

## Draft

### Great Plains Tree Pest Council Minutes of the 2002 annual meeting

Holiday Inn; Casper, Wyoming  
April 2-3, 2002

#### Meeting Summary

##### 1. Action Items – Old Business

- Letter addressing lack of representation of riparian areas in current USFS Forest Health Monitoring plot system to the President of the National Association of State Foresters: Marcus Jackson to fix-up draft, get it to Chairperson Koch, who circulates it among the membership for comment, edits, signs and sends it

##### 2. Action Items – New Business

- Send slides of hardwood bark beetles and borers and their impacts to Dave Leatherman before the meeting next year
- Discuss and/or update and then approve the minutes of the 2001 GPTPC meeting

##### 3. Motions Passed

- Jeri Lyn Harris to pursue and provide input to the Riparian Forest Health Monitoring focus group representing GPTPC concerns

##### 4. Officers Elected

- Chairperson Elect – Jeri Lyn Harris
- Secretary Elect – Bill Schaupp

#### Meeting Minutes

Les Koch, Chairperson, called the meeting to order.  
After the meeting was convened, attendees introduced themselves.

There were 16 attendees, as follows:

Les Koch	Wyoming State Forestry Division	Dan Long	USFS-Rapid City, SD
Laurie Stepanek	Nebraska Forest Service	Bill Schaupp	USFS-Rapid City, SD
Mark Harrell	Nebraska Forest Service	Jim Walla	North Dakota State University
Bill Jacobi	Colorado State University	Adrian Juttner	South Dakota State Division of Forestry
Holly Kearns	Colorado State University	Ken Gibson	USFS-Missoula, MT
Jeri Lyn Harris	USFS-Lakewood, CO	Marcus Jackson	USFS-Missoula, MT
Jeff Witcosky	USFS-Lakewood, CO	Dave Leatherman	Colorado State Forest Service
Carl Jorgensen	USFS-Lakewood, CO	Christine Pontarolo	USFS-Lakewood, CO

USFS = United States Department of Agriculture, Forest Service

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The GPTPC mailing list was distributed and corrections noted upon it. This list will be mailed to members once updated. The 2001 GPTPC meeting minutes were not discussed and not approved. This omission means the issue will become an old business item at the 2003 meeting.

Guests: Tom McClure (USDA Forest Service, Rocky Mountain Region, Invasive Species Coordinator) was invited to speak on invasive species in riparian habitats, but was not able to attend.

Secretary Joel McMillin (USFS-Rapid City, SD) was unable to attend, having transferred to Flagstaff, AZ. Chairperson Koch asked for volunteers to handle meeting notes and Bill Schaupp agreed to do this.

### Organization Reports (part 1)

#### Colorado State University --- Bill Jacobi and Holly Kearns \*

- Due to prior commitments, their report was given at the meeting outset.
- Research continued at the Tree and Turf Research Facility for a fourth season, monitoring tree growth, canker resistance, tree water potentials, soil moisture, and turf production under three irrigation treatments. Trees and bluegrass turf are difficult to grow well together. Lack of funding threatens the future of this work.
- *Thyonectria* spp. fungi were recovered from uncomposted wood chip mulch two years after inoculation, regardless of colonized branch piece position in or on the mulch. Some attenuation was noted, although irrigation treatment did not affect viability. Potential risks from importation and use of wood and wood products implied by these results were brought to the attention of the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA-APHIS). It was suggested that such risks be considered more fully in the future. No action by USDA-APHIS on this had taken place yet. The Canadian government is apparently more involved with this topic. Bill's group hopes to examine actual infection hazard from and composting effects on tree pathogens. They seek cooperators regarding risk potential for invasive pests in wood chip mulch from pallets and other foreign wood products.
- Old canal-side cottonwoods experienced water stress 6-8 weeks after the canal water was turned off, but recovered in less than a day when water was restored. Recovery duration is unknown. Some roots went under the canal; roots extended about 20 feet out from the trees at most. Soil moisture above 20% apparently keeps trees non-stressed, while leaf water potential drops to stressed levels below 10% soil moisture. Precipitation events of one or more inches increased leaf water potential (i.e. lowered tree stress), but the response was short-lived; an increase in soil moisture was not noted.
- Road salts applied for snow and dust control are coming under scrutiny. The literature on this is meager; recent work known to the group was named. It may be that MgCl applied for dust control may have a greater impact than materials applied during the winter against snow and ice. The city of Fort Collins applied road salts during 16 snow events in 2001, but the actual material applied was unknown.
- Publications are pending from completed work on the spatial relationships of *Armillaria* root disease in the Black Hills and on black stain root disease in pinyon pine ecosystems. A larger spatial study using infrared photography in pinyon to detect black stain and *Ips* bark beetle activity will hopefully be finished this year.

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## Special Reports

### White pine health --- Bill Jacobi and Holly Kearns

Many people are conducting a lot of work now on white pine blister rust, including doctoral research by Holly Kearns. The biology and history of this alien invader was described. Early research was limited in scope and additional information is needed. From its introduction in 1910 to the 1940s, spread was rapid. The rate of spread appeared to slow and was presumed static until recently. Infection signs, symptoms, and damages were described. The fungus appears to have an increasingly significant impact. Now that white pine blister rust has been discovered in Colorado, much of their work is focused on its potential impact on Colorado's forests, funded by the USFS. Many pathologists are concerned about the potential for introduction of eastern and/or alien genotypes of both fungus and alternate host (*Ribes* spp.). Horticultural varieties of *Ribes* sp. and white pines are moved about extensively. They sent out about 1200 surveys on this subject and received 83 responses documenting such plantings. This could create natural bridges for the fungus across previously impassable geographic barriers. Holly's work utilizes USFS stage 2 intensive inventory, but white pines often occur in mixed stands, so getting good information on host distribution is challenging. She will build a model predicting spread using weather, site and stand conditions, and other factors. They continue to facilitate coordination among the many folks working on white pine blister rust in the central and southern Rocky Mountains.

### Forest Health Monitoring in the Great Plains States --- Jeri Lyn Harris \*

The purpose of the USFS Forest Health Monitoring (FHM) program is to look for change in forest conditions and investigate mechanisms in order to understand what is responsible for the observed change. There are plot and off plot components to the FHM program. A recent program decision has resulted in the combination of plots used by the USFS-Forest Inventory and Analysis (FIA) and FHM programs, previously referred to as P2 and P3 plots, respectively. This new FHM plot system has some statistical validity in monitoring forest conditions and changes across large areas, meaning areas larger than one western state. There are many cooperators in developing methods for and implementing this plot system, including university researchers, state employees, USFS National Forest System, USFS Research and others. It is not always clear who is involved with each component or state. In addition, the FHM program utilizes regional boundaries that do not correspond to the USFS-National Forest System (NFS) or USFS-Research's regional boundaries.

A handout showed that not all states, especially Great Plains states, have implemented the FHM program yet, although this is expected in the near future. Things keep changing a lot as the FHM program becomes more fully implemented. One type of product from the FHM program is state and FHM regional reports. Jeri Lyn handed out an example of a good state report from Iowa in 1999, available at [http://www.na.fs.fed.us/spfo/fhm/fhh/fhh-99/ia/ia\\_99.htm](http://www.na.fs.fed.us/spfo/fhm/fhh/fhh-99/ia/ia_99.htm). A discussion ensued as to how this program might better serve the Great Plains states and how their needs could be made known.

None of the attendees, except Jeri Lyn, was aware of the data, results, and reports available from the FIA program for Great Plains states. Analyzed FIA plot data is available on the Internet, but one must request raw data in writing. Not all states are using the same methods to measure plots; a lot of training is aimed at getting consistent methods and at having all data sent to the St Paul FHM office.

At present, it is not clear if aerial survey, remote sensing and/or ground surveys would best meet the off plot needs for Great Plains states. FHM provides project funding through their Evaluation Monitoring program to investigate mechanisms of change.

A new aspect of the FHM program is urban forest health monitoring. Some components are street tree assessments (see [http://www.fs.fed.us/institute/fhm\\_riparian/street\\_trees.doc](http://www.fs.fed.us/institute/fhm_riparian/street_trees.doc)), site-specific monitoring, and some form of an annualized grid of plots. Pilot tests are being conducted in Indiana and Maryland.

Another new aspect of the FHM program is riparian forest health monitoring. Riparian vegetation comprises a small, but very important, percentage of the overall flora. Its linear features are ill suited to the FHM grid-based plot system. Riparian forest monitoring methods, if developed, might also be applied to wooded draws and shelterbelts, which are also characterized by linear features.

### **Riparian forest health monitoring --- Marcus Jackson \***

This new program is well funded, but is moving slowly. A brief status report as of February 14, 2002, was handed out. Mary Manning (USFS), Missoula, MT, is the lead. Additional information is available on the Internet at [http://www.fs.fed.us/institute/fhm\\_riparian/](http://www.fs.fed.us/institute/fhm_riparian/). Considering all the unmet forest health monitoring needs in the Great Plains states, Marcus suggested that the group focus on one area to pursue. At the GPTPC meeting last year, Marcus had volunteered to draft a letter to the President of the National Association of State Foresters addressing the lack of representation of riparian areas in the current FHM plot system. Marcus handed out his draft letter.

**ACTION ITEM:** Chairperson Koch asked Marcus to fix up the draft a bit, send it to him, and then he'd circulate it for comment from the membership using the GPTPC electronic mailing list. Dave Leatherman offered to get suggestions on the draft letter draft from the Colorado State Forester, Jim Hubbard. Presumably, either Les will sign and send an edited version of this letter or it will be an old business item to be handled at the GPTPC meeting next year.

The group asked, "Who will champion this cause from our group?" State pest specialists from plains states were suggested. There is a Riparian Focus Group to which representation from the GPTPC should be provided. Evidently, there is also a Core Group that gives input to the Riparian Focus Group Leader.

