown upon the ground near the door.

#### SUPPLIES.

You will furnish them with the necessary iron teakettles and pots for cooking. They are expected to procure driftwood for fuel. You will also furnish them a sufficiency of reindeer skins for bedding. These supplies are Government property, and are to be carried upon the inventory list.



## CLOTHING.

You will supply them with comfortable native fur clothing, according to the season.

If the supplies I leave with you for this year are not sufficient, you will employ some of the native women to make more. As the reindeer clothing can be purchased ready made in Siberia cheaper than made in Alaska, you will make out at each season a list of garments needed and respectfully request the commanding officer of the revenue cutter to have them purchased for you. For this you will furnish him sufficient barter from the reindeer trade goods.

Once a month you will inventory all bedding, clothing, cooking utensils, and other Government property used by the herders.

Twice a month, if the weather is suitable, all bedding should be hung out to air and sun upon a line erected for the purpose.

Herders of the second class need special watching that they do not give or sell their clothes, bedding, or other Government property to their friends.

## FOOD.

Flour, corn meal, pilot bread, beans, and tea will be sent from San Francisco. It is best, however, as far as possible, to preserve their native diet. You will therefore purchase supplies of oil, dried and fresh fish, etc.

As soon as you can determine it fix upon a regular ration, which you can issue daily or at regular intervals as experience shall show to be best.

Outsiders or friends are not to be allowed to gather in and eat with the herders. Nor shall the herders be allowed to give them food. If any food is to be given away it must be done by the superintendent or his assistant, and an account kept of the same, giving date, approximate amount, and number of recipients. You will encourage the herders when off duty to trap for rabbits and foxes both for fur and food.

When any garment, bedding, skin, or other property (except food) is issued to a herder or his wife, charge it against him in a book kept for the purpose. This will be a check against wastefulness, prevent any one receiving more or less than his share, and enable us to keep an account of the expense of training each individual.

## WIVES.

If any of the herders shall be married and have their wives with them, you can issue a ration and clothing also to the wife, requiring from her in return some sewing or cooking for the herders. If there are several women you can apportion the work among them.

## SCHOOL.

If circumstances permit, you will gather the herders that are off duty, and such others as may wish to attend, into the schoolroom for two or three hours daily (except Saturday and Sunday) and drill them in elementary reading, arithmetic, and writing. Special emphasis will be given, both in and out of school, to the use of the English language.

## FUEL.

As far as possible you will procure and use driftwood for fuel at the station. The coal is to be reserved for keeping a fire through the night and for seasons when you may be unable to secure driftwood.

## MORALS.

It is scarcely necessary to write that you will allow no liquor, gambling, profanity, or immorality at the station or among the herders.

You will allow no barter or unnecessary work at the station on Sunday.

You or your assistant must always be at the station. Both of you must not be absent at the same time. If the station is temporarily removed to the winter grazing grounds then that for the time being becomes headquarters.



## REPORTS.

1. You will keep a log book or brief daily journal of events at the station, extending from July 1 of each year to the following June 30. This book is to be mailed to the Bureau of Education.

2. You will keep in a book furnished you an itemized statement of all barter for supplies for the station, giving date of transaction, name and quantity of article purchased, and articles and quantities of each given in exchange. A copy of this statement will be annually forwarded to the United States Bureau of Education.

3. On the last day of March, June, September, and December of each year you will make out an inventory of all stores and public property in your possession, including bedding and cooking utensils in use by the herders. This does not include the clothing issued to and in use by the herders.

A copy of these reports will be forwarded by the annual mail to the United States Bureau of Education.

4. On the last day of June each year you will make out and mail to the United States Bureau of Education an annual report of operations at the station. In this report you will embody any recommendations that your experience may suggest for the benefit of the station.

5. On the 1st of August each year you will make a requisition for supplies for the following year.

As the work is new and untried, much must necessarily be left to your discretion and good judgment.

Wishing you great success, I remain

Yours truly,

SHELDON JACKSON,  
General Agent.

Mr. MINER W. BRUCE,  
Superintendent of Reindeer Station, Port Clarence, Alaska.

## APPENDIX J.

## DOMESTIC REINDEER IN LAPLAND.

[From Du Chaillu's Land of the Midnight Sun, vol 2, pp. 167 and 168.]

