Cooperative Agricultural Pest Survey (CAPS)

Annual Reports Colorado FY2007

Compiled by: Colorado Department of Agriculture Plant Industry Division











Annual Report for Colorado

Cooperative Agricultural Pest Survey

February 29, 2008

Compiled by Department of Plant Industry Colorado Department of Agriculture

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CORE

1. Pest Detection CORE Project Kara Hempy-Mayer, Project Coordinator (CDA)

Survey

To achieve the objectives of the CORE project in 2007, a variety of activities and projects have been accomplished or are underway. From March onward, activities related to the Exotic Wood Associated Insect and Exotic Fruit Pests Surveys had begun. Research on site selection was done during March through May, and a seasonal technician was hired in May to carry out the trapping portions of these projects. Training materials were prepared for these surveys for the technician as well as several state inspectors. A lure for the Siberian silk moth was obtained later in the season, but we were still able to deploy these traps by July for several months of survey. Sampling for the Potato Cyst Nematode (PCN) survey was carried out for Colorado from March through November. The other surveys and biocontrol activities carried out by Colorado Department of Agriculture (CDA) were completed by October.

Colorado State University cooperators carried out a number of surveys, including: Common Bean Pests Survey, Cereal Crop Nematode Survey, Production Area Survey, Exotic Wood and Fruit Pest Surveys (in cooperation with CDA), Exotic Moth Survey, Cereal Leaf Beetle Survey, and Karnal Bunt and



Khapra Beetle Surveys. To date, we have received all data with the exception of biocontrol release data, which is not yet available, and data from the PCN samples that still need to be analyzed. All available data has been entered into NAPIS, as well as in ISIS in the case of PCN. We were again unable to

incorporate ISIS into the data collection/entry portion of survey projects this year due to time constraints. We intend to notify survey cooperators (landowners and business owners) of survey results.

Outreach

We continued with efforts to coordinate an expanded State Pest Committee begun the year before, with the purpose of sharing information on survey, detection, control, response, and outreach concerning all pests of concern to Colorado. Members of the group now include representatives from the following agencies or groups: US Forest Service, National Park Service, Bureau of Land Management, Ute Mountain Ute and Southern Ute Tribes, State Forest Service, State Park Service, City Foresters, and County Pest Coordinators, along with the SCC participants from the PPQ, CDA, and CSU. We held a first meeting in February 2007 regarding issues surrounding firewood movement in Colorado. This meeting was very productive, and led to increased dispersal of posters and handouts, message postings on agency websites, more outreach within agencies, and efforts to change firewood purchasing policies within agencies with campground firewood vendors. State Parks held a follow-up meeting in November, and the CDA requested that the Weights and Measures Division add "Curing Time" and "Place of Origin" to their firewood labels. The addition of "Curing Time" at least may be considered. This project is on hold until summer 2008, when the Western Weights and Measures Conference occurs. A request for the change can be submitted at that time, and if accepted, will be presented at the National Conference.

In collaboration with PPQ, CO State Forest Service, and City Foresters, we set up an Emerald Ash Borer Workshop for city and state foresters and landscape and nursery industry representatives in July. Three workshops were held in three different regions of the state, with participation ranging from about 25-35 people. Elizabeth Pentico, John Bedford, and Craig Kellogg of PPQ in Michigan traveled to Colorado to lead



these workshops, and their talks were very informative and well-received. John Bedford led a hands-on segment, in which participants learned how to strip ash logs to look for signs of EAB, as well as set a trap tree.

A large focus of our exotic pest outreach was again on generating materials highlighting a number of exotic pests of concern to Colorado. They included:

Booklets

a. Exotic Pests of Trees and Shrubs (updated)

Posters

- b. Protect Colorado's Landscape (firewood)
- c. Don't Destroy the Things You Love (firewood)

Other

- d. Buy It Where You Burn It! matchbooks (firewood)
- e. Notice on EAB Status in Colorado

The notice was sent out in response to a number of rumors and reports of tree-care specialists advising homeowners to treat for EAB, although we have not yet found EAB in Colorado. The camper firewood poster has been distributed statewide, to campgrounds and offices of the NPS, State Park Service,





State Forest

Service, and BLM. The larger firewood poster targeting landowners is intended primarily for agency offices to educate personnel, while the smaller of these will be going to firewood businesses that sell Colorado firewood. The booklets will go along with annual license renewals to nursery dealers. In addition, we designed and created a CAPS poster for display at conferences and the State Fair. All materials will be distributed at the ProGreen Expo, the Colorado Farm Show, the State Fair, and at other conferences that are appropriate.

A couple of exciting new projects are underway in collaboration with Dr. Whitney Cranshaw at CSU. The first of these is the Colorado Exotic Insect Detection and Identification Fact Sheet Series. These provide pictures and descriptive information of the target pest appearance and symptoms of damage, as well as regional look-alikes, and insects that produce similar symptoms of damage. Five fact sheets have been produced, one for each of the following five pests; Emerald Ash Borer, European wood wasp, gypsy moth, Asian longhorned beetle, and Light Brown Apple Moth. The fact sheets are available at the CSU Extension website <u>http://www.ext.colostate.edu/pubs/insect/exotic.html</u> In addition, Dr. Cranshaw created exotic pest learning materials for grades K-12, to be included in the Colorado Ag in the Classroom series. The design is finished and printing will be done in 2008.

We've expanded the CAPS page on the CDA website to provide background information, access to annual reports, and access to outreach materials (<u>http://www.colorado.gov/ag/dpi</u>). We hope to continue to expand this to include maps, summaries of past surveys, and pest links, including the new identification sheets. We are also linked to other websites, as well.

Emergency Response

The Emerald Ash Borer Workshop provided city, county, and state personnel with information regarding EAB identification and appropriate response efforts. Other than the workshop, we have yet not finalized the state emergency plan, nor put together response plans for targeted survey pests. We hope to accomplish this for next year. **Priority Pest List, Pest Risk and Pathway Analysis.** The SCC did not change the State Priority Pest List of exotic pests for FY2007. The following list is arranged alphabetically, not in order of priority.