**MOTION:** Bill Jacobi moved that Jeri Lyn Harris be the person to represent the GPTPC in pursuing the Riparian Forest Health Monitoring focus group and in providing input to that group. Les Koch seconded the motion. The motion passed without dissent or additional discussion.

There are some concerns regarding the plot measurements in the Great Plains. It was suggested that a team of folks could be assembled to do the all the plot measurements. This would provide some consistency. Timing is critical in plot measurement, too, because there are some "biological windows" in time through which the impact of specific organisms and processes are best viewed. Another idea was to abandon the plot concept and do only "off plot" monitoring.

### **Aesthetically pleasing photographs of forest insects --- Dave Leatherman \***

Dave showed the collection of slides of defoliators that he had assembled. He had one set of slides comprised mostly of his own excellent work, with some additions from other GPTPC members, and another fine set of slides from GPTPC member Don Reynard (PFRA Shelterbelt Center, Indian Head, Saskatchewan). Both sets of slides had been downloaded onto compact disks, which were distributed, funded courtesy of FHM in Lakewood, CO. These CDs provide a fine teaching and learning tool, in addition to aesthetic pleasures. Slide duplicates are available at cost from Dave, if you wish. This culminated a lot of effort by Dave, for which the group expressed gratitude. Mark Harrell described a method for importing slides into the electronic environment for later uses as follows:

\* indicates a handout was provided

Scan the slide at high resolution and save the image as a *.tiff* file, edit that file as desired, and resave it as a *.tiff* file for reference (size about 7 megabytes), then re-export that *.tiff* image as a *.jpeg* file to use in powerpoint or other presentations. Because the *.jpeg* files are much smaller, this will allow the use of many images in a presentation without having file space problems.

**ACTION ITEM:** Dave asked the group to send him good slide images of hardwood bark beetles and borers and their impacts before the next meeting, so he can do a similar bit with these two important, but not so well documented, groups of forest insects.

## Organization Reports (part 2)

### Montana Department of Natural Resources and Conservation and Forest Health Protection (USFS) for Montana – Ken Gibson \*

#### Bark Beetles

- The worst fire season in 80 years, warm temperatures, and drier-than-normal conditions allowed bark beetle populations to continue unabated; increases are anticipated in the future in fire-affected areas.
- Mountain pine beetle (MPB) has returned to epidemic status in lodgepole pine, especially on the Lolo, Deerlodge, and Nez Pierce National Forests; MPB building up in ponderosa and white bark pines.
- Douglas-fir beetle (DFB) starting to decline from epidemic, but still killing many trees, especially in the fire-damaged Bitterroot National Forest (NF).
- Subalpine fir decline continues; mortality from western balsam bark beetle seemed to spike up (a drought effect ?); balsam wooly adelgid a player in this, too.
- Fir engraver in grand fir in northern Idaho is very active, induced by drought and root disease

#### Defoliators

- One gypsy moth was captured in Montana in Glacier National Park; delimitation survey planned for 2002.
- Douglas-fir tussock moth defoliation of grand fir and Douglas-fir nearly tripled to about 150,000 ac near Moscow, ID, in 2001; controversy was significant, especially regards treatment (none on federal lands; ca. 70,000 ac on state/private) and material(s) used or available; treatment may occur again in 2002; naturally occurring DFTM virus on the rise.
- For the first time in 25 years, significant defoliation was noted by hemlock looper and false hemlock looper.
- Western spruce budworm defoliation was relatively light, although moth traps indicate a rise next year on the Helena and Beaverhead-Deerlodge NFs.

#### Diseases

- Mortality and growth losses from root diseases continue to be at high levels, especially west of the Continental Divide; 2000 fires offer the opportunity to reduce root disease effects by favoring western larch and ponderosa pine, as they are more tolerant of both frequent low intensity fires and root disease.
- Dwarf mistletoe continues to cause losses of about 33 million cubic feet annually; fire greatly influences its distribution through host impacts and so changes are expected due to recent fires.
- White pine blister rust continues throughout the range of 5-needle pines; rust is most severe in northwestern Montana, where mortality continues to be extensive from this exotic disease.

- Limber pine decline and mortality appears to be continuing across scattered locations in central and western Montana; permanent plots established in 1996 are scheduled for remeasurement in 2002; needle blight caused by *Dothistroma pini* was found on limber pine.
- Heavy, localized infections from Elytroderma needle blight were reported from western Montana.

#### Abiotic factors

- Interest in possible damage from magnesium chloride built into dirt roadbeds for dust control lead to an investigation in several locations; symptoms included tip burning, completely red foliage and branch dieback; preliminary analyses showed elevated chloride content in symptomatic trees; drought is thought to contribute to observed symptoms; a more thorough report is forthcoming.

### North Dakota Forest Service --- Marcus Jackson \*

#### Abiotic factors

- Winter injury of conifers is expected, but seemed more severe in 2001; most trees recovered by late summer, but numerous ornamental junipers and a few other trees and shrubs did not recover in central and western ND.
- A big windstorm on August 8 caused significant damage to community forests in Grand Forks, Hillsboro and smaller communities; for example, across all ownerships about 19,500 trees in Grand Forks and 2,500 trees in Hillsboro required removal or therapeutic treatment.

#### Insects

- No gypsy moths were caught in 2001 (or 2000).
- Two Japanese beetles were trapped in Bismarck in 2001.
- Forest tent caterpillar has been defoliating aspen and other hardwoods since 1997 in eastern and north-central ND; 2001 aerial survey showed 3.045 ac defoliated in the Turtle Mountains; an egg mass survey was conducted there, allowing classification of expected defoliation in 2002; follow-up larval surveys in the spring can confirm these predictions.
- Damage consistent with feeding by yellowheaded spruce sawfly was found less than 10 miles north of Bismarck, much further south than reported in recent years; many small to moderate aged trees are killed each year in the northern half of the state by this insect.
- Cottony maple scale heavily infested silver maple and linden trees in Fargo and West Fargo in 2001; more damage is possible in 2002, but this insect is rarely a serious problem for more than two years.

#### Diseases

- Sphaeropsis shoot blight injury was evident in September on trees in Bismarck following hailstorms in early June; a 2000 survey of the Towner State Nursery found infection in most ponderosa pine windbreaks, several of which were removed in 2001 as a result; a management plan for the nursery is in place.
- Canker diseases affected branches mostly in the western part of the state; fall/winter temperature fluctuations and low soil moisture may have contributed to the high number of observed cankers.
- An unidentified root disease problem has been killing Laurel Willow (*Salix pentandra*) in Fargo and West Fargo in recent years; isolation attempts of the pathogen continue to be unsuccessful.
- A Phytopthera sp. isolated from spruce roots in 1998 was contaminated and lost, but materials are now in place to attempt reisolation and identification.

#### Forest Health Monitoring

- North Dakota entered the FHM program in 2001 and some data collected; efforts will continue and a baseline assessment developed over the next 5 years.



#### Personnel

- North Dakota is in the process of hiring a Forest Health Specialist and an extension forester; collaborative programming between these positions will be emphasized.

#### **North Dakota State University, Plant Pathology Department --- Jim Walla \***

##### Ash yellows

- Evaluation of tolerance to ash yellows by commercial ash cultivars continues, with some changing results.
- All of this will be sorted out to select a moderately and highly aggressive isolate to use for host tolerance testing.

##### X-disease of chokecherry

- Hail defoliated plants in field trials, precluding rating of disease symptoms; field ratings are planned for 2002.
- Production of clonal materials from about 20 putatively tolerant plants is progressing; adequate numbers of almost all clones are now growing in the greenhouse; outplanting and graft inoculations by the 2003 growing season is planned.
- Graft inoculations of 10 isolates were made in 2001, but results were not promising; improved methods will be developed using test inoculations in 2003.

##### Juneberry diseases

- Sixteen planted and natural stands of juneberry (syn. serviceberry, Saskatoon, *Amelanchier* sp.) across ND were examined in 2001 to identify potential problems for producers.
- Although many diseases, insects, and other potential damaging factors were observed, no substantial damage was associated with most of the observed pests; the number requiring control is likely limited.
- Serious damaging factors found, in descending order of prevalence among sites, were berry insects, stem cankers, animal browse, leaf spots, blackleaf, hail damage, branch dieback, Gymnosporangium leaf rust, powdery mildew, stem decay, and root rot.
- As the survey progressed, each new site yielded insects and diseases not seen at previous sites, suggesting that additional insects and diseases are likely present.

#### **Nebraska Forest Service --- Mark Harrell and Laurie Stepanek \***

##### Pine wilt

- A large number of trees were killed by pine wilt in 2001, but maybe less than in 2000; southeastern NE is where mortality is greatest, but trees to the north and west are also affected.
- Preliminary testing with trunk injections showed promise in killing or at least immobilizing nematodes; one material used was abamectin (Greyhound); trials will continue in 2002.
- Additional plans for 2002 and beyond are aimed at determining the likelihood that pine wilt will become a serious problem in western and northern parts of NE; this includes identification and assessment of potential vector species and pathogenicity trials.
- Pine wilt nematode can kill any pine species, but native species are generally less susceptible; other nematode species are also present and can be found in trees killed by other factors; pine wilt nematode distribution within trees is spotty; sampling a tree in many places using distilled water and an increment corer was suggested.

#### Unexplained white pine mortality

- The search for a cause of observed mortality of white pines continues; basal resinosis and foliar symptoms are similar to that reported for Procera root disease (*Verticicladiella procera*), but attempts to isolate this fungus have been unsuccessful so far.
- Affected trees typically have good growth rates, but turn brown and die in one to two months; affected trees vary in age from about 5 years to near maturity on sites ranging from urban landscapes to Christmas tree plantations; similar unexplained problems are reported in Iowa.

#### Cercospora blight control test

- The search for an economic alternative to the fungicide Camelot involved testing the copper fungicide Champ.
- Trees were treated in 2001, will be treated again in 2002 and then evaluated that fall; preliminary results from a 1999/2000 test showed that Champ provided some degree of protection.