The Fjeld Lapp's time is engaged in adding to his herd, to which he and his family devote all their energies, for their welfare depends on the growth of the animals. It is difficult to ascertain exactly the increase or decrease of reindeer according to the districts, for the people often change, and there has been of late years in the North a large immigration of Norwegian Lapps to the territory of Sweden, especially to Keresuando, but, taken as a whole, the population and the reindeer are increasing. There is a greater number in Norway than in Sweden, owing to the number of stationary bönder (farmer) and sea Lapps which far outnumber the nomads.

According to the late census there are in Sweden (1870) 6,702 Laplanders, with 220,800 reindeer; in Norway (1865) 17,178 Laplanders, with 101,768 reindeer; in Finland (1865) 615 Laplanders, with 40,200 reindeer; in Russia (1859) 2,207 Laplanders, with 4,200 reindeer.

With those that belong to farmers and others I think we may safely say that the reindeer number about 400,000. The Samöides have the largest and finest breeds which are not numbered among those of the Lapps. In Kautokeino there are Lapps who own 2,000 reindeer; in Sorsele, in Sweden, one is said to own 5,000, and others 1,000 and 2,000. Some of the forest Lapps have 1,000. In Lulea Lappmark there are herds of over 2,000; in Finmarken, of 5,000; and some Lapps have owned as many as 10,000. A herd of 2,000 to 2,500 is said to give about 200 to 250 calves yearly.

Every owner has his own mark branded upon the ears of all his reindeers, and no other person has a right to have the same, as this is the lawful proof of ownership; otherwise, when several herds are mingled on the mountains, the separation would be impossible. According to custom no one can make a new mark but must buy that of an extinct herd; if these are scarce the price paid to the families that own them is often high; the name of the purchaser and each mark have to be recorded in court, like those of any other owner and property. The tax paid is according to the pasture land occupied.



## APPENDIX K.

U. S. REVENUE STEAMER BEAR,  
*San Francisco, Cal., December 6, 1890.*

DEAR SIR: Under orders from the Secretary of the Treasury, I have been ten years on the Bering Sea and Arctic Ocean station of the U. S. Revenue Marine Service.

My duties have brought me very closely in contact with and greatly interested me in the native population.

On account of this interest, I have watched with pleasure the coming among them of the missionaries of the several churches and the teachers of the Government schools.

I have also seen with apprehension the gradual exhaustion of the native food supply.

From time immemorial they have lived principally on the whale, seal, walrus, salmon, and wild reindeer. But in the persistent hunt of white men for the whale and walrus, the latter has largely disappeared, and the former been driven beyond the reach of the natives. The white men are also erecting canneries on their best fishing streams, and the usual supply of fish is being cut off; and with the advent of improved firearms the wild reindeer are migrating farther and farther away.

With the disappearance of the whale, walrus, salmon, and reindeer, a very large portion of their food supply is taken away, and starvation and gradual extinction appear in the near future.

On my recent cruise I was accompanied by Dr. Sheldon Jackson, United States General Agent of Education, and together we have made the question of a future food supply the subject of special thought and investigation.

We have consulted with a few of the leading teachers, missionaries, traders, and whaling captains whom we have met, and they, without a single exception, agree with us that the most practical relief is the introduction of domesticated reindeer into that portion of Northern and Arctic Alaska adapted to them.

In Lapland there are 400,000 domesticated reindeer, sustaining a population of 27,000. In Siberia, but a few miles from Alaska, with climate and country of similar conditions, are tens of thousands of tame reindeer supporting thousands of people, and it will be a very easy and comparatively cheap matter to introduce the tame reindeer of Siberia into Alaska and teach the natives the care and management of them.

This it is proposed to do in connection with the industrial schools established among the natives by the Bureau of Education. As in connection with the industrial schools in Dakota, Indian Territory, and elsewhere, the Indian boy is taught the raising of stock, so in the industrial schools of Alaska it is proposed to teach the Eskimo young men the raising of tame reindeer.

A few thousand dollars expended now in the establishment of this new industry will save hundreds of thousands hereafter. For if the time comes when the Government will be compelled to feed these Eskimo it will cost over \$1,000,000.

In Northern Alaska there are about 400,000 square miles that are adapted to the reindeer and are unfit for anything else.

This region has a present population of about 20,000, all of whom will be ultimately benefited by the new industry.

With an assured support, such as will come from herds of tame reindeer, there is no reason why the present population shall not be increased in numbers and advanced to the position of civilized, wealth-producing American citizens.