Pest	Associated Pest List			
Focus on Survey and Information Outreach				
Apple ermine moth	Emerging Plant Pests			
Asian gypsy moth	Line Item			
Asian longhorned beetle	Emerging Plant Pests			
Bean bacterial wilt	Western Region List			
British Root-knot Nematode	National Pest List Top Twelve			
Cereal cyst nematode	Western Region List			
Cereal leaf beetle	State List			
Cherry ermine moth	Emerging Plant Pests			
Chrysanthemum white rust	Western Region List			
Citrus longhorned beetle	Line Item			
Daylily rust	Western Region List			
Egyptian cottonworm	National Pest List Top Twelve			
Emerald ash borer	Western Region List			
European gypsy moth	Line Item			
False codling moth	National Pest List			
Fruit piercing moth	National Pest List Top Twelve			
Giant woodwasp	National Pest List Top Twelve			
Japanese beetle	Emerging Plant Pests			
Karnal bunt	Line Item			
Khapra beetle	Emerging Plant Pests			
Light brown apple moth	Western Region List			
Mediterranean cereal cyst nematode	National Pest List			
Metallic beetle	National Pest List Top Twelve			
Old world bollworm	National Pest List			
Passionvine mealybug	National Pest List Top Twelve			
Pear leaf blister moth	National Pest List			
Phytophthora ramorum	Emerging Plant Pests			
Pine-tree Lappett	National Pest List			
Plum fruit moth	Western Region List			
Potato cyst nematode	Line Item			
Pratylenchus spp.	National Pest Universe			
Ralstonia solanacearum R3 B2	National Pest List Top Twelve			
Siberian silk moth	National Pest List Top Twelve			
Silver Y moth	National Pest List Top Twelve			
Sirex wood wasp	National Pest List Top Twelve			
Small white-marmorated longhorned	National Pest List			
beetle				
Soybean aphid	Emerging Plant Pests			
Soybean pod borer	Western Region List			

Soybean rust	Select Agent List		
Summer fruit tortrix moth	National Pest List Top Twelve		
Facus on Information Outreach Only			
	ion out each only		
Apple maggot/hawthorne maggot	Western Region List		
Cactus moth	Western Region List		
Cherry bark tortrix	National Pest List		
European grape vine moth	CO State Pest List only		
Horse thistle	Emerging Plant Pests		
Witchweed	National Pest List Top Twelve		
Additional Pe	sts Of Concern		
Archips xylosteanus	CO State List only		
Bacterial wilt of potato	National Pest List		
Bulb eelworm	Western Region List		
Chili thrips	CO State List only		
Columbia root knot nematode	Western Region List		
European chaffer	Western Region List		
European corn borer	Western Region List		
Golden nematode	CO State List only		
Iris yellow spot virus (tospovirus)	Western Region List		
Japanese wax scale	National Pest List		
Mediterranean pine engraver	CO State List only		
Onion white rot	Western Region List		
Oriental beetle	CO State List only		
Passionvine mealybug	National Pest List		
Pink gypsy moth	National Pest List		
Pine shoot beetle	Emerging Plant Pests		
Potato tuberworm	CO State List only		
Red imported fire ant	Line Item		
Red-haired bark beetle	CO State List only		
Silverleaf whitefly	CO State List only		
Soybean cyst nematode	Western Region List		
Stewart's wilt	Western Region List		
Swede midge	CO State List only		
Sweet potato whitefly	CO State List only		
Western cherry fruit fly	Western Region List		
White pine blister rust	Western Region List		

PEST SURVEY

2. Cereal Crop Nematode Survey 2007 Ned Tisserat, Project Coordinator (CSU)

The overall objective of the survey was to document the presence/absence of the British root knot nematode (*Meloidogyne artiellia* National Targeted Pest List) and cereal cyst nematodes (Mediterranean Cereal Cyst Nematode – *Heterodera latipons* National Pest List) in northeastern Colorado including the counties of Sedgewick, Phillips, Logan, Weld, Morgan, Washington, Yuma, Adams, Arapahoe, and Kit Carson. Our survey was similar to one being submitted by the Kansas Department of Agriculture to survey all counties in that state for exotic nematodes of cereals. Methods used in the two proposals were similar and will provide uniformity to the survey. Thus, the combined survey of Kansas and Colorado will provide valuable information on the distribution and abundance of exotic and endemic nematodes in the central Great Plains region.

No British root knot or cereal cyst nematodes were detected in the 550 samples collected in 2007 (See MAP 1, Page 32) . Several other endemic nematode species were recovered. The most abundant species in the sampling were species of the stunt nematodes (*Pratylenchus* spp.). Populations of stunt nematodes found in this survey can reduce wheat yields, although it may not be economically feasible to apply treatments.

3. Cereal Leaf Beetle Survey Dr. Louis Bjostad and David James, Project Coordinators (CSU)

Colorado State University conducted an early detection sweep/visual survey for the cereal leaf beetle. Small numbers of CLB larvae were found in three of four fields surveyed in Larimer County, and one of three fields surveyed in Routt County (See MAP 2, Page 32). In the four fields with CLB, numbers ranged from 1–11 larvae per 1,000 sweeps.



Cereal leaf beetle

Fifty fields were surveyed in the following 17 Colorado counties; San Miguel, Delta, Dolores, La Plata, Mesa, Moffat, Montezuma, Montrose, Rio Blanco, Larimer, Weld, Washington, Adams, Morgan, Phillips, Boulder and Routt.



Wheat, barley, rye or oats fields were surveyed in late May/early June when CLB is most likely to be present, using the following visual and sweep survey protocol:

Visual Survey: Surveys were conducted to detect larvae, adults and feeding damage. A minimum of

200 feet were walked in each field.

Sweep Survey: A minimum of 1000 sweeps were taken at each site and suspect specimens were preserved in alcohol for later examination.

4. Detection of Common Bean Pests in the Western Region Dr. Howard F. Schwartz, Project Coordinator (CSU)

For this survey, targeted pests included:

- Bacterial Wilt (*Curtobacterium flaccumfaciens pv. flaccumfaciens* (Cff)) of Dry Edible or Common Bean (*Phaseolus vulgaris*) – Western Region Pest List
- Egyptian Cottonworm (*Spodoptera littoralis*) #9 on the National Target List
- Old World Bollworm (*Helicoverpa armigera*) Top 25 on National Target List
- Silver Y Moth (*Autographa gamma*)
- Soybean Rust *(Phakospora pachyrhizi)* National Select Agents List
- Soybean Aphid (*Aphis glycines*) Emerging Plant Pest List
- Soybean Pod Borer *(Etiella zirokenilla)* Western Region Pest List



The purpose of this multi-state project was to conduct a state-wide survey of dry bean production regions for distribution of bacterial wilt and other pests of dry bean. The Vegetable Pathology & Pest Management Programs in the CSU Bioagricultural Sciences and Pest Management (BSPM) program provided technical support for enhanced plant health and crop production in Colorado and neighboring areas.