#### Oak anthracnose (?)

- Bur oaks along the southeastern edge of NE over the past few years have shown symptoms often diagnosed as oak wilt.
- Additional experience suggests that these symptoms are more consistent with oak anthracnose or some other pathogen causing anthracnose-like symptoms, but producing more damage than that usually associated with anthracnose; "it looks like sycamore anthracnose but is not."
- A more thorough study is planned in 2002.

#### Oak lace bug

- Bur oaks across much of southeastern NE were heavily infested by oak lace bugs in 2001, making the foliage appear silvery, but no long-term damage likely occurred.

#### Verticillium wilt

- Mortality of maples from Verticillium wilt seemed higher than usual in 2001.

## Field Trip

The remainder of the afternoon of Day 1 was spent on Casper Mountain examining impacts from white pine blister rust and bark beetles on limber pine and mountain pine beetle activity in lodgepole pine. A good, informative time was had by all, despite the snowpack and showy weather.

## Organization Reports (part 3)

### Lakewood Service Center, Forest Health Management (USFS) --- Jeff Witcosky \*

#### Staff Changes

- Jeff Witcosky replaced Dave Johnson (retired) as the Lakewood Service Center leader.
- Jeri Lyn Harris vacated the pathologist position to become the Rocky Mountain Region's Forest Health Monitoring Coordinator.
- Lee Pederson vacated the Biological Technician position to become an entomologist with USDA Forest Service in Ogden, UT.
- Bill Schaupp vacated the entomologist position to become the entomologist at the Rapid City Service Center.
- All three vacant positions are in the process of candidate selection, having been advertised.

#### Gypsy moth

- None captured in detection traps in 2001.

- Delimitation trapping at Rocky Mountain National Park was negative for the first time since 1999, when it began around a capture site in the Moraine Park Campground.

#### Other Defoliators

- Ongoing control problems with pine tip moth in Kansas have led to the idea that more than one species is involved; pheromone trapping was conducted at one site in 2000, but a specialist able to identify species has yet to be located.
- Western spruce budworm becoming more apparent in CO and WY, although late spring frosts are suspected of retarding populations at areas in CO.
- Douglas-fir tussock moth early warning system captured two moths, the first captures since this trapping was restarted in 1995.

#### Bark Beetles

- Douglas-fir beetle populations declined, but may rebound near 2000 fires.
- Mountain pine beetle populations at several locations continued to expand for the seventh consecutive year in Colorado.
- Dramatic increases in mortality due to spruce beetle are expected over the next decade near Steamboat Springs because of windthrow, primarily in 1997, within a vast area of susceptible forest.

#### Diseases

- White pine blister rust is a significant problem in Wyoming and has been detected in Colorado as well; several projects and surveys are planned to look at this problem in 2002.
- 2001 aerial survey of the northern Shoshone NF and Big Horn NF identified about 46,000 ac of limber and white bark pines impacted by white pine blister rust and other agents such as mountain pine beetle, needlecasts, and dwarf mistletoes.
- Long-term root disease monitoring plots in CO and South Dakota were remeasured in 2001; data analysis will allow calibration and extended use of available root disease impact models.

#### Aerial survey

- General detection surveys were flown over approximately 21 million acres in 2001 in Colorado, Wyoming, and South Dakota.
- Most widespread was subalpine fir decline followed by mortality caused by mountain pine beetle; spruce beetle activity in Colorado and northwestern Wyoming increased significantly in 2001.
- Complete aerial survey report for 2001 is posted on the Internet at [http://www.fs.fed.us/r2/fhm/reports/air\\_r2-02-09.pdf](http://www.fs.fed.us/r2/fhm/reports/air_r2-02-09.pdf).

### **Rapid City Service Center, Forest Health Management (USFS) --- Bill Schaupp and Dan Long \***

Current work at the Rapid City Service Center reflects the forest insect and tree disease problems encountered by customers. It continues to be difficult to focus on Great Plains forestry matters, given the workload from federally managed lands in the mountains. Conifer-killing bark beetle epidemics, effects from wildfires including wood borer activity, evaluation of hail damage and its aftermath, Armillaria root disease and dwarf mistletoe evaluations, and white pine blister rust impact occupied staff efforts in 2001. The following list of current work, taken from the handout, often has one or more associated reports. Current work includes the following:

#### Insects and Diseases

- Subalpine fir decline in spruce-fir forest type of the north-central Rocky Mountains
- Evaluation and monitoring of direct and indirect effects of hail damage to ponderosa pine stands on the Black Hills National Forest.

## Insects

- Gypsy moth detection trapping in recreation sites of national forest and parks in South Dakota and Wyoming
  - None captured in 2001
- Bark beetle sampling of *Ips*, mountain pine beetle, Douglas-fir beetle, and western balsam bark beetle in the Black Hills, Bighorn, and Shoshone National Forests
- Role of subalpine fir blowdown in western balsam bark beetle populations dynamics
- Interaction between fire-damaged ponderosa pine and insects
- Mountain pine beetle pheromone biology
- Use of lethal trap trees in mountain pine beetle management
- Using MCH to prevent Douglas-fir beetle attacks

## Diseases

- Armillaria permanent plot re-measurements
- Mistletoe control evaluation
- White pine blister rust and limber pine interaction

## South Dakota Division of Forestry --- Adrian Juttner

- Newly hired; no state report available at present for 2001.
- Interested in testing entomophagous nematodes and fungi against mountain pine beetle brood in logs as potential control tactic.
- Provided handouts regarding his company's control work against termites in Louisiana and on "Tree Termites 'Round the World".

## Colorado State Forest Service --- Dave Leatherman \*

### Insects

- Mountain pine beetle (MPB) continues to be the primary pest of concern on private lands; despite significant increases in some areas, indications are that the epidemic is slowing along the Front Range, due possibly to the combined effects of wood borer competition and protection/prevention efforts; CSFS efforts include general landowner education, direct suppression (ca. 20,000 infested trees treated annually), timely salvage coordination, preventive spraying assistance (ca. 150,000 trees preventively sprayed by private contractors annually), and preventive management prescriptions; preventive spray materials used are carbaryl and permethrin (Astro), though Telstar may be used soon.
  - Discussion of blue-stain fungi: nobody is an expert on all the different bluestain fungi; Tom Harrington (Iowa State University) is the expert on pines, but not working in this area now; questions remain as to exact mode of action re bark beetles.
- Spruce beetle infestations on private land near the Routt Divide Blowdown of 1997 are still minimal but increasing; losses are expected to increase there and at a number of scattered blowdown spots throughout the higher elevations, primarily on federal lands.
- Engraver beetles (*Ips* spp.) are becoming increasingly conspicuous, causing big problems; reasons include tree stress from dry mild weather and MPB activity, development in forested areas, and vegetation management resulting from the National Fire Plan that leaves slash; pinyon and ponderosa pines are mostly affected, with reduced activity in ornamental Colorado blue spruce.
  - Discussion: Fort Collins just released a nice brochure on *Ips hunteri* on ornamental blue spruce; many trees in town are now big enough to become infested.
- Western spruce budworm, on the rise recently, was set back by late spring frosts; nearly 500 ac of private land was aerially treated with *Bacillus thuringiensis* in June; the Lake City Demonstration Thinning will be completed in 2002.

\* indicates a handout was provided

- The largest Douglas-fir beetle infestation has subsided, while smaller, scattered infestations seem not to be important at present.
- Ponderosa needleminer (*Coleotechnites ponderosae*) continues at high levels, reducing growth and sometimes being confused with MPB or dwarf mistletoe.
- Fall webworm (*Hyphantria cunea*) heavily defoliated narrowleaf cottonwood and, to a lesser extent, plains cottonwood and boxelder even more than has been usual lately; so far, only branch dieback has been noted.
- Gypsy moth was captured in detection traps near South Fork (Mineral County), Manitou Springs (El Paso County), and Fort Collins (Larimer County); delimitation traps in northwest Denver caught four moths near the single positive catch site of 2000; this site is on the Arvada/Jefferson County border and several nurseries and landscaping firms suspected of being the source; mass trapping will be the plan for 2002, because aerial spraying may be problematic in this terrorist-influenced climate.

#### Diseases

- In general, Dutch elm disease reports showed very low numbers except for 11 positives in Sterling, a relatively small town.
- Two needlecasts of minor importance were reported, *Davisomycella* needlecast and Douglas-fir needlecast (*Rhabdocline pseudotsugae*).
- Dwarf mistletoes are widespread throughout ponderosa pine and heavy in certain areas of lodgepole pine statewide; tree mortality a problem in many areas, exacerbated by mild winter and prolonged drought conditions; most CSFS Districts along the Front Range report that about 10% of their sick tree phone calls from the public are mistletoe related.
- Fireblight not bad along the Front Range but heavy dieback was noted on ornamental apples in the Beulah area.