Asking for your favorable consideration and earnest advocacy of this matter,

I remain, very respectfully,

M. A. HEALY,  
*Captain, U. S. Revenue Marine.*

Hon. W. F. HARRIS, LL.D.,  
*U. S. Commissioner of Education, Washington, D. C.*

#### DESTITUTION AMONG THE ALASKA ESKIMO.

[An interview with Capt. M. A. Healy, U. S. Revenue Marine Service, in San Francisco Chronicle, December 12, 1890.]

For several seasons past the Eskimo of Northwestern Alaska have experienced great hardships in obtaining a supply of deer meat for their winter stores. It is to be feared that when the *Bear* makes her annual visit to the Arctic next



summer many of the villages will be found to have lost their residents from starvation. The latest advices from the Arctic report a failure not only in the autumn deer hunt, but in the entire catch of whales, walrus, and seals.

Naturally of a timid disposition the deer have learned that the natives with breech-loading arms are far more formidable foes than when bows, arrows, and spears were employed in the chase. Again, the Eskimo spare neither young nor old when a herd is found, and little suckling fawns, as well as does carrying young, fall victims to their guns.

Formerly on the lower Yukon around St. Michael, on Norton Sound, and in the country known as the Kotzebue Sound district, numbers of deer made yearly visits. Now it is rare to find that the natives living at these points have seen or tasted deer meat.

The Alaskan deer of the Arctic and sub-Arctic regions have been confounded with the reindeer of other localities, but while certainly belonging to the rangifer family, they are the true barren-ground caribou, differing from the upland caribou and domesticated reindeer of Lapland and Siberia in being smaller in body and horns. From July to September the instincts of the deer induce them to come from the interior to the seacoast to obtain rest and freedom from the tortures inflicted by the hordes of mosquitoes that infest the inland swamps, and also to get saline matter from the herbage and moss growing in proximity to the ocean. In September they commence their inland migration, and from July until the middle of October they are ruthlessly pursued by the natives. Some rest is afforded to the animals during the dark days that prevail in the Arctic zone from November until January, but as soon after the early part of February as the weather permits the food-seekers again take the field. The does have their young during April, and by a provision of nature the horns of the female only attain size during the time she is suckling the fawn and until it reaches such an age that it can feed—about two months.

When it is considered that a deer weighing on an average 125 pounds is consumed at a single sitting by five or six natives it may be readily perceived that the average returns of a successful hunting party must be large to feed a village.

During the past season in the Arctic the attention of Capt. Healy of the United States revenue steamer *Bear*, has been directed to a very pointed manner to the attainment of some method whereby the supply of deer for food and clothing purposes may be increased in Northwestern Alaska. This year, taking advantage of the presence on the *Bear* of Dr. Sheldon Jackson, United States Commissioner of Education for Alaska, the captain, in conjunction with Commissioner Jackson, intends to present to the Secretary of the Interior data upon the subject.

Within a radius of 100 miles inland from the shores of the ocean on the Siberian coast, from Cape Navarin to Plover Bay, there are a people known as deer men. They belong to the Chukchee tribe of Siberians, and are essentially a nomadic race, wandering from East Cape, on the northern coast, to Cape Navarin, southward. Accompanied by their herds of tame reindeer, aggregating in many instances thousands, they roam in search of food. These reindeer, while resembling the Alaskan species in the main, differ in the texture of their skins, the pelts being spotted brown and white, with a smooth surface. These deer men subsist mainly on the products of their herds, bartering the skins with the coast natives for tobacco, seal oil, walrus hides for their boot soles, and other minor commodities, such as powder, shot, lead, and flour. At Cape Navarin and East Cape, Siberia, they sometimes meet the whaling ships and sell them deer meat and skins for tobacco, etc.

Capt. Healy's ideas are to propose to the Government that he be empowered to purchase a number of these deer of both sexes and transport them on the *Bear* to some point on the Alaskan coast where moss and feed are plentiful. These deer are to form the nucleus of a herd, and from the yearly increase they can be distributed over other portions of the Northwest Territory. As the Alaskan Eskimo are not skilled in herding the deer, Capt. Healy intends, if permission be granted by the Government, to endeavor to enlist the services of some experienced Siberian natives to instruct them.

Unless some measures be adopted, as suggested by Capt. Healy, it is sure that a decade will witness the extermination of the people of our Arctic province on its northwest shores. The results of the active and unscrupulous chase of their pelagic food supplies by the whalers have already become evident; walrus are almost invisible on the ice floes within reach of the native hunters, while the flurried and galled whale makes its passage to the unknown regions of the Arctic Ocean at a speed which defies the natives to capture it.