CSU vegetable pest management personnel conducted visual surveys for symptomatic plants in current (new crop seeded) and previous (volunteer) fields. County surveys were conducted in northeastern (Weld, Morgan), southern (Otero, Pueblo), and western (Mesa, Montrose) dry bean production regions of Colorado. These survey areas comprised 3 transects each with at least 5 fields per transect. The presence of the pathogen or pest was noted and tagged by GPS technology, thus readily creating maps to observe distribution. Visual surveys for other bean pests listed above were carried out in conjunction with the bacterial wilt surveys and pest presence/absence recorded. Soybean rust (SBR) and Soybean aphid (SBA) monitoring followed the national protocol as described at: <u>http://sbrusa.net/</u>. Suspect insect specimens were sent to Boris Kondratrieff at CSU for identification.



Bacterial wilt symptomatic plants (interveinal necrotic lesions surrounded by yellow borders on leaves, possible water-soaking of leaves or pods, wilted and dead plants) were transported in chilled coolers to the laboratory at CSU for initial analyses with standard laboratory

protocols. These included streaking of surface-sterilized symptomatic tissue and sap from such tissue onto bacteriological media, incubation, and observation for characteristic colony type. Suspicious colonies were purified and evaluated for pathogenicity in the greenhouse with susceptible seedlings (e.g., pinto Othello). Reisolated colonies were evaluated by use of real-time PCR and cryogenically preserved for future research and as a reference for comparison of isolates between different bean producing regions in future studies. Bacterial-wilt type cultures will also be sent to other cooperating diagnostic labs (e.g., at the Universities of Nebraska and Wyoming) for confirmation as *C. flaccumfaciens pv. flaccumfaciens*.

Results

Visual inspections and sweep net passes detected no targeted or unusual insect specimens. Occasionally, bean aphid, thrips, Mexican bean beetle, and/or Western bean cutworm adults and larvae were detected, but these represent endemic insect pests that are common in bean producing regions of Colorado and the surrounding region.

The 2007 survey targeted 12 pinto, 3 snap bean and 17 yellow commercial bean fields in eastern, southern and western bean growing regions of Colorado; (see attached Table 1, Page 13) with locations that were inspected. An additional 10 pinto fields in the western slope certified seed program were also inspected by a Colorado Seed Grower Association specialist (George Novotny) who is familiar with insect pests and diseases such as bacterial wilt. He found no evidence of unusual insects or bacterial wilt in any of these pinto fields. Likewise, we found no evidence of bacterial wilt-type symptoms in any pinto field that was surveyed throughout Colorado.

However, we did recover Curtobacterium flaccumfaciens-type (Cf)

colonies from symptomatic plants (less than 0.5 % incidence) in 10 of the 17 yellow bean fields surveyed in eastern (8 fields), southern (1 field), and western (1 field) Colorado, and 3 of 3 snap bean fields surveyed in western Colorado in areas with a history of yellow bean production. Seven purified cultures (noted with a Lab Isolate # in Table 1) recovered from infected plants in these fields have



Curtobacterium flaccumfaciens pv. flacumfaciens Photo: Howard Schwartz, CSU AgImage

been sent to another laboratory for additional tests (e.g., Biolog, GC-FAME) to confirm identity and hopefully pathovar designation; some of these *Curtobacterium* isolates differ slightly in cultural characteristics from our Cff (*Curtobacterium flaccumfaciens pv. flaccumfaciens*) standards. After we receive the final lab results, we will conduct growth chamber bean seedling pathogenicity tests with isolates that are confirmed as Cff or other Cf pathovars; and share pathogenic cultures with bacterial wilt cooperators in Nebraska (Dr. R. Harveson) and Wyoming (Dr. G. Franc).

We do not plan to repeat the Bacterial Wilt survey in 2008. It appears that the pathogen is not widely distributed and does not appear to pose a serious threat to the majority of our Colorado bean acreage that is devoted to pinto beans which seldom show evidence of infection; while yellow and great northern beans tend to be more expressive. In addition, the yellow bean acreage has declined in recent years, and seed quality has been improved with less obvious contamination by Bacterial Wilt.

On a related note, the bean pathology and breeding programs at Colorado State University are evaluating a wide range of bean germplasm for resistance to 3 pathogenic strains (yellow, orange, purple) of Cff recovered from Colorado and/or western Nebraska bean fields. Results will be compared with those generated by similar screenings that are ongoing at the University of Nebraska-Scottsbluff by Bob Harveson and Carlos Urrea. Great Northern Emerson continues to serve as a resistant check that is effective against all 3 strains. Resistant materials will be used by the dry bean breeding program to improve resistance of future bean varieties for growers in Colorado and surrounding region.

Table 1: 2007 BEAN / PEST SURVEY SHEET - Dr. H. F. Schwartz, BSPM - Colorado State University