#### Abiotic problems

- Major late freezes on May 20 and June 13 resulted in foliage loss on Gambel oak, aspen, and non-pine conifers over a broad swath of central Colorado; most hardwoods re-foliated and appeared to recover; affected conifers lost new growth upon which defoliators such as western spruce budworm feed; loss of fruit resulted in higher than normal reports of "bears in town".
- It is thought that long-term drought combined with low snowpacks, mild winters, below average monsoon rains, and unusually high late summer temps in 2000 all contributed to impacts on lodgepole pine, Douglas-fir, and spruce forests in at least Boulder and Gilpin Counties at higher elevations; early spring found trees, especially in the understory, looking really bad; this set of conditions is probably tied to the prominence of "subalpine fir decline" statewide, as well.
- Magnesium chloride continues to receive increased application to paved and dirt road surfaces statewide; it appears undeniable that trees growing immediately near these roads, especially downhill, are being adversely affected; symptoms include foliage tip burn that accumulates on older needles and branch/top dieback.
  - Discussion: Forest pathologist Susan K. Hagle, USDA FS Forest Health Protection from Region 1, is working on this problem long-term; her email is shagle@fs.fed.us and phone is (208) 926-4275; also, the Natural Resource staff at the US Air Force Academy has had success getting chemical analysis done on affected trees.
- Pinyon pine decline remains a mystery, but is an issue at several locations; it's probably best described as a set of environmental conditions (mild winters ?) interacting with certain site factors (soil type and depth ?) that attracts certain organisms (*Ips*, *Armillaria*, pitch-mass borer moths) that garner the blame; the actual combination probably varies by area.
- Miscellaneous and worthy of mention
  - Pinyon needle scale
  - Elm leaf beetle
  - Poplar borer

- Carpenterworm (*Prionoxystus robiniae*)
- Green ash dieback

### Wyoming State Division of Forestry --- Les Koch \*

- Douglas-fir beetle is at outbreak status on the eastern and western fronts of the Big Horn Mountains; drought has led to DFB increases on the Absaroka Front to the Owl Creek Mountains.
- Mountain pine beetle increased three-fold on Casper Mountain in ponderosa pine; MPB is also at epidemic status along the entire east side of the Big Horn Mountains in ponderosa pine and across large acreages on the Wyoming side of the Black Hills; a small infestation was surveyed on state land in the ponderosa pine breaks north of Manville on state land.
- Spruce beetle-caused mortality is again evident in the Big Horn Mountains; almost 250,000 killed trees were detected in the side drainages of the North and South Forks of the Shoshone River, nearly double the estimate from the 2000 aerial survey.
- Fires and severe weather have created pine engraver habitat on all ownerships in the Black Hills of Wyoming.
- Six European gypsy moths were captured in a delimitation effort in Teton County, suspected of hitchhiking from a nursery in Michigan; no gypsy moths were captured in detection trap statewide.
- Dwarf mistletoe (DM) was not detected in ponderosa pine forests of northeastern Wyoming (Crook and Weston Counties); lodgepole pine DM is common on Green Mountain in Fremont County where 5,000 ac are infected across all ownerships; DM played a role in leading to limber pine decline on the Bighorn and Shoshone NFs.
- White pine blister rust probably occurs on Casper Mountain on limber pine and has been confirmed on the west side of the Bighorn Mountains, particularly in Ten Sleep Canyon.
  - Discussion on control methods: pruning off infected branches in timber and high value areas; try fungicide on high value trees.
- Subalpine fir decline is evident in many stands in central Wyoming, on Little and Pine Mountains south of Rock Springs and on the Bighorn and Shoshone NFs.
- Pheromone baited Lindgren funnel traps were placed on Casper Mountain in 2001, one set for MPB and one for western balsam bark beetle (WBBB) and checked weekly from June through September; MPB showed one peak of flight in late August and WBBB showed two distinct flight peaks, one in late June and another in late July. These results match what others have found; tapping will again be conducted in 2002.

### Submitted Materials

The following were submitted and distributed to attendees:

- "Report to the Great Plains Tree Pest Council" by Don Reynard; PFRA Shelterbelt Centre; Indian Head, Saskatchewan; Canada. Don was not able to attend and hopes to do so next year.
- "Homeowner Packaged Plant Disease Control Chemicals" by George L. Philley, Extension Plant Pathologist, Texas Cooperative Extension, Overton, TX. This was obtained for and submitted to the membership by Ned Tisserat, who was unable to attend.

### New Business

A hearty "Thank you !" was extended to Les Koch for planning and arranging the meeting.

\* indicates a handout was provided

Suggestions for next year's meeting site included northeastern Colorado near the Platte River (Jewelsburg or Sterling) or Rapid City near Rapid Creek to allow a field trip re riparian forest health.

Suggested dates were during the week of April 7 (i.e. April 8 and 9, 2003).

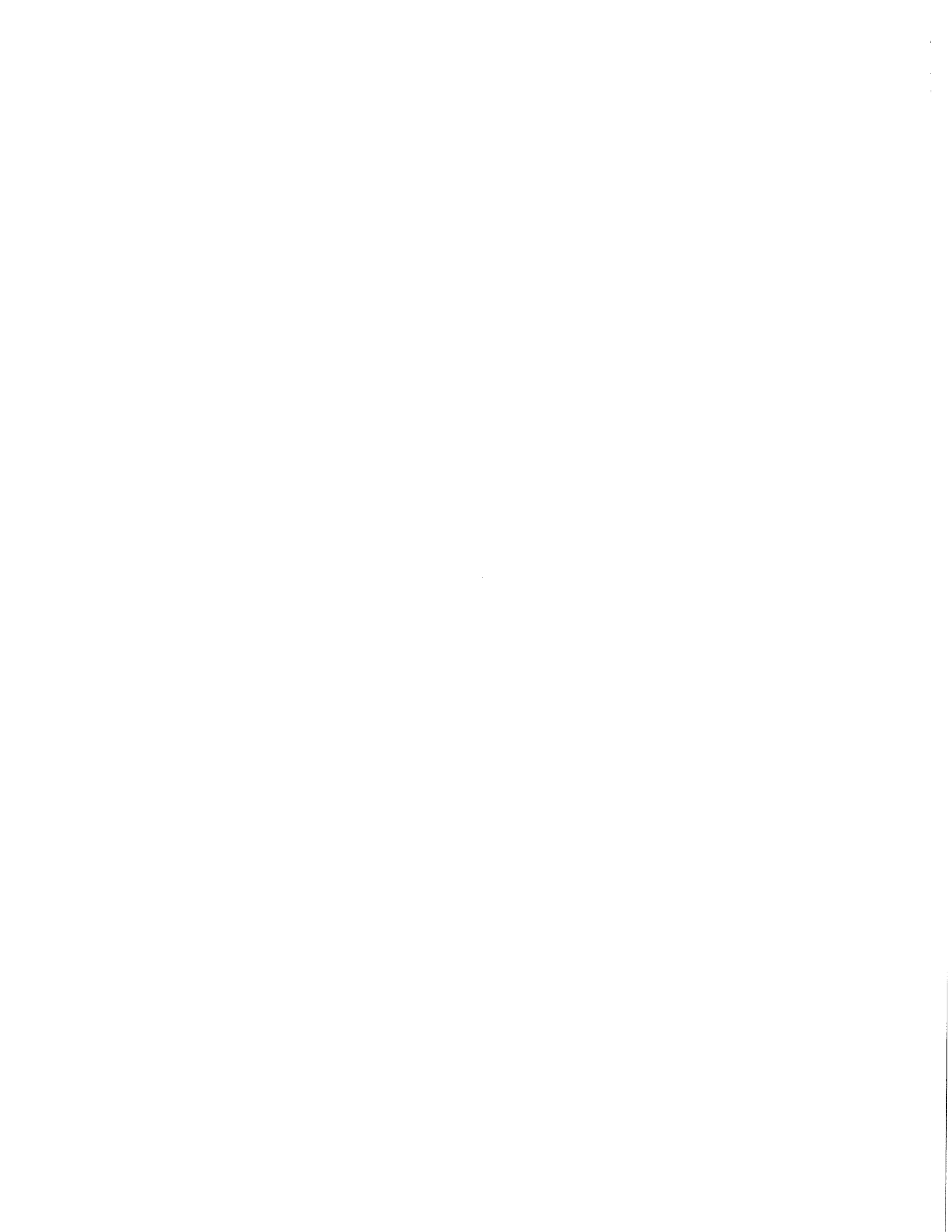
Mailing list changes from present members will be incorporated by Les and sent to the membership; an asterisk will be placed next to the names of those in attendance who provided handouts so that interested parties can contact them directly.

#### Election of new officers

- ❑ Laurie Stepanek nominated Jeri Lyn Harris for Chairperson; seconded by Dan Long; passed by voice vote.
- ❑ Jeri Lyn Harris nominated Bill Schaupp for Secretary; Marcus Jackson seconded; passed by voice vote.

Discussion on ideas for featured speaker at the 2003 meeting produced the following:

- ❑ Report from the riparian focus group by Jeri Lyn
- ❑ Tom McClure on riparian forest invasive species
- ❑ Ned Tisserat on fungicide treatment options for tree diseases
- ❑ Mark Harrell on converting photographic slides to digital images stored as computer files.





**RAPID CITY SERVICE CENTER, FOREST HEALTH MANAGEMENT  
USDA FOREST SERVICE, ROCKY MOUNTAIN REGION (R-2)**


Report to the Great Plains Tree Pest Council Casper, WY April 2 and 3 2002

Staff: Kurt Allen - Leader/Entomologist	Office:
Vacant - Plant Pathologist	1730 Samco Road
Joel McMillin – Entomologist	Rapid City, SD 57702
Bill Schaupp-Entomologist	Phone: (605) 394-1960
Dan Long - Forest Health Technician	FAX: (605) 394-6627

Service Area: All of South Dakota, except northwest corner; All of Nebraska; Northern Wyoming east of the Continental Divide (north of Casper and South of Pass City).