The proposition of Capt. Healy will be communicated to the Washington authorities at an early date.



## DESTRUCTION OF THE WHALES.

[From Bancroft's History of Alaska, pp. 668 and 669.]

Of whaling enterprise in the neighborhood of the Alaskan coast mention has already been made; but a few statements that will serve to explain the enormous decrease that has occurred in the catch within the last three decades may not be out of place.

Of the 600 or 700 American whalers that were fitted out for the season of 1857, at least one-half, including most of the larger vessels, were engaged in the north Pacific. The presence of so vast a fleet tended of course to exhaust the whaling-grounds or to drive the fish into other waters, for there are no permanent whaling-grounds on any portions of the globe except those encircled by ice for about ten months in the year. In the seas of Greenland, not many years ago, whales were rarely to be seen; in 1870 they were fairly plentiful. The sea of Okhotsk and the waters in the neighborhood of the Aleutian Islands were a few decades ago favorite hunting grounds but are now almost depleted, while in 1870 the coast of New Siberia was swarming with whales. Schools of sperm whale are occasionally seen between the Alaska peninsula and Prince William Sound, and the humpback sometimes makes its appearance as far north as Baranof Island. Between Bristol Bay and Bering Strait a fair catch is sometimes taken, but most of the vessels forming what is termed the north Pacific whaling fleet now pass into the Arctic Ocean in quest of their prey. Probably not more than 8 or 10 of them are employed on the whaling-grounds of the Alaskan coast.

In 1881 the whaling fleet of the north Pacific mustered only thirty and in the following year forty craft, of which four were steamers. The catch for 1881 was one of the most profitable that has occurred since the date of the transfer, being valued at \$1,139,000, or an average of about \$57,000 for each vessel, some of them returning with cargoes worth \$75,000 and few with cargoes worth less than \$30,000. In 1883 the catch was inconsiderable, several of the whalers returning "clean," and few making a profit for their owners.

The threatened destruction of these fisheries is a matter that seems to deserve some attention. In 1850, as will be remembered, it was estimated that 300 whaling vessels visited Alaskan waters and the Okhotsk and Bering seas. Two years later the value of the catch of the north Pacific fleet was more than \$14,000,000.

After 1852 it gradually decreased until in 1862 it was less than \$800,000; for 1867 the amount was about \$3,200,000; in 1881 it had again fallen to \$1,139,000, and for the season of 1883 there was a still further reduction.

SAN FRANCISCO, *December 18, 1890.*

DEAR SIR: Referring to your desire to obtain information relative to the introduction of reindeer into the northwest portion of the Territory of Alaska, I would say that in my opinion the project is entirely feasible. My experience in Alaska permits me to state on authority that the next decade will witness the extinction of the American reindeer, or rather caribou. In 1881, when I first visited the district of Norton and Kotzebue Sounds and the lower Yukon, deer were plentiful. This past winter (1889) not a single animal had been seen within a radius of 200 miles. Similar conditions are coexisting from Port Clarence to Point Barrow, and where in former years the hunters had to travel but 50 miles to reach the deer haunts, to-day they traverse twice that distance. These contingencies arise from three causes:

1. The indiscriminate slaughter of young and old animals.
2. The use at the present day of improved weapons of the chase, in lieu of the primitive bows, arrows, and spears.
3. The conditions of wind prevailing at the seasons when the deer go to and from the coast. It must distinctly be understood that upon a supply of these animals our Alaskan Eskimo depend for clothing as well as their stores of meat, should their pelagic sources of provender fail.

The proposition to introduce deer from the Siberian herds can be effected at a cost of but a few thousand dollars.

The location for the first experimental station should be on Choris Peninsula or the vicinity of Kotzebue Sound. This location has climatic similarities with Siberia. The food (moss) supply is abundant and herding easy.



As the results of this initial experiment become manifest, additional locations for herds can be established. Within two seasons the Chukchee herdsmen will be able to instruct the Eskimo in the style of herding.

I have made inquiries upon the subject and now give you the result. Ten years ago the Russian steamer *Alexander* went to the Kamchatka Peninsula, and officers of the Alaska Commercial Company bought seven male and seven female deer, transporting them to Bering Island (one of the islands leased by the company from Russia). Capts. Blair and Greenberg, and Superintendent Lubegoll inform me that the herd now numbers 180. From this you can judge the rate of propagation.

The revenue steamer *Bear* can be utilized for transportation, and I know no man more capable of conducting the experiment than Capt. Healy.