	Lab		2007					
ID #	Isolate #	Date	Project	City	Road Markers	GPS – North	GPS - West	Comments
FR-1		06/08/07	BW	Eaton	74/37 S, west side	40.51431	104.71607	Myasi, Rod Weimer grower
FR-2		06/15/07	Survey	ARDEC	Field 400B, east side	40.64919	104.99607	Myasi, CSU
ARK-1		06/18/07		Rocky Ford	AVRC	38.03837	103.68955	Buckskin, planted 06/01/07
ARK-2				Rocky Ford	Hwy 50, Road 16 by Marker 365	38.07833	103.77979	Enola, planted 05/24/07, Les Mills, BW
E-1		06/25/07		Joes	Hwy 36 to Rd H, 2.25 mi N to Rd 8	39.68858	102.66931	Sprinkler, Bean VT + Legume PIPE Sentinel Plot
E-2		06/25/07		Proctor	Hwy 138, Rd 71, 3 mi N to Rd 60, 1 mi E	40.86411	102.88396	Furrow, Bean VT + Legume PIPE Sentinel Plot
WS-1	B613	08/13/07	BW	Montrose	¹ / ₄ mi N Spring Creek Blvd, north half N long	38.48740	107.91515	Dart snap Q61317, BW, BBS, virus ** Keith
WS-2			Survey	Montrose	East of the north field	38.48740	107.91515	Carlin
WS-3	B616			Montrose	Lacuer Place	38.47271	107.95332	
WS-4				Olathe	4 mile Corner, ½ mile	38.59728	108.06383	Grand Mesa pinto, John Harold [negative]
WS-5				Olathe	54.50, North Rolling Place	38.60652	108.04647	Bill Z pinto, David Williams [negative]
WS-6				Olathe	3 miles, Carrel Trinhail Place	38.60660	108.03678	Bill Z pinto, David Willimas [negative]
WS-7				Delta	Road 1325, Sawmill	38.73740	108.11607	Montrose pinto, Phil Knob [negative]
FR-1		08/16/07	BW	Eaton	74/37 S, west side	40.51431	104.71607	Myasi, Rod Weimer
FR-2			Survey	ARDEC	Field 400B, east side	40.64919	104.99607	Myasi
FR-3				Berthoud	West of town	40.18500	105.10150	Myasi, Steve Anderson, BW
FR-4				Lucerne	Hwy 392, 1 mile E of Hwy 85	40.48022	104.69673	Myasi, Paul Hungenberg, BW
FR-5				Lucerne	Hwy 392, 1 mile E of Hwy 85, ½ mile SE	40.46959	104.69081	Myasi, Paul Hungenberg, BW, WM
FR-6	B619			Greeley	Roads 64/39.5 south of main shed	40.45639	104.68747	Myasi, Paul Hungenberg, BW, WM
FR-7				Greeley	Roads 64/41	40.45049	104.67641	Myasi, Paul Hungerberg, BW
FR-8	B620			Greeley	Roads 64/41, ¹ / ₂ mile north	40.45688	104.67792	Myasi, Paul Hungenberg, BW, WM
FR-9	B621 &			Lucerne	Hwy 392 E, Road 41	40.47356	104.66987	Myasi, Les Peterson, BW
	B622							
FR-10	B623			Lucerne	Hwy 392, Road 43	40.47881	104.66556	Myasi, Les Peterson, BW
FR-11				Eaton	Roads 41/80	40.56685	104.66965	Myasi, Yetter, BW
ARK-3		08/23/07	BW	Vineland	South Ave, 36 th , ½ mile east	38.22780	104.46879	Pinto, no BW, trace WM
ARK-4			Survey	Vineland	South Ave., 36 th , 1 mile east	38.22643	104.42685	Pinto, no BW, trace WM
ARK-5				Avondale	Hwy 50/Wheeler, north	38.23684	104.38201	Pinto, no BW, some MBB
ARK-6				Avondale	Hwy 50/Martin , south	38.23102	104.33114	Pinto, no BW, pivot field
ARK-7				Avondale	Hwy 50/Martin, south	38.21309	104.31855	Pinto 'Vision', no BW

BW = Bacterial Wilt, WM = White Mold, Rust = Common Rust ID Codes: E = East, FR = Front Range, ARK = Arkansas Valley, WS = West Slope, Colorado Region.

5. Emerald Ash Borer Firewood and Tree Survey Dr. William R. Jacobi, Project Coordinator, Colorado State University

Firewood can harbor insects and fungi and transport those organisms across state borders. Currently there are several exotic insects and fungi that we hope to prevent from moving into new areas of the US. These organisms can cause major epidemics to trees such as the sudden oak death pathogen in California and the emerald ash borer in the Midwest. Future movement of exotic pests might be prevented if we can learn how to manage and restrict the movement of infested wood, particularly firewood.



emerald ash borer

Objectives of Emerald Ash Borer Firewood and Tree Survey

- Campground Trapping
- Firewood Survey
- Education

Campground Tree Trapping

An emerald ash borer (EAB) trap tree survey was conducted between June and September of 2007 at nine campgrounds across the state by Dave Leatherman, retired Colorado State Forest Service entomologist. No emerald ash borers were found (See MAP 3, Page 33). Firewood posters and EAB information was distributed at all locations and six additional locations in Colorado.

Two potted ash trees were placed at each campground and watered periodically

by park personnel over the summer, though they were still allowed to be under stress. Sites were chosen because of the potential presence of out-of-state campers transporting infested firewood. The majority of sites were in State Parks campgrounds, while three of the nine were private or KOA campgrounds. Sites were located in Yuma, Prowers, Bent, Pueblo, Adams, Douglas, Larimer, Moffat, and Ouray Counties. Trees were inspected at the end of the season. No adult EAB or symptoms were found.



Firewood Survey

Western United States Firewood Survey (not funded by CAPS)

A western states retail firewood survey of 137 retail outlets in 27 cities across 10 states was conducted in spring 2007 and revealed that 38% of the firewood bundles came from companies whose headquarters were located out of state. Sixty percent of the wood was conifer, 30% was hardwood only, and 10% of the bundles contained both. In this survey, evidence of current or past insect presence was noted on 58% and presence of fungi on 56% of the bundles.

Colorado Firewood Survey

Cities throughout Colorado were chosen to survey local businesses for firewood sales. Surveys were conducted through phone interviews, store visitations and firewood sampling. Three types of retailers were chosen for the majority of sampling.

<u>Western slope</u>

- Durango
- Glenwood Springs
- Grand Junction
- Rifle/Vail

Eastern plains

- Sterling
- Burlington
- Lamar

Front Range

- Lakewood
- Fort Collins
- Colorado Springs
- Pueblo

Major Retail Types chosen for Colorado Firewood Survey:

- Big box/department stores (e.g. Wal-mart)
- Grocery stores (e.g. Safeway)
- Convenience stores (e.g. 7-11, gas stations)

C. Firewood Survey: Colorado

We contacted or visited 114 retailers in Colorado and asked if they sold firewood

at all, year-round, or seasonally. Results are separated by region:



- Eastern Colorado
 - 90% do not sell firewood
 - 10% do sell (all year)
- Western Slope, Colorado
 - 42% do not sell firewood
 - 26% do sell (all year)
 - 33% sell firewood seasonally (winter only)
- Front Range, Colorado
 - 33% do not sell firewood
 - 59% do sell (all year)
 - 8% sell firewood seasonally (winter only)



A visual survey of firewood status (wood supplier and contact information, wood species identification, insect holes, fungal fruiting body presence, etc.) was conducted at randomly selected stores. Firewood was collected for insect rearing and fungal isolations. The majority of firewood visibly examined was purchased for insect rearing. As of December 1, 2007, we visibly surveyed and/or collected 42 bundles of firewood throughout Colorado. Forty-five percent of the wood assessed came from companies whose headquarters were out of state (California, Texas, Kansas and British Columbia, Canada). Seventy-one percent of the wood was conifer, 24% was hardwood only and 5% of the bundles contained both conifer and hardwood species. We will identify firewood down to genus and/or species.