**Summary of Rapid City Service Center 2001 – 2002**

**Reports:**

- RCSC-01-01 – Aerial survey of insect and disease conditions, Black Hills National Forest
- RCSC-01-02 – Aerial survey of insect and disease conditions, Shoshone National Forest
- RCSC-01-03 – Monitoring of hail damage in northern Black Hills, Black Hills National Forest
- RCSC-01-04 – Wood deterioration of fire-damaged pine, Black Hills National Forest
- RCSC-01-05 – Aerial survey of insect and disease conditions, Bighorn National Forest
- RCSC-01-06 – Bark Beetle flight monitoring on the Black Hills NF
- RCSC-01-07 – Bark Beetle flight monitoring on the Bighorn NF
- RCSC-01-08 – Monitoring of hail damage along Sheridan Lake Road, Black Hills National Forest
- RCSC-01-09 – Insect activity on the Rosebud Reservation
- RCSC-01-10 – Insect activity in the Rogers Shack fire
- RCSC-01-11 – Deterioration of fire damaged trees
- RCSC-01-12 – Insect activity in the Uncle Unit in the Jasper Fire area 
- RCSC-02-01 - Aerial survey of insect and disease conditions, Black Hills National Forest
- RCSC-02-02 - Aerial survey of insect and disease conditions, Bighorn National Forest
- RCSC-02-03 - Aerial survey of insect and disease conditions, Shoshone National Forest
- RCSC-02-04 - Bark Beetle flight monitoring on the Shoshone NF
- RCSC-02-05 – Mountain pine beetle activity on the Bighorn NF

## Evaluations:

McMillin, J. D. , K. K. Allen & D.F. Long. 2001. Evaluation of western balsam bark beetle fight periodicity in the Bighorn National Forest. *USDA Forest Service, Region 2, Biological Evaluation RCSC-02-01.*

Allen, K. K. & D.F. Long. 2001. Evaluation of mountain pine beetle activity in the Black Hills National Forest. *USDA Forest Service, Region 2, Biological Evaluation RCSC-02-02.*

Allen, K. K. & D.F. Long. 2002. Evaluation of Douglas-fir beetle along the North Fork of the Shoshone River, Shoshone National Forest, Wyoming. *USDA Forest Service, Region 2, Biological Evaluation RCSC-02-03.*

## Current Work at Rapid City Service Center

### Insects and Diseases:

- Subalpine fir decline in spruce-fir forest type of the north-central Rocky Mountains
- Evaluation and monitoring of direct and indirect effects of hail damage to ponderosa pine stands on the Black Hills National Forest.

### Insects:

- Gypsy moth detection trapping in recreation sites of national forest and parks in South Dakota and Wyoming
- Bark beetle sampling *Ips*, mountain pine beetle, Douglas-fir beetle, and western balsam bark beetle in the Black Hills, Bighorn, and Shoshone National Forests
- Role of subalpine fir blowdown in western balsam bark beetle populations dynamics
- Interaction between fire-damaged ponderosa pine and insects
- Mountain pine beetle pheromone biology
- Use of lethal trap trees in mountain pine beetle management
- Using MCH to prevent Douglas-fir beetle attacks

### Diseases:

- Armillaria permanent plot re-measurements
- Mistletoe control evaluation
- White pine blister rust and limber pine interaction

# Report to the Great Plains Tree Pest Council

**Don Reynard**

PFRA Shelterbelt Centre

Indian Head, Saskatchewan, Canada, S0G 2K0

voice: 306-695-5133

fax: 306-695-2568

email: [reynardd@em.agr.ca](mailto:reynardd@em.agr.ca)

## 2001 PEST REPORT

In 2001 we received over 600 inquiries relating to insects and diseases of trees and shrubs. Most enquiries were received from rural areas of Saskatchewan, with the most common enquiries regarding spruce spider mite, yellow-headed spruce sawfly, woolly elm aphid, ash plant bug, spruce budworm and bronze birch borer.

## 2001 RESEARCH STUDIES

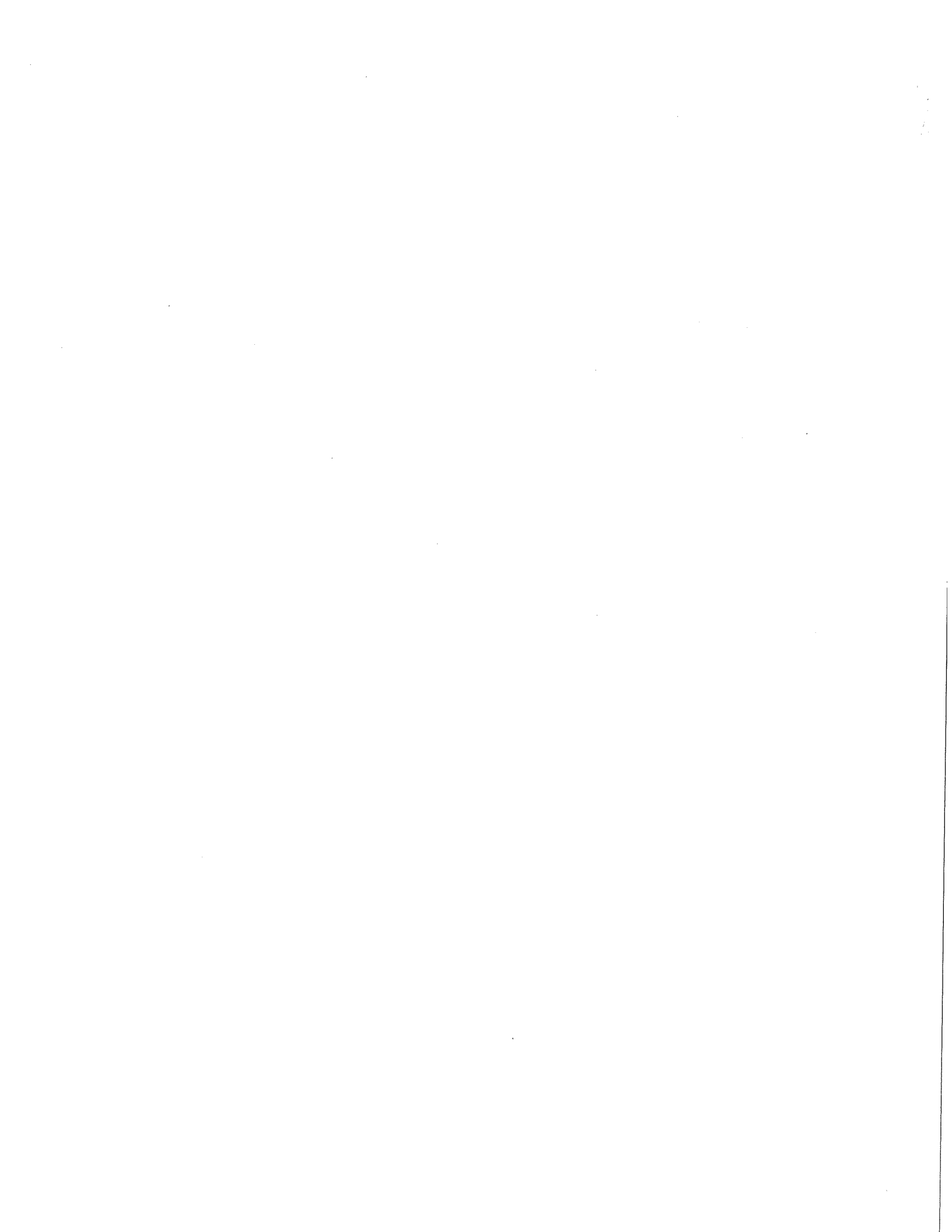
**Poplar Pest Survey** - There has always been a high demand for hybrid poplar for use in farmyard and field shelterbelts to reduce wind and prevent soil erosion. Recently there has been interest in using hybrid poplars for; carbon sequestration, phytoremediation, oriented strand board lumber, and for value-added products such as hardwood flooring, paneling and furniture. In 1998 and 1999, the Shelterbelt Centre established hybrid poplar plantations at six sites in Saskatchewan. Each plantation was approximately six hectares in size and contained 10,000 hybrid poplars. In 2001, surveys were conducted three times at four of the sites to monitor insect, mite, disease and environmental damage. Surveys were conducted at the plantations near Esterhazy, Birch Hills, Prince Albert and Meadow Lake, Saskatchewan. Pest surveys were conducted on the five poplar clones; Assiniboine, CanAm, Manitou, Prairie Sky and Walker that are used in the clonal portion of each poplar plantation. The surveys were conducted during the weeks of June 4, July 16 and September 4, 2001. During each survey, between 120 and 130 plants at each location were examined for insect, mite, disease and environmental damage.

The most noticeable insect observed during the surveys in 2001 was the gray willow leaf beetle (*Tricholochmaea decora*) which caused light to moderate damage at the four poplar plantations. Numerous leafrollers and leaftiers were recorded during the surveys with only four identified, green aspen leafroller (*Apotomis removana*), lined black aspen caterpillar (*Xylomyges dolosa*), obliquebanded leafroller (*Choristoneura rosaceana*) and rustylined leaftier (*Clostera albosigma*). There were other leafrollers and leaftiers present but they were found in such low numbers they could not be identified. Four species of leafminers were commonly found during the surveys, aspen serpentine leafminer (*Phyllocnistis populiella*), cottonwood leafmining beetle (*Zeugophora scutellaris*) and two species that have no common name (*Messa leucostoma* and *Phyllonorycter salicifoliella*). Although the above insects were commonly noted feeding on the poplar within the plantations the insects did not appear to reduce the growth and vigour of the poplars. Other insects recorded causing insignificant damage to the hybrid poplars within the



plantations in 2001 were:

Alder dagger moth	<i>Acrionicta dactylina</i>
American hornet moth	<i>Sesia tibialis</i>
Black willow aphid	<i>Pterocomma smithiae</i>
Canadian tiger swallowtail	<i>Pterourus glaucus canadensis</i>
Cottonwood leaf beetle	<i>Chrysomela scripta</i>
Flea beetles	<i>Phyllotreta</i> and <i>Crepidodera</i> sp
Forest tent caterpillar	<i>Malacosoma disstria</i>
Grasshoppers	Various species
Leaf folding sawfly	<i>Phyllocolpa agama</i>
Poplar and willow borer	<i>Cryptorhynchus lapathi</i>
Poplar and willow leaf weevil	<i>Lepyrus canadensis</i>
Rusty tussock moth	<i>Orgyia antiqua</i>
Spotted poplar aphid	<i>Aphis maculatae</i>
Tarnish plant bug	<i>Lygus lineolaris</i>
Willow sawfly	<i>Nematus ventralis</i>
White admiral	<i>Basilarchia arthemis</i>





"Don Reynard"  
<REYNARDD@em.agr  
.ca>  
Sent by:  
owner-gptpc@ndsuent.  
nodak.edu

To: <gptpc@ndsuent.nodak.edu>  
cc:  
Subject: 2001 Pest Report

03/27/02 03:11 PM

Please find attached a copy of the 2001 report on pest conditions and research activities at the PFRA Shelterbelt at Indian Head, Saskatchewan.