I hope that the small sum required will be voted by Congress, as unless something is done for these people their annihilation is only a question of a brief period.

The whalers have so frightened the big fish that the natives are unable to pursue them in their rapid passage, while the extermination of the walrus is almost a fact.

These remarks I present as requested.

Yours very truly,

HENRY D WOOLFE.

Dr. SHELDON JACKSON,  
Washington, D. C.

#### WILD REINDEER IN ALASKA.

[Charles H. Townsend in the Report of the Cruise of the U. S. Revenue Marine Steamer *Corwin*, 1885, Capt. M. A. Healy, commanding, pp. 87 and 88.]

Reindeer are found more or less regularly throughout Alaska. They were found by Mr. McLennan on the Noatak, as well as by our party on the Kowak. Traders in the service of the Alaska Commercial Company told me of their common distribution over the Yukon, Kuskokvim, and Aleutian divisions of the country. They have even been shot on Ounimak Island, at the end of the peninsula; but reindeer are restless animals, irregular in their migrations and habits. Sometimes they desert whole sections of the country for months together, and they appear to have withdrawn from many regions where firearms have been introduced. Notwithstanding the fact that large herds of reindeer are kept in a state of domestication by the Chukchees at East Cape and other well-known places on the Asiatic side of Bering Straits, with whom the natives of the Alaskan side communicate regularly, there appears to be no domestication of the species whatever in Alaska, nor indeed in any part of North America.

In time, when the general use of firearms by the natives of upper Alaska shall have reduced the numbers of this wary animal, the introduction of the tame variety, which is a substantial support to the people just across the straits, among our own thriftless, alcohol-bewitched Eskimos, would be a philanthropic movement, contributing more toward their amelioration than any system of schools or kindred charities. The native boats could never accomplish the importation, which would, however, present no difficulty to ordinary seagoing vessels. The taming of the American reindeer is impracticable, for domestication with this animal at least is the result of subjection through many generations. Something tending to render a wild people pastoral or agricultural ought to be the first step toward their advancement. In our management of these people, "purchased from the Russians," we have an opportunity to atone, in a measure, for a century of dishonorable treatment of the Indian.

#### REINDEER.

[From *Encyclopedia Britannica*, vol. 7, pp. 24 and 25.]

The reindeer (*Tarandus ranqifer*), the only domesticated species of deer, has a range somewhat similar to the elk, extending over the entire boreal region of both hemispheres, from Greenland and Spitzbergen in the north to New Bruns-



wick in the south. There are several well-marked varieties, differing greatly in size and in form of the antlers, the largest forms occurring farthest north, while by many writers the American reindeer, which has never been domesticated, is regarded as a distinct species. The antlers, which are long and branching, and considerably palmated, are present in both sexes, although in the female they are slender and less branched than in the males. In the latter they appear at a much earlier age than in any other species of deer, and Darwin conjectures that in this circumstance a key to their exceptional appearance in the female may be found. The reindeer has long been domesticated in Scandinavia, and is of indispensable importance to the Lapland race, to whom it serves at once as a substitute for the horse, cow, sheep, and goat. As a beast of burden it is capable of drawing a weight of 300 pounds, while its fleetness and endurance are still more remarkable. Harnessed to a sledge it will travel without difficulty 100 miles a day over the frozen snow, its broad and deeply cleft hoofs being admirably adapted for traveling over such a surface.

During summer the Lapland reindeer feeds chiefly on the young shoots of the willow and birch: and as this season migration to the coast seems necessary to the well-being of the species, the Laplander, with his family and herds, sojourns for several months in the neighborhood of the sea. In winter its food consists chiefly of the reindeer moss and other lichens, which it makes use of its hoofs in seeking for beneath the snow. The wild reindeer grows to a much greater size than the tame breed, but in Northern Europe the former are being gradually reduced through the natives entrapping and domesticating them. The tame breed found in Northern Asia is much larger than the Lapland form and is there used to ride on. There are two distinct varieties of the American reindeer, the barren-ground caribou and the woodland caribou. The former, which is larger and more widely distributed of the two, frequents in summer the shores of the Arctic Sea, retiring to the woods in autumn to feed on the tree and other lichens. The latter occupies a very limited tract of woodland country, and, unlike the barren-ground form, migrates southward in spring. The American reindeer travel in great herds, and, being both unsuspicious and curious, they fall ready victims to the bow and arrow or the cunning snare of the Indian, to whom their carcasses form the chief source of food, clothing, tents, and tools.