Species identified as of December 1, 2007:

- Lodgepole pine (*Pinus contorta*)
- Ponderosa pine (*P. ponderosa*)
- Elm (*Ulmus* spp.)
- Douglas-fir (*Pseudotsuga menziesii*)
- True fir (*Abies* spp.)
- Oak (*Quercus* spp.)
- Aspen (*Populus tremuloides*)
- Cottonwood (*Populus* spp.)
- Western red cedar (Thuja plicata)

Insect and Fungal Evidence of Firewood

Firewood from Colorado was assessed for wood species, and fungal and insect contaminants. Sixty-four percent of firewood had evidence of Ascomycete or Basidiomycete fruiting bodies or had evidence of blue-stain fungi. To determine if firewood can harbor viable fungi, isolations from a subsample of firewood bundles will be conducted this winter. Specific hardwood (oak) bundles have been chosen to carry out isolations of fungi by a student in December 2007 – February 2008. If there are signs or symptoms of fungi not normally found locally on that host, isolations will be carried out to identify species.

Fifty – nine percent of collected firewood had evidence of insects. Wood bundles have been placed in rearing cages and checked bi-weekly for emergence of any insects, following protocols and equipment established and developed by the Rocky Mountain Forest Research Station. Insects collected are in the process of preservation and identification, and will be identified to genus by CSU unless there are suspected exotics and then they will be passed on to APHIS. These data will be entered into NAPIS once identifications are completed.

Insects collected and identified as of December 1, 2007:

- Dendroctonus ponderosae
- *Ips* spp.
- Scolytus schevyrewi
- Other *Scolytus* spp.
- Some Buprestidae (no EAB)

Colorado Campground Surveys

The objective of campground surveys was to quantify the number of campers visiting Colorado USFS and National Parks, including Rocky Mountain National Park and Great Sand Dunes National Monument and Preserve, who are bringing firewood from outside of Colorado. This survey is part of our statewide education and research project on reducing the risk of importation of invasive tree insects and disease pathogens to the Rocky Mountain Region. This survey will help us determine the risk of invasive species importation via visitors and help us direct our education and management actions.

Colorado parks and campgrounds visited in summer/fall 2007:

ROCKY MOUNTAIN NATIONAL PARK Contact: Judy Visty, (970) 586-1302

- 1. Glacier Basin Camp Ground (7/27/07)
- 2. Morraine Park Camp Ground (7/24/07)

GREAT SAND DUNES NATIONAL PARK AND PRESERVE

Contact: Phyllis Bovin or Fred Bunch (719) 378-6361

1. Pinyon Flats Camp Ground (7/20/07)

ARAPAHOE/ROOSEVELT NATIONAL FOREST Contact: Jim Cuthbertson, (970) 295-6615

- 1. Dowdy Lakes Camp Ground (7/5/07)
- 2. Bel-Aire Lakes Camp Ground (7/5/07)
- 3. Mountain Park Camp Ground (7/5/07)
- 4. West Lake Camp Ground (7/5/07)

Out of 484 campsites visited....

- 364 campsites were occupied (collected license plate state information)
- 167 occupied campsites were currently empty (vehicles or tents only)
- 197 campsites with people were surveyed
- 21% of campers had no firewood and did not plan to get any
- 79% of campers had firewood with them when we surveyed them
- Of campers with firewood, 91% of firewood was obtained in-state (Colorado)

State Source of Wood	Frequency	Percent of Total
Arizona	2	1.3
Colorado	141	91.0
Kansas	2	1.3
Louisiana	1	0.7
Missouri	2	1.3
Nebraska	2	1.3
Oklahoma	1	0.7
Texas	2	1.3
Utah	1	0.7
Wyoming	1	0.7

Table 2: State Firewood Sources (from campers who had firewood with them).

Table 3: Sources of Colorado firewood (from campers with Colorado firewood)

Source of Wood	Frequency	Percent of Total
Unknown	10	7.1
2 x 4's	4	2.8
Home/cut (yards, cabinets, etc.)	23	16.2
Colorado based firewood dealers	27	19.2
Local Vendor (at campground)	69	48.9

Table 4: Sources of out-of-state firewood (from campers with out-of-state firewood)

Wood source	Frequency	Percent of Total
Unknown	5	35.7
Building material	1	4.1
Cut themselves/backyard	8	57.1

Education

Publications and <u>www.emaraldashborer.info</u> car magnets posted and provided at:

- 1. ROCKY MOUNTAIN NATIONAL PARK (July September 2007)
 - Ranger Station at Glacier Basin Camp Ground
 - Ranger Station at Morraine Park Camp Ground
- 2. GREAT SAND DUNES NATIONAL PARK AND PRESERVE (July 2007)
 - Ranger Station and Information Boards in Pinyon Flats Camp Ground
- 3. ARAPAHOE/ROOSEVELT NATIONAL FOREST (July 2007) Information Boards and Campground Hosts at:
 - Dowdy Lakes Camp Ground
 - Bel-Aire Lakes Camp Ground
 - Mountain Park Camp Ground
 - West Lake Camp Ground
 - USFS Ranger Station outside Rustic, Colorado
- 4. WESTERN INTERNATIONAL FOREST DISEASE WORKING CONFERENCE MEMBERS, Sedona, Arizona (October 2007)
- 5. Fairplay and Salida, Colorado USFS Offices
- 6. West Slope Master Gardener Trainees July, 2008.
- 7. ProGreen Expo, Denver, Colorado, January, 2008
- 8. Boulder Valley Science Fair (Poster Presentation, February 2008)

Presentations:

- Jacobi, W.R. and B.A. Goodrich. 2007. Risk of interstate movement of invasive tree pests. 55th Annual Western International Forest Disease Working Conference. September 15-19. Sedona, Arizona [Oral Presentation given by W.R. Jacobi].
- Jacobi, W.R. 2007. Invasive species movement risk assessment. Forest Health Discussion Group, Colorado State University. Sept 20, 2007. Fort Collins, Colorado.
- Jacobi, W.R. 2007. Great Plains Tree Pest Council Meeting. April 19, 2007. Manhattan, Kansas [Oral Presentation given by W.R. Jacobi].