I'm afraid I will not be able to attend the Great Plains Tree Pest Council meeting this year.

Have a great meeting and I'll try to attend next years meeting.

Don Reynard

Don Reynard  
Insect and Disease Technician  
PFRA Shelterbelt Centre  
Indian Head, Saskatchewan  
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<http://www.agr.gc.ca/pfra>



2001.wpd





*Great Plains Tree Pest Council  
Wyoming State Forestry Division  
2001 Report*

**Douglas-fir beetle**

Narrative: The west and east fronts of the Bighorn Mountains are experiencing outbreaks of Douglas-fir beetle although the extent on the west side is not as severe as on the east. Drought conditions on the Absaroka Front to the Owl Creek Mountains have led to increased DFB activity. Forest Service aerial surveys show increases from 2000 in acreages in activity on the Clarks Fork and Wapiti Ranger Districts of the Shoshone NF. The number of trees has decreased, though. In 2000, there were 25,971 trees affected on 7,636 acres whereas the totals in 2001 were 15,604 trees on 11,575 acres.

**Mountain pine beetle**

Narrative: Wyoming State Forestry conducted an aerial survey of Casper Mountain (Natrona County) and recorded 451 ponderosa pines killed by mountain pine beetle. This is a threefold increase from 2000's survey that showed 147 dead trees. Most of the infestations were spotty with only one or two trees per polygon. Lodgepole pine forests on Casper Mountain had no noticeable mortality during the 2001 survey. Ownerships affected were primarily private but a State section was also recorded along with some BLM property. As with last year's survey, Teton County, particularly the Jackson area, has endemic levels of MPB. MPB is causing considerable damage in ponderosa pine in the lower foothills of the Bighorn Mountains starting from Kaycee in Johnson County and proceeding north to Dayton/Ranchester areas in Sheridan County. This comprises State, private, and federal land ownerships. Ground surveys in a State section north of Manville in Niobrara county yielded approximately 30 ponderosa pine infested with MPB. MPB continues to infest large acreages of ponderosa pine on the Wyoming side of the Black Hills NF. Region 2's aerial survey documented over 5000 ponderosa pines killed by MPB on both State and private property in this area. MPB is suspected of playing a significant role in limber and whitebark pine decline in the Shoshone National Forest. Dwarf mistletoe, white pine blister rust, and MPB are leading to the decline of over 58000 acres of white pine.

**Spruce beetle**

Narrative: Spruce beetle killed roughly 995 Engelmann spruce on 305 acres in the Bighorn National Forest. The 2000 numbers showed 1320 trees killed on 1211 acres. Spruce beetle damage was present in many side drainages of the North and South Forks of the Shoshone River. Numbers for 2001 were 238,695 trees killed on 61,361 acres. This is a significant increase over 2000's numbers when 138,745 trees were killed on 17,874 acres.

**Pine engraver beetle**

Narrative: Past wildfires and severe weather played roles in creating suitable habitats for Ips in the Black Hills area of Wyoming. Surveys show 74 ponderosa pines were killed on state, private, and federal property.

**European gypsy moth**

Narrative: Wyoming State Forestry Division did not capture any adult gypsy moths in 2001. Delimit trapping by APHIS in Teton County yielded six adult moths. These moths are suspected of hitch-hiking on infested planting stock transported from a nursery in Michigan.

**Dwarf mistletoes**

Narrative: No dwarf mistletoe was detected in ponderosa pine forests in northeast Wyoming (Crook and Weston Counties). Lodgepole pine dwarf mistletoe is common on Green Mountain in Fremont County where 5,000 acres (state, federal, and private properties) are affected. Dwarf mistletoe played a role in leading to limber pine decline in the Bighorn and Shoshone NF's.

**White pine blister rust**

Narrative: Several limber pine stands on Casper Mountain in Natrona county are suspected of being infected by white pine blister rust. White pine blister rust has been confirmed in Big Horn and Washakie counties (west side of Bighorn Mountains), particularly in Ten Sleep Canyon.

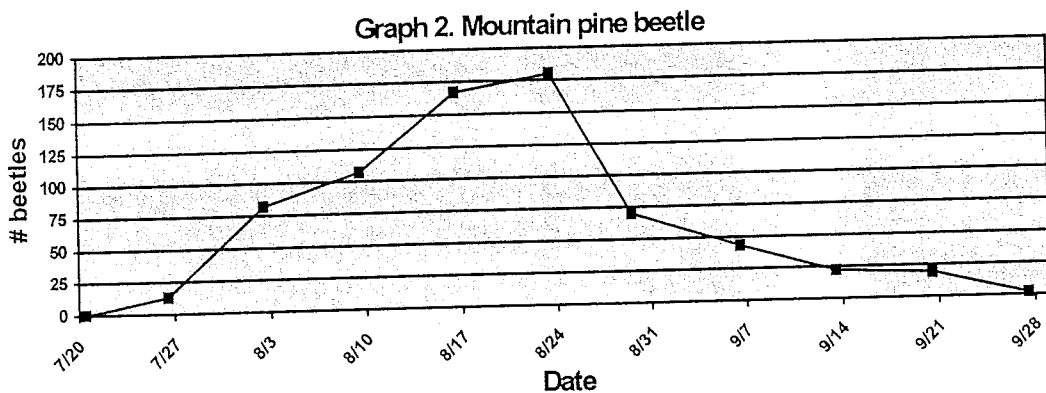
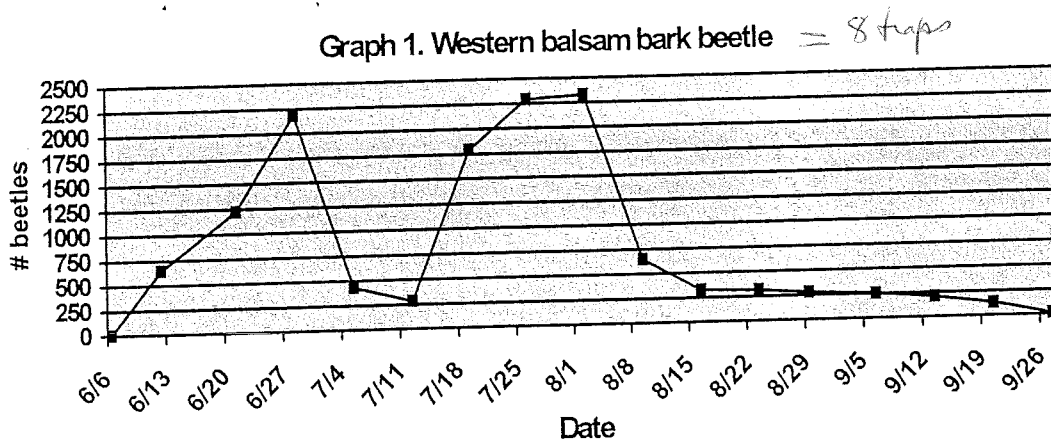
**Subalpine fir decline**

Narrative: Many stands of subalpine fir are declining on private and state properties in central Wyoming, particularly on Casper Mountain in Natrona county. Large pockets of subalpine fir are declining on Little and Pine Mountains south of Rock Springs. Shoshone NF has 19020 trees on 10607 acres impacted by this decline. The Bighorn NF had less numbers in 2001 (19966 trees on 3944 acres) compared to 2000 (70,000 trees on 33605 acres).

## 2001 Bark Beetle Trapping on Casper Mountain

Mountain pine beetle and western balsam bark beetle were trapped on Casper Mountain during summer 2001. Two lindgren funnel traps containing WBBB aggregate pheromones were placed on May 22<sup>nd</sup> at each of these four locations: (1) State property on the west side of the mountain, (2) the main radio tower hill, (3) Beartrap Meadow County Park on the hillside overlooking the campsites, and (4) private property off East End Road north of the Ponderosa Park turnoff. The first collection date was June 6<sup>th</sup> and the traps were checked and beetles counted weekly through September 27<sup>th</sup>. Total beetle counts for all eight traps were plotted weekly (graph 1).

Three lindgren funnel traps baited with MPB aggregate pheromones were placed in ponderosa pine near the main drainage between Muddy and Casper Mountains. The first collection date was July 20<sup>th</sup> and traps were checked weekly through September 27<sup>th</sup>. As with WBBB, total MPB counts per week were plotted against respective dates (graph 2).





**COLORADO STATE FOREST SERVICE 2001 REPORT TO:  
GREAT PLAINS TREE PEST COUNCIL  
CASPER, WYOMING (APRIL 2002)**

**INSECTS**

**Mountain Pine Beetle** - This insect continues to be the primary pest of interest on private land (see the 2001 aerial survey information for distribution and numbers of infested trees). The statewide total for current faders recorded during 2001 flights is 458,000 trees (which compares with 275,000 for 2000). Despite this significant increase, indications are for key areas of residential development (such as the Front Range) that the epidemic, while not over, is slowing. In some areas, rate of spread is definitely below the "doubling" rate witnessed in the late 90's. As a possible explanation, at Manhattan several current faders were checked just prior to expected MPB flight and extensive galleries of longhorned wood borers were found along with very few MPB brood. This indirect "biological control" is as McCambridge found late in the 1970's.

The primary ponderosa pine hot spot continues to be the Upper Arkansas Valley centered around Buena Vista, with alarming associated build-ups in southwestern South Park west of Antero Junction/Trout Creek Pass and south of US50 (Little Cochetopa Creek area). Interestingly, a relatively large number of pinon pine (100's?) intermingled with (or near) infested ponderosa pines continue to be attacked and cause concern on private land from Nathrop south to Poncha Springs. In some cases ponderosa pine firewood brought into town areas with ornamental pinons appears to be the "source". Other areas of concentrated ponderosa pine mortality exist in Park County west of Bailey, in Larimer County from Pingree Park north to Rustic and Red Feather Lakes, near Beulah in Pueblo County, and others. In lodgepole pine, Granby-Grand Lake (still increasing?) and Vail (slowing) suffered the greatest losses in 2001.