#### APPENDIX L.

Capt. M. A. Healy, in January, 1892, writing to Senator Charles N. Felton, says:

"The three great problems of existence of both natives and whites in the Territory of Alaska are food, clothing, and transportation. They are to be solved in a rigorous climate and rough and almost impenetrable country, and one in which nothing as yet is produced from the ground. The food supply must either be found in the flesh of the wild animals and birds of the country or brought from without. With the white population the food might be said to be brought wholly from without. The enormous expense this entails has kept this population down to the narrowest limit of employés of firms or companies capable of maintaining stations there and confined these stations to a few scattered well-known points along the immense stretch of seacoast or on some of the principal rivers as the Yukon.

#### "FOOD SUPPLY.

"The native population of the northwest part of the country depend for food upon whale, walrus, seal, fish, and what few wild animals, such as deer and caribou, they can kill. The whale and walrus have been so persistently pursued by white men that they have rapidly diminished and are now so scarce and shy that their capture by the natives is attended with great difficulty and uncertainty. This scarcity of their principal supply of food is greatly felt by the natives along the whole northwest coast and to such an extent that in the short space of winter whole villages have been wiped out.

"I have seen almost the entire population of St. Lawrence Island lying strewn about their huts dead from starvation. And this winter of 1891-'92 the same fate may be that of Kings Island. Upon my visit there in September last, the seal and walrus catch having failed them, the natives were reduced to the direst extremities. Their larders were exhausted and their only means of subsistence



their dogs and the kelp and carrion cast up by the tide. What supplies could be spared from the vessel and what bought at St. Michaels station were given the people, with the hope that it would tide them over until more successful hunting. But this hope is not without misgiving that upon my return in the spring I shall find many of them whom I count as friends cold in death. The interior natives are dependent wholly upon caribou and deer and what fish come into their streams during the short summer. Caribou and deer are rapidly diminishing there, as they have in other countries, and the fishing streams are being taken up by white men, so that the lines of existence are on all sides being drawn tighter and tighter about these poor native Alaskans.

#### REINDEER-SKIN CLOTHING.

"Clothing of reindeer skin has been found the best and only kind to withstand the intense and continued cold of the country. These skins are now bartered at a high price from the natives of the Siberian coast, and are passed along the Siberian side from village to village, increasing in value the farther they go from the Bering Straits. The experience of white men and natives has been the same, and even in our summer visits to the country we on the vessel use reindeer clothing to keep from suffering.

"The methods of transportation now in use in Alaska are by dog trains and boats. By boat it is impossible to travel nine months in the year, and during the three months of summer when the streams are open they can be used only down stream. By dog trains transportation is limited, slow, and uncertain, and the greater part of the load is taken up with food for the animals. These dogs have been so closely bred that they are now degenerated in size, strength, and sagacity. I have for years been requested by natives to bring them a larger breed to improve their dogs, and the Hudson Bay Company has imported the English mastiff for use in trains where the native dog is too slight.

"Among the whites the greatest difficulty experienced by miners, missionaries, explorers, and residents has been the want of a rapid and assured means of transportation. The history of every expedition that has penetrated into the country any distance from the coast has been one of suffering and oftentimes hunger from the difficulty of travel and packing. Horses, cattle, asses, and other beasts of burden, excepting tame reindeer, are out of the question because they can not live in the country, and it is impossible to provide food for them when snow covers the ground the larger part of the year. On account of this difficulty the country, except along the seacoast and a few of the navigable rivers, is as little known to-day as when it was first bought. And those great mineral deposits which Alaska is said to contain remain as yet undiscovered.

#### "WHAT THE REINDEER MIGHT DO.

"To my mind the only satisfactory solution of all three of these problems, important as they are, is the introduction of tame reindeer into the country. In proper numbers they will transform the native population from a fishing to a pastoral people, and prove to them a never-failing supply of food. The hides of the animals already furnish almost the only clothing used, but at a greatly exaggerated cost. And to the white explorers, miners, missionaries, and settlers the reindeer will prove a means of transportation and packing that will enable them to learn and develop the resources of a vast country.

"The natives of Siberia have for centuries herded and reared the tame reindeer, and thus been safe against periodical periods of starvation when the whale and walrus fail them. They are a strong, swift, and hardy animal, tractable, and easily broken to harness and packing, and especially adapted, or, in fact, made for the country and climate. In travel they are self-sustaining. The supply of moss upon which they feed covers the whole of northern Alaska, and instinct leads them to secure it in winter as well as summer by burrowing through the deepest snows. It is not necessary for us to speak of the value of such pack animals to the prospector. To the explorer they are equally valuable, and when supplies fail are equally valuable as food.