Future Outreach:

Boulder Valley Science Symposium (Oral Presentation, April 2008)

6. Exotic Fruit Pest Survey Kara Hempy-Mayer, Project Coordinator (CDA) Dr. Lou Bjostad and David James, Project Coordinators (CSU)

Colorado Department of Agriculture (CDA) and Colorado State University (CSU) cooperatively conducted an early detection trap survey for the following exotic fruit pests:

- Pear Leaf Blister Moth Leucoptera malifoliella,
- Apple Ermine Moth Herpestomus brunnicornis,
- Summer Fruit Tortrix Moth Adoxophyes orana,
- False Codling Moth Cryptophlebia leucotreta,
- Fruit piercing moth (*Eudocima fullonia*),
- Cherry ermine moth (*Yponomeuta padellus*),
- Light brown apple moth (*Epiphyas postvittana*)
- Plum fruit moth (*Cydia funebrana*).



None of the targeted pests were detected in this survey (See MAP 4, Page 33).

For CDA, surveys were performed with pheromone baited Pherocon 1C wing traps. One trap

for each target pest was placed at each site, with false codling moth, pear leaf blister moth, light brown apple moth, and summer fruit tortrix moth traps placed at three nurseries and three orchards, and the remaining targets placed solely at orchards. Sites included six orchards and three nurseries. Traps were deployed by June 4, and were removed by October 9, for a total trapping period of approximately 126 days. Due to the discovery of *Epiphyas postvittana* during the trapping season in California, CSU placed additional traps for this species in the field. Surveys were also performed with pheromone baited Pherocon 1C wing traps. Seven traps were placed at each site. Sites surveyed this year included orchards, and nurseries mostly in high fruit

production areas on the western slope. Counties include Delta, Mesa, Montrose and Larimer County. Complete cooperator information concerning trapping done on the western slope is not currently available. Traps were installed by mid-May and serviced bimonthly or monthly depending on location through mid-September. Servicing of traps included collection of all contents and replacement of traps and attractants as directed. All trap contents were initially screened by David James at Colorado State University. Suspect material was sent to Boris Kondratieff, systematic entomologist at Colorado State University.

7. Exotic Moth Survey Dr. Louis Bjostad and David James, Project Coordinators (CSU)

Colorado State University conducted an early detection trap survey for the following exotic moths:

- Old World Bollworm Helicoverpa armigera,
- Egyptian Cottonworm Spodoptera littoralis, and
- Silver Y Moth Autographa gamma.

Surveys were done with pheromone baited Pherocon 1C traps. No exotic moths were found (See MAP 5, Page 34). Overall, 38 sites were trapped for these exotic moths (Table 5). Each site had a single trap for each exotic species. Trap numbers had to be reduced from the original

plan due to the large number of local moth species that were attracted to these traps. Because





Old World bollworm larvae on corn



Spodoptera littoralis



Silver Y Moth

screening for these exotics often involves dissection of the moths, trap numbers were reduced in order to allow time to properly screen what was caught.

Table 5: Exotic Moth Trapping

County	Number of Sites Trapped
Mesa	5
Delta	5
Montrose	5
Larimer	13
Weld	5
Washington	2
Morgan	1
Otero	1
Adams	1

Traps were serviced bimonthly or monthly depending on location through mid-September. Servicing of traps included collection of all contents and replacement of traps and attractants as directed. All trap contents were initially screened by Bob Hammon, Area Extension Agent, Tri River Area Extension. Suspect material was sent to Boris Kondratieff, systematic entomologist at Colorado State University. No suspect moths were found.

8. Exotic Wood Associated Insect Survey Kara Hempy-Mayer, Project Coordinator (CDA)

Colorado Department of Agriculture (CDA) and Colorado State University (CSU) cooperatively conducted an early detection trap survey for the following wood associated pests:

- Asian longhorned beetle (Anoplophora glabripennis),
- Citrus longhorned beetle (A. chinensis),
- Metallic beetle (Agrilus biguttatus),
- Small white-marmorated longhorned beetle (*Monochamus sutor*),
- Emerald ash borer (Agrilus planipennis),
- European wood wasp (Sirex noctilio),
- Giant wood wasp (Urocerus gigas),
- Siberian silk moth (*Dendrolimus superans sibiricus*), and



• Pine-tree Lappett (Dendrolimus pini).

CDA inspectors were trained in looking for and recognizing these species during their annual visual inspections of nurseries, though this data was not reported as they were not doing targeted surveys specifically for these species. CSU personnel also conducted visual surveys for these pests at a variety of sites. None of the targeted pests were found (See MAP 6, Page 34).

CDA deployed three 12-funnel Lindgren funnel traps at each of 11 high-risk sites. More sites had been planned, but CDA deployed a new method requiring 3 traps per site (following USFS protocol), thus limiting the number of sites that could be done. The three traps were baited respectively with ethanol, alpha-pinene (CDA used a 70:30 alpha: beta pinene lure), and 3-part IPS lures. Survey sites were located along the Front Range and included six pallet sources, three campgrounds, three nurseries, and two firewood dealers. Locations included two sites in Adams County, one in Arapahoe, four in Denver, two in Douglas, and one each in Teller and Weld Counties. Traps were deployed between May 15 and June 5, and were removed by October 9, for a total



trapping period of approximately 126 days. Traps were checked bimonthly to monthly depending on location. Specimens were sent to Dr. Boris Kondratieff at CSU for identification.

CSU personnel trapped and surveyed, 27 sites were in

Colorado. On the western slope, 3 sites were checked in Mesa County, 4 in Delta County, and 3 sites in Montrose County. In eastern Colorado,

10 sites were checked in Larimer County, 2 sites in



Weld County, 2 sites in Boulder County, and 1 site each in Morgan, Yuma and Logan Counties. Most sites were trapped with a single Lindgren funnel trap in which different lures were alternated. Siberian silk moth modified carton traps were used at these sites as well. Visual surveys were also performed at each site. Most sites were visited every other week. Traps in some places were out a little later this year as pheromones took a little longer to be delivered. Sites included distribution centers, lumber and saw mills, nurseries, locations near airports, state parks, and mills.