CSFS efforts include general landowner education, direct suppression, timely salvage coordination, preventive spraying assistance, and preventive management prescriptions. Annual accomplishment levels are about 20,000 infested trees treated annually on private land and 150,000 trees preventively sprayed by private contractors. The great majority of infested trees are now being treated via solar methods and transport to "safe" sites (where beetle emergence poses minimal threat to live trees). In the Bailey area an innovative program is being tried where landowners can bring infested trees to predetermined dropoff points and an organics company picks up the logs, transports them to Golden, and converts them to mulch prior to beetle flight.

**Spruce Beetle** - Infestations on private land near the Routt Blowdown site are still minimal but increasing. The Steamboat Ski Area continues to be a concern but actions by the ski corporation and the USFS have helped suppress populations, at least so far. The tiny community of Hinton near Clark has suffered heavy infestation according to Bill Schaupp (CSFS has not seen this personally). Aerial surveys in 2001 show over 10,000 trees infested on public land near the blowdown (which is thought to represent as little as 1/10th to 1/30th of the actual infestation level on the ground!) and concern is great for the unpredictable but expected spread to other public and private lands. Particularly impacted are the various drainages of the Elk River north of Steamboat Springs. Preventive spraying appears to be an increasingly wise option for live, high-value trees on private (and public) land in the near future.

Spruce beetle losses are expected to increase at a number of scattered blowdown spots throughout the higher elevations, mostly on federal land. Of particular note is the Lost Lake area of Hinsdale County. The West Lake Creek area in Eagle County, Muddy Creek north of Paonia Reservoir in Gunnison County, and north of Rifle Falls State Park in Garfield County are also concerns on private land.

### **Engraver Beetles (*Ips* spp.)**

These insects are becoming increasingly conspicuous for a number of reasons. In general, weather conditions over the last decade have been dry and mild, which leads to the type of pine and spruce forest stress these insects prefer. Also, the mountain pine beetle creates a lot of dead limbs and tops that are being colonized by engraver beetles. [This has resulted in sapling mortality near the base of Mount Shavano in Chaffee County.] Third, the tremendous human development of forested areas in Colorado is placing stresses on native forests and resulting in lots of landscaping with ball-and-burlap pines (and subsequent ips-caused mortality). Examples of this would be Coal Creek Canyon (Boulder County), Elizabeth (Elbert County), Castle Pines (Douglas County), mountain subdivisions throughout Jefferson County, the Colorado Springs area, and south of Montrose. Lastly, vegetation management resulting from the National Fire Plan is creating large amounts of slash that lend themselves to engraver beetle colonization. [As for the latter, roller-chopper operations to thin dense forests and reduce fire hazard, particularly in pinyon pine, have resulted in flare-ups of ips-caused mortality in live trees nearby. A 50-acre area on Colorado Division of Wildlife property 8 miles northwest of Salida in Chaffee County is a good example. But in general, such spikes in activity are short-lived and manageable by standard slash management procedures.]

Major pinon mortality (5000+ trees) is occurring in the southwest corner of the state centered around Mancos in Montezuma County. Usually the primary organism in these trees is Pinon Ips (*Ips confusus*). In some trees, signs of blackstain root disease are found, but this situation appears to be mostly drought/ips in nature (this, despite relatively normal winter weather and good summer rains in 2000 and 2001). The affected area includes at least lower Dolores Canyon on the north, McElmo Canyon on the west, Mesa Verde on the south, and Hesperus on the east.

Ips beetles can also be found in pinon mortality in Las Animas County northeast of Kim and along the north and east sides of the Glenwood Springs city limits in Garfield County. As for the Kim situation, it appears the species is *Ips pini*. A few hundred trees are involved at a minimum at Kim, 20-30 trees at Glenwood. The underlying causes appear to be moisture related (too much or too little?). Locals report a similar die-off of pinons in the Kim area in the 1950's.

In the pinon area of the eastern San Luis Valley (near Crestone), ips beetle activity is usually found in conjunction with Armillaria root disease. No doubt this disease is associated with much more of the so-called "ips" problem than is ever reported.

Ips beetles, mostly *I. pini* and other larger species (probably *I. calligraphus* and *I. knausi*) are causing pockets of mortality in the northern part of Colorado Springs and a nearby pocket of 68 acres (estimated 400 dead trees) occurs on the Air Force Academy.

Ips attacks on urban Colorado blue spruces (*Ips hunteri*) continue in Greeley, Denver, and Colorado Springs but have subsided from levels of 5 years ago.

**Western Spruce Budworm** - This defoliator, which has shown signs of a resurgence along the Front Range over the past two years, was greatly set back by a series of late frosts which killed much of the new growth on Douglas-fir, white fir, and other hosts. Particularly impacted in this way were the Wet Mountains near Lake Isabel. The frost events of May20 and June13 were most significant (see Abiotics Section).

An area of private land (317 acres) in the Pass Creek area northeast of LaVeta Pass was aerially sprayed with *Bacillus thuringiensis* in June by private contractor. Two other areas totalling 152 acres were similarly treated near Lake Purgatory north of Durango.

The Lake City Demonstration Thinning is under contract and work will be completed in 2002.

**Douglas-fir Beetle** - The largest infestation area, around the edges and within the Douglas-fir Tussock Moth infestation area of the early 1990's near Westcreek in Douglas County, appears to have subsided considerably in 2001 (based on August aerial survey). Other small infestations are reported: Placerville (San Miguel County) and near Powderhorn (Mesa County) but do not seem of major consequence or to be generating much public inquiry.

**Ponderosa Needleminer** (*Coleotechnites ponderosae*) - This insect continues at high levels throughout the forested portions of the Black Forest in Elbert, Douglas and El Paso Counties. Our Franktown District reported receiving about 10 calls a week on this insect for most of July and August. Tip damage occurs to the distal half of old needles and, as such, is not considered particularly harmful in itself (other than reduced radial growth). The confusion it causes with MPB fading and/or natural needledrop later in the fall can be a landowner education issue, as trees have mistakenly been cut down in the name of pine beetle and mistletoe.

**Fall Webworm** (*Hyphantria cunea*) - Narrowleaf cottonwoods, and to a much lesser extent plains cottonwood and boxelder, along the Arkansas River between Canon City and Salida, were completely defoliated during late summer. Heavy defoliation of these same trees is almost an annual occurrence of late, but 2001 seemed particularly severe. So far, only branch dieback has been noted. Other areas of heavy fall webworm activity include the lower elevations of most foothills drainages and local areas of the eastern plains, the Grand Junction area, etc.

**Gypsy Moth** - Four moths were caught in delimitation traps in the northwest Denver area in 2001 near the single positive catch site in 2000. This site is on the Arvada/Jefferson County border and a small group of nurseries and landscaping firms in the area are suspected of being the introduction source(s). Because spraying with BT may be problematic this year owing to the various anthrax scares, a decision has been made to mass-trap only in this area in 2002.

In addition, positive traps were found in detection traps near South Fork (Mineral County), Manitou Springs (El Paso County), and Fort Collins (Larimer County). Traps (total of 194) deployed by USFS, both Lakewood and Gunnison Service Centers, were all negative.

## DISEASES

**Dutch Elm Disease** - In general, reports from the normal DED areas in eastern Colorado show very low numbers. Sterling (Logan County) had a elevated number of 11 positives for that relatively small town.

**Davisomycella Needlecast** - Examples of this needlecast (thought to be *Davisomycella ponderosae*) were again found in the Wet Mountains and in the South Platte Ranger District south of Westcreek. This is a minor issue.

**Douglas-fir Needlecast** (*Rhabdocline pseudotsugae*) - Reported as common by our Fort Collins District in lower Poudre Canyon and at the Glacier View development near Red Feather Lakes (both Larimer County). Not a major problem but does result in interior needle browning/shed.

**Dwarf Mistletoe** (mostly *Arceuthobium vaginatum*) - Widespread throughout ponderosa pine stands statewide. *A. americanum* also heavy in certain local areas of lodgepole pine throughout the host type. In conjunction with mild winter conditions and a period of drought years, these parasitic plants are contributing to mortality in many areas of the Front Range, including the Red Feather Lakes area; Estes Park; much of the higher elevation portions of Boulder, Clear Creek and Gilpin Counties; the Jarre Canyon area of Douglas County; Park County including South Park; and the foothills west of Colorado Springs in El Paso County. DM is also a continuing problem in the Black Forest northeast of Colorado Springs in ponderosa pine. Most of our CSFS Districts along the Front Range report that about 10% of their phone calls from the public concerning sick trees are mistletoe related.

**Fireblight** - Not a bad year for it along the Front Range, but heavy dieback noted in the Beulah area in ornamental apples.

## ABIOTIC PROBLEMS

**Frost** - Major late freezes occurred on May 20 and June 13. This resulted in foliage loss for many deciduous trees over a broad swath of central Colorado and as far west as the west half of the Uncompahgre Plateau. Species particularly affected were Gambel oak, aspen, and non-pine conifers. Most of the deciduous hosts appeared to re-foliate and appear "recovered" by July, although some aspen stands north of Fort Garland showed only "tufted, large, sparse leaves" by summer's end. Sprouting in meadows near these stands appeared to be heavier than normal, as if stimulated by the freeze injury to established, above-ground stems. As mentioned above, the loss of new coniferous growth may have been a setback to defoliating insects dependant on new growth such as western spruce budworm. Loss of fruit on some of the deciduous trees and shrubs resulted in higher-than-normal reports of "bears in town".