"If I may revert back to the days of the Western Union Telegraph expedition to that part of the country, where reindeer could be procured for drafting as well as for food, the thousand and one obstacles that at first seemed insurmountable were, through the medium of these animals, easily overcome.

"The natives of Alaska quite see the advantage of such an animal in their



midst, have expressed to me their eager wishes for them, and along the Yukon, the most thickly settled part of the country, the white people are enthusiastic over their introduction, for in them they see a solution of many of the difficulties of existence there.

"Horses and cattle have been tried in this section, but, on account of the unacclimated nature of the animals and the impossibility of feeding them in winter, with no success.

"THE SIBERIANS WILL SELL.

"Some writers and others have claimed that the Siberian natives will not sell reindeer to white men, but Dr. Jackson and I have disproved this by buying during the past summer, at different points on the Siberian coast, sixteen of the animals, and securing promises to sell us as many as we could take care of the coming summer, should they be wanted. The sixteen we purchased, the first ones to be introduced into the Territory, we placed at Unalaska for propagation.

"I believe this is the most important question that bears upon the Territory of Alaska to-day, and a small sum donated by Congress for the purpose will in the end develop the country, its character and resources, and prove a great benefit to the commerce and wealth of the United States in general and the Pacific coast in particular.

"I am referring not to the Alaska of the tourist—that narrow strip of island from the southernmost boundary to Sitka—but to that immense territory of 500,000 square miles of the north and west of which the world has no knowledge and no conception, and to which the Alaska of the tourist bears as much relation as the State of Florida does to the whole United States."

APPLICATION FOR A TEAM OF REINDEER.

FORTY MILE CREEK, *August 13, 1892.*

DEAR SIR: Capt. Peterson informs me that you would bring some reindeer, bought by the Government to distribute in Alaska. If you did get any and send me a pair, or, better, two cows and one bull, I will surely reward your trouble. I am doing freighting here in the winter with dogs, and reindeer would be far ahead of them. You could leave them in somebody's care in St. Michael for the winter, and have them sent up here in the spring. I will pay for all the expenses. If you did not get any this year for the Government, and you have a chance to buy some for me, I wish you would do it, and I will pay for them whatever, it is.

Respectfully,

FRITZ KLOKE,  
*Forty Mile Creek, Alaska.*

APPENDIX M.

COMMERCIAL VALUE OF REINDEER.

[N. Width, importer and commission merchant of Scandinavian products, 63 Broadway, room 29. Cable address, "Puncheon, New York."]

607 PENN MUTUAL BUILDING,  
*Philadelphia, Pa., April 16, 1892.*

DR. SHELDON JACKSON,  
*Bureau of Education, Washington:*

I received your favor of the 14th and a pamphlet, which I have read with great interest. If reindeer can be imported in Alaska from Siberia and if there exists abundance of reindeer moss in Alaska, the facilities for realizing the plan are rather great.

Besides the advantages mentioned in the pamphlet, there exists one to which I want to call your attention—the great commercial importance.

To Sweden and Norway it is not only the Laplanders who live on reindeer: smoked reindeer meat and smoked tongues are sold everywhere in the said countries and the hides are in great demand, tanned to a soft skin (used for gloves, military riding trousers, etc.).



There are merchants in Stockholm the only trade of whom is in Lapland products, and the skins, dried with the hairs on, are exported by the thousands to Germany and England. I sold myself, 1878, about 5,000 such skins to a firm in Leipzig, Germany. The Norwegian Preserving Company use large quantities of reindeer meat for canning, and fresh it is considered a delicacy. Russia exports fresh reindeer meat, frozen, in carloads to Germany.

The price of smoked hams is in Sweden about 10 to 9 cents a pound; of smoked tongues, 8 to 10 cents apiece (or a pair, I can not exactly remember which); of dried hides, with hair on, \$1.25 to \$1.75 apiece, and more if they are not worm-bitten. The Swedish reindeer have mostly a kind of insect which lays its eggs in their skins; this causes holes which are seen in the skin when tanned, and diminish their value. The hairs are in great demand for the filling of life-saving apparatus (buoys, etc.), while they possess buoyancy in a wondrous degree. The best existing glue is made of reindeer horns. If I were sure of getting a trade in these articles and had the money, I would not consider it a moment, but go to Alaska at the first opportunity and make a fortune in ten years.