Suspect specimens were sent to Dr. Boris Kondratieff at CSU for identification. No target specimens were found.

9. Gypsy Moth Survey Ingrid Aguayo, Project Coordinator (Colorado State Forest Service)



female and male gypsy moths



The Gypsy Moth Survey program for FY07 was coordinated by Ingrid Aguayo, forest entomologist for Colorado State Forest Service. This year CSFS hired four hourly students to deploy the traps, and were given appropriate background and training for this task. The traps were deployed from May 31 through July 26, 2007. This year a total of 1501 traps were deployed throughout all counties of Colorado, on private and state lands. Each trap was labeled and its location was registered with a lat/long coordinate. Collection of traps started September 17 and finished November 10, 2007. The slow collection of traps is due to the number and lay-out of traps throughout the state.

The process of checking moth catch was carried out by Ingrid Aguayo. From 1501 traps deployed, there were 271 (18%) missing traps due to vandalism, storms, or tear. A total of 1235 were checked, of which 5 traps had suspicious moths. The suspicious moths were taken to Dr. Boris Kondratieff (CSU) to confirm identification. The suspicious moths were identified as *Dasychira* sp., and other tussock moths. All traps deployed by CSFS on state and private lands had negative results for gypsy moth in 2007 (See MAP 7, Page 35).

10. Karnal Bunt and

11. Khapra Beetle Surveys Dr. Louis Bjostad and David James, Project Coordinators (CSU)

Colorado State University conducted an early detection trap survey for the khapra beetle and collected



Karnal bunt symptoms on wheat

grain samples to be tested for karnal bunt. Surveys for khapra beetle were conducted using either pitfall style traps or vertical wall-mounted traps or a combination of the two. Both trap types employ a pheromone lure. Karnal Bunt surveys were done by visiting granary locations and collecting wheat grain samples to be sent on to Olney, Texas for optical scanning. No target organisms were detected.

Karnal Bunt. Colorado State University collected 40 samples that included wheat grain collected from Kit Carson, Morgan, Phillips, Sedgwick, Weld, and Yuma counties.

Khapra Beetle. Colorado State University placed traps at elevator sites in the following counties: Weld, Sedgwick, Kit Carson, Washington, Morgan and Larimer. Most traps were checked bimonthly. The beetles were screened and suspect were mounted on points and sent to Dr. Beale for further identification. No positive beetles were found.



12. National Potato Cyst Nematode Early Detection Survey Kara Hempy-Mayer, Project Coordinator (CDA)

Colorado Department of Agriculture (CDA) conducted the National Potato Cyst Nematode Survey in cooperation with PPQ, CSU San Luis Valley Research Center, CSU Plant Diagnostic Lab, Biel Crop Consulting, Inc, and DP AG Services.



Fields were chosen according to the national protocol based on the presence of potatoes in 2006, and whether or not they were seed or commercial potatoes. We were able to survey 100% of the 2006 seed potato acreage, and about 14% of the 2006 commercial potato acreage, resulting in 6,077 five-pound samples. Samples were collected from the field in March, June, and August through November. At least 60% of the samples have been processed by February 1. The data for these samples has been entered in both ISIS and NAPIS (2,435 samples). All samples have been negative for white potato cyst nematode and golden cyst nematode thus far (See MAP 8, Page 35).

13. Survey of Colorado Production areas for Exotic/Emerging Plant Pests

Ned Tisserat, Project Coordinator, Colorado State University

The purpose of this project is to conduct a state-wide survey of production areas for the presence of various plant pathogens and arthropods on the National Select Agent list, and the Western Region Pest list. The primary focus of the survey was to ascertain the presence/absence of the following pests:

- Ralstonia solanacearum Race 3 Biovar 2,
- Planococcus minor (Passionvine mealybug),
- Puccinia horiana (Chrysanthemum white rust),
- Puccinia hemerocallidi (Daylily rust).



Information on all insects and diseases encountered during the survey were recorded.

Fifty separate sites were surveyed (some with multiple visits) across 10 counties including Adams, Arapahoe, Boulder, Broomfield, Delta, Denver, Jefferson, Mesa, Montrose, and Weld (Table 6). Daylily rust was observed at two locations, one in Boulder and one in Denver County during the summer of 2007. The plants were isolated until they were shown to be free of the disease. This data was entered into NAPIS by the SSC. No other pests on the National Select Agent list, or the Western Region Pest list were identified during the survey.

Table 6: Production Area Survey				
Pest	Number of visits			
Ralstonia solanacearum Race 3 Biovar 2	16			
Planococcus minor (Passionvine mealybug)	13			
Puccinia horiana (Chrysanthemum white rust	18			
Puccinia hemerocallidi (Daylily rust	37			

BIOCONTROL

14. Biological Control of Cereal Leaf Beetle Dan Bean, Colleen Jandreau, Project Coordinators, CDA

Anaphes flavipes culturing, production and release. Cooperators in Maryland, Pennsylvania and North Carolina provided several thousand cereal leaf beetle eggs to the Palisade Insectary this spring. From these we established a colony of the egg parasitoid *Anaphes flavipes* and produced about 2,000 parasitized eggs for release in the western states. The Western CLB group met in Boise, ID this September 18-19 and it was decided that *Anaphes flavipes* would no longer be released in the western states since it hasn't taken at most sites and where it has taken it might not be as important a control agent as once thought. For this reason we will no longer keep them in culture.

Using artificially overwintered Cereal Leaf Beetles to produce eggs during the off season. One of the major difficulties in rearing CLB egg parasitoids is that they have to be cultured on an alternate host during the winter. That host is the three lined potato beetle which is a poor host at best. Potato beetle eggs are sticky and readily trap and kill small egg parasitoids. The egg parasitoids don't develop as well in these eggs and the transition from CLB to potato beetle eggs in the fall is highly problematic with culture loss always a very real possibility. The Western CLB group is currently trying to obtain and rear the egg parasitoid *Anaphes nipponicus* which is found in China and may be more suitable for the western range of CLB. Clearly they need a steady supply of CLB eggs to keep the parasitoids going after they are collected overseas. This will be extremely difficult unless methods are found to hold overwintered CLB and break diapause and obtain a steady supply of eggs. For that reason the Western CLB group has given us the task of finding ways to break diapause in CLB and obtain steady supply of eggs.

We received 20,000 beetles of the overwintering generation during the summer of 2007. Survival was very poor and we started the experiment with only 5,000 overwintering beetles left. These have been divided into lots of 200 beetles and stored at -5°C. These will be removed from the freezer at regular intervals during the fall and winter and tested for egg-laying capability. The first lot has been removed and they are now feeding and mating. We have not yet seen any eggs.

15. Diorhabda Monitoring Project Dr. Andrew Norton, Project Coordinator (CSU)

As part of the USDA-APHIS permit for insectary establishment, 5 years of postrelease monitoring of *Diorhabda* populations and their impact on Tamarisk and non-target vegetation are mandated. In Colorado, initial site selection, characterization, and monitoring of effects after the first year post-



release at all sites was funded by a variety of cooperating state and federal agencies. We have received additional funding for the two western Colorado sites (Dinosaur National Monument and Horsethief Canyon) for the duration of the required monitoring period. CAPS funding allowed an additional year of the required monitoring for the two western Colorado *Diorhabda* insectaries (Bonny Reservoir and Adams County open space). Data for all four sites are reported here.

At least 21 trees per site per survey date were visually surveyed for the presence of Diorhabda larvae and adults. Sites were monitored from five to seven times throughout the season. Establishment was positive at three of the four sites, though it was most successful at Dinosaur National Monument and Horsethief Canyon, with large numbers of both larvae and adults present. At the Adams County site, only three larvae were found during the season on one tree, while at Bonny Reservoir neither larvae nor adults were found. The numbers of overall established Diorhabda at the four sites is encouraging, however, particularly given the short period of time since their initial release in 2005 (See MAP 9, Page 36).

16. Weed Survey and Biocontrol Project, 2007 Dan Bean, Project Coordinator (CDA)

Tamarisk. Over 200,000 tamarisk leaf beetles (*Diorhabda elongata*, Fukang ecotype) were collected this spring from western Nevada. The collections were made by the Colorado Department of Agriculture, Biological Pest Control in collaboration with USDA APHIS. The Palisade Insectary housed and fed the adult beetles until APHIS cooperators were ready to receive them for field releases. Releases were made in 9 western states (Wyoming, Montana, South Dakota, Washington, Oregon, Nebraska, Idaho, Kansas and Colorado). In Colorado major releases were made in Mesa County on



BLM land (Salt Creek, 29,000 adults, 100,000 larvae), in Montrose County on BLM land (12,000 adults) and in Dinosaur National Monument (40,000 adults), in cooperation with the National Park Service and Dr. Andrew Norton of CSU. Dr. Norton is responsible for monitoring the releases made in Dinosaur National Monument and the CDA Biological Pest Control is

responsible for monitoring the releases made in Mesa and Montrose Counties. Releases in Mesa and Montrose counties were done at established monitoring sites (USDA APHIS protocol) and monitoring data were entered into hand held GPS units with PDAs.

The second part of the tamarisk project for 2007 was to monitor the movement of beetles from Utah, where releases had been done in 2004-2005, into Colorado. Sticky traps baited with Diorhabda pheromone and tamarisk plant volatiles, were set up at monitoring locations on the Dolores and Colorado Rivers. Beetle movements were also followed by sweep sampling along the Dolores River and at selected sites in San Miguel,

Dolores, Montezuma, Montrose, and Mesa Counties as well as sites in Utah near the Colorado border. The first beetles from Utah entered Colorado on approximately August 1, 2007 along the Dolores River corridor (Mesa County) where they were detected on sticky traps and in sweep samples. Beetles also were



discovered in Salt Wash, a small tributary of the Dolores River, on August 10. In early September beetles were found in San Miguel, Dolores, Montezuma, Montrose and Mesa Counties during a sweep sampling study. Apparently they rode wind currents into Colorado from sites along the Colorado River in Utah. *D. elongata* from Utah are now established across most of southwestern Colorado. In 2008 areas will again be surveyed to see if these founder beetles have established overwintering resident populations.

Yellow Toadflax. The Toadflax Consortium, headed up by Rose De Clerck-Floate (AAFC Lethbridge) and Andrew Norton (CSU) is seeking assistance in establishing a

root galling weevil *Rhinusa linariae* in the US. Small populations are currently established in British Columbia (BC) and with the assistance of Canadian colleagues we are seeking to establish these in the US. In Colorado the Palisade Insectary will take a lead role in this project. We have located at least four sites in Mesa and Rio Blanco counties where cages will be set up this summer and



beetles introduced. After establishment beetles can be moved to numerous sites around the state.

Other Targets and Agents. In addition to the tamarisk leaf beetle the Insectary also released at least 12 other species of biocontrol agents. These included 157,000 *Aceria malherbae* mites and 23,446 *Tyta luctosa* moths for field bindweed, 58,000 *Aphthona* beetles for leafy spurge, and 8,390 *Larinus minutus* weevils and 500 *Cyphocleonus achates* weevils for diffuse and spotted knapweed. Biocontrol agents for puncturevine (2700 *Microlarinus* spp.), yellow and Dalmatian toadflax (4,865 *Mecinus janthinus* and 8,472 *Calophasia lunula*), purple loosestrife, musk thistle (2,686 *Trichosirocalus horridus*), and Canada thistle (3,600 *Urophora cardui*) were released as well this year.

Monitoring. Long-term biocontrol sites were also monitored this year including Dalmatian toadflax sites, leafy spurge sites and tamarisk sites.



The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map. Negative data spans over last 3 years only.

MAP 2

Reported Status of

Cereal Leaf Beetle (Clb) , Oulema melanopus

in COLORADO (01/01/2007-12/31/2007)

Data retrieved from National Agricultural Pest Information System on 03/27/2008





The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map. Negative data spans over last 3 years only.

MAP 4

Reported Status of Light Brown Apple Moth , Epiphyas postvittana in COLORADO (01/01/2007 – 12/31/2007) Data retrieved from National Agricultural Pest Information System on 03/27/2008





The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map. Negative data spans over last 3 years only.

MAP 6



Reported Status of Gypsy Moth (European)(GM) , Lymantria dispar in COLORADO (01/01/2007 – 12/31/2007) Data retrieved from National Agricultural Pest Information System on 03/25/2008



The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map. Negative data spans over last 3 years only.

MAP 8

Reported Status of White Potato—cyst Nematode , Globodera pallida in COLORADO (01/01/2007—12/31/2007)

Data retrieved from National Agricultural Pest Information System on 03/27/2008





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