The number of reindeer killed for the trade (besides what the Laplanders use for themselves) is yearly 12,000 to 15,000 in Norway, probably 6,000 to 7,000, besides Sweden imports large quantities of meat and skins from Finland.

In 1881 I visited the fair in Nischni-Novgorod, Russia, and became there acquainted with a merchant from Nuhangel, who had brought to the fair 5,000 pair smoked tongues and 6,000 tanned skins (the tanned skins have a value of \$2 to \$3 apiece). A Swedish dragoon regiment wear trousers exclusively made of tanned reindeer skins (no other material permitted).

I think these facts might be of some interest. Capt. Healy says in his letter: "If the Government will be compelled to feed the Eskimo it will cost over \$1,000,000." If the Government realize the plan of domesticating reindeer, it would probably bring a good yearly income to the United States.

Yours respectfully,

N. WIDTH.

I should be very much pleased to learn later on how far the project succeeds and what steps the Government will take; if I move to Puget Sound next fall I shall probably make a trip to Alaska.

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PHILADELPHIA, PA., *December 31, 1892.*

DEAR SIR: Your favor of the 29th received, and in answer beg to say, that I wrote to a friend in Norway about a book or pamphlet, as desired; I think, however, it would be easier to get such book from England, as probably some English tourist or other has written about the Laplanders, who always have been an object of great interest to tourists traveling in Norway.

The acclimatization of reindeer in Alaska would most certainly considerably increase the revenues from this province, as soon as some thousand deer could be yearly slaughtered and the hides and meat brought into the market. I believe I have written to you hereabout on a previous occasion; the tanned skins (soft and with a beautiful yellow color) would no doubt find a ready sale; in Sweden they are paid with seven to ten kr. (\$2 to \$2.75) and used for military pantaloons, gloves, bed-pillows, etc., and the hair, owing to its great buoyant quality, is much used for life-saving material. Russia sends frozen reindeer meat by carloads to Germany.

If I had capital, and if the climate in Alaska were not too severe, I would like very much to start such trade, in which I have some experience.

There is also another animal which would suit admirably for Alaska—the so-called "Thibetian ox," "yak," also "grunting ox" (probably while grunting as a hog). The animal has feet as a goat, well fitted for climbing rocks and stones; the cow gives an excellent milk which gives an excellent butter (the reindeer has not this merit); is used in Thibet also very much for transporting purposes. This ox, which is to the natives in Thibet what the reindeer is to Laplanders, is admirably qualified to sustain cold, seems even to love the cold, and to thrive best in cold and rough weather; it loves to throw itself in frozen lakes and rivers, to lie in snow and shady places, is always lying in the open air, has to seek its food for itself, only the herders have to take care to bring it down in the winter in the lower regions where the snow melts and the food is accessible.

In Thibet these animals are completely left to themselves; if taken some care



of they might multiply quicker and be much improved. They are seen in the zoölogical gardens in Europe, probably also in this country; might be shipped from Bombay or Calcutta, I presume. This animal might become by and by as abundant in Alaska as formerly were the buffalo on the Western prairies, and make Alaska a visiting place for sportsmen.

With my compliments for the new year, I remain, dear sir, yours, respectfully,  
N. WIDTH.

Rev. SHELDON JACKSON,  
*Washington, D. C.*

P. S.—As a proof of what man can do with a good will and good sense, even in the cold, inhospitable region, I wish to mention that in a place in Sweden, under 67° north latitude, where rich iron ores have been found and bought by an English company, a Swedish colonel and engineer in 1890 planted a grand park and garden, where all kinds of vegetables are growing, even rhubarb, asparagus, cauliflower, raspberries, straw berries, currants, large pine and birch trees. The park has an area of 2,800 to 3,000 square feet.

#### APPENDIX N.

##### THE CHAMBER OF COMMERCE OF SAN FRANCISCO, *San Francisco, January 20, 1891.*

*Resolved,* That our delegation in Congress be requested to urge the passage of the joint resolution introduced December 19, 1890 (H. Res. 258), extending to Alaska the benefit of laws encouraging instruction in agriculture and the mechanic arts.

Adopted unanimously by the Chamber of Commerce of San Francisco this 20th day of January, A. D. 1891.

Attest:  
[SEAL.]

THOS. J. HAYNES,  
*Secretary.*









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