**Drought/winter-drying** - Many lodgepole/Douglas-fir/spruce forests in the higher elevations of Boulder and Gilpin County looked very bad in late spring (particularly understory Douglas-fir), with the only green foliage being very sparse new growth at the branch tips. Fortunately, these areas did not seem affected by the late frost mentioned above, or else ALL foliage would have been dead. In some stands in Boulder County near Allenspark, armillaria root disease was found in the root collars of small lodgepole pines. But the underlying cause in most of these situations



is thought to be long-term drought combined with low snowpacks, mild winters, below average monsoon rains and unusually high late summer temps in the summer of 2000. No doubt the extent of forest affected by such conditions extends well beyond the above-mentioned counties. These things are probably tied in to the widespread prominence of "Subalpine Fir Decline" involving armillaria and the balsam bark beetle.

**Magnesium chloride** - This ice and dust-control chemical is continuing to receive increased application to paved and dirt roads statewide. Specific reports of tree injury come from Old Snowmass-Aspen Village (spruce), Lake City (spruce and fir), Nederland, and near Golden Gate State Park (lodgepole pine). It appears undeniable that trees growing immediately near these roads (particularly the downhill side) are being adversely affected. Symptoms include foliage tip burn (that becomes accumulatively worse on older needles) and branch/top dieback. Both would appear to be consistent with toxic salt accumulations. Can the jury still be out on the direct connection between MgCl road treatments and tree injury?

**"Pinyon Decline"** - This malady remains a mystery and is probably best characterized as a set of environmental conditions (mild winters?) interacting with certain site factors (soil type and depth?), which attracts certain organisms (ips, armillaria, pitch-mass borer moths (for example, Pinyon Canyon Maneuver Site northeast of Trinidad), etc.) that garner the blame. The actual combination affecting any one area may, and probably does, vary. Known localities of "decline" include the Buena Vista-Nathrop area, south of US50 in Fremont County west of Canon City, the Kim area, and several areas of the West Slope.

#### **MISCELLANEOUS SITUATIONS/ORGANISMS**

**Pinyon Needle Scale** - An area of infestation continues along the eastern flank of the southern Collegiate Peaks centered around Mt. Princeton Hot Springs.

**Elm Leaf Beetle** - Generally not too bothersome, with locally heavy feeding on Siberian elms on the Eastern Plains and in the lower foothills canyons.

**Poplar Borer** - Reported causing problems at increased levels in native and planted trees from many mountainous CSFS Districts, in particular Montrose and Steamboat Springs.

**Carpenterworm** (*Prionoxystus robiniae*) - Reported to be fairly common in globe willows in Delta. Also an occasional issue in windbreaks and urban forests throughout the Eastern Plains.

**Ash Dieback** - The Grand Junction and Denver areas (and others?) report unexplained dieback and occasional mortality of large green ash. No organism has been identified as the cause.

**FOREST HEALTH MONITORING** (See M. Schomaker input, provided elsewhere)

Report prepared by:

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**Report to the Great Plains Tree Pest Council**  
**April 2-3, 2002; Casper, WY**

**LAKEWOOD SERVICE CENTER, FOREST HEALTH MANAGEMENT**  
**USDA FOREST SERVICE, ROCKY MOUNTAIN REGION (R-2)**

**Lakewood Service Area:** Northern Colorado, Kansas, and southeastern Wyoming

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**Function:** We provide technical assistance on forest pest problems and forest health issues to federal land management agencies. We cooperate with state and other federal agencies to provide assistance on state and private lands.

**Websites:** R-2, Forest Health Management: [www.fs.fed.us/r2/fhm](http://www.fs.fed.us/r2/fhm)  
This site, created by Jim Worrall, Plant Pathologist at our Gunnison Service Center, includes a bulletin board, reports, staff listings, links, and much more.

National Office, Forest Health Protection: [www.fs.fed.us/foresthealth](http://www.fs.fed.us/foresthealth)  
This site provides national program descriptions, forest insect and disease leaflets on line, publications, the national mortality risk map, and much more.

### Staff Changes

- Jeff Witcosky, Entomologist, replaced David W. Johnson (retired), as the Lakewood Service Center Leader in August, 2001.
- Jeri Lyn Harris moved from the pathologist position to the Regional Forest Health Monitoring Coordinator position in October, 2001.
- Lee Pederson obtained an Entomologist position with the USDA Forest Service in Ogden, Utah, in November, 2001.
- Bill Schaupp moved from the Lakewood Entomologist position to the vacant Entomologist position in our Rapid City Service Center in March, 2002.
- The Lakewood Service Center Entomologist, Pathologist, and Biological Technician positions have been advertised and we are now in the process of selecting candidates for these positions.

### Summary of Select Insect and Disease Conditions

**Gypsy moth, *Lymantria dispar*:** Each year, detection traps are placed in campgrounds and at other locations that have a high likelihood of being introduction sites for the gypsy moth, a quarantined insect. This is part of a cooperative effort led by the USDA-Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine. The assistance of Steve Wallace, US Air Force Academy, Natural Resources staff, and Pat McPherrin, USDA Animal and Plant Health Inspection Service, Colorado Work Unit, is gratefully acknowledged.

The detection trapping sites were selected on the basis of elevation, presence of hardwood species, and potential for high numbers of out-of-state visitors. Several National Forest recreation sites in Colorado and Wyoming, Fort Carson Military Reservation, the US Air Force Academy, and Rocky Mountain National Park were trapped for gypsy moth during 2001. No traps were placed in Kansas by LSC staff. A total of 52 gypsy moth detection traps were placed in the field in 2001. No gypsy moths were caught in these detection traps.

In addition to the detection traps, a total of 60 traps were set within Rocky Mountain National Park's Moraine Park Campground to delimit a possible gypsy moth infestation. The year 2001 was the third consecutive year of delimitation trapping in the Park, in response to the capture of a single gypsy moth in 1998, 1999, and 2000. No gypsy moths were recovered from the traps from Moraine Park Campground when they were removed in October 2001.

**Douglas-fir tussock moth, *Orgyia pseudotsugata*:** Low-dose pheromone traps were set out in the upper South Platte River drainage to serve as an early warning system for the Douglas-fir tussock moth. Clusters of 5 traps were placed at twelve locations along the river drainage. Two moths were caught in the traps in 2001; this is the first time we have caught tussock moths since the early warning system was set up.

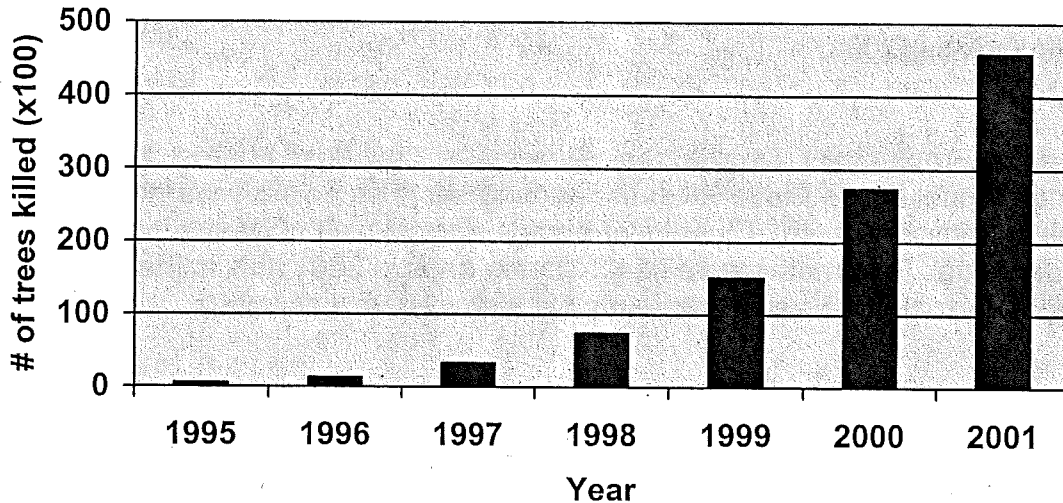
**Western Spruce Budworm, *Choristoneura occidentalis*:** Western spruce budworm defoliation is becoming apparent in more locations in Colorado and Wyoming. It is causing defoliation on Douglas-fir, white fir, Englemann spruce and subalpine fir and areas of significant concern include: Medicine Bow Mountains southeast of Saratoga, the Front Range in Colorado near Evergreen and Bailey, the Northern Sangre de Cristo Mountains, the northern and eastern San Juan Mountains, and the Uncompahgre Plateau. Late spring frosts killed new shoot growth in many Colorado locations in 2001 and halted the build up of budworm numbers.

**Douglas-fir beetle, *Dendroctonus pseudotsugae*:** The Douglas-fir beetle outbreak within the upper South Platte watershed, which expanded and intensified in 1999 and 2000, subsided to a considerable extent in 2001. Affected areas include Sprucewood in Douglas County, site of a Douglas-fir tussock moth infestation of 1993 – 1995, and areas adjacent to the Buffalo Creek fire of May 1996. The fires of 2000 provided this beetle with additional breeding material and some additional losses were observed around the perimeter of burned areas in 2001. Another Douglas-fir beetle outbreak in Central Colorado, west of Saguache, declined significantly in 2001.

**Mountain pine beetle, *Dendroctonus ponderosae*:** Mountain pine beetle populations have been increasing at a number of locations in Colorado since 1995 and this trend continued in 2001. The graph on the following page illustrates the increasing number of mountain pine beetle infested trees in the state over the last seven years.

Beetle outbreaks continued to expand in a number of locations across the state. Areas of concern in Colorado include the upper Arkansas Valley, Vail Valley, South Park, the Lake Granby area, Middle Park areas such as the upper Williams Fork and East Troublesome Creek, southern North Park near Rand, and the Front Range of Colorado. Areas of concern in Wyoming include the upper Platte Valley near the Colorado border.

**Summary of mountain pine beetle killed trees in Colorado  
based on aerial surveys, 1995 – 2001**



**Pine tip moths, *Rhyacionia* spp.:** Ongoing control problems in pine plantings in Kansas have led to the idea that more than one species of tip moths is causing damage. Pheromone trapping on one property was conducted in 2000. More of this and other surveys are needed, but first a specialist able to distinguish the candidate species must be located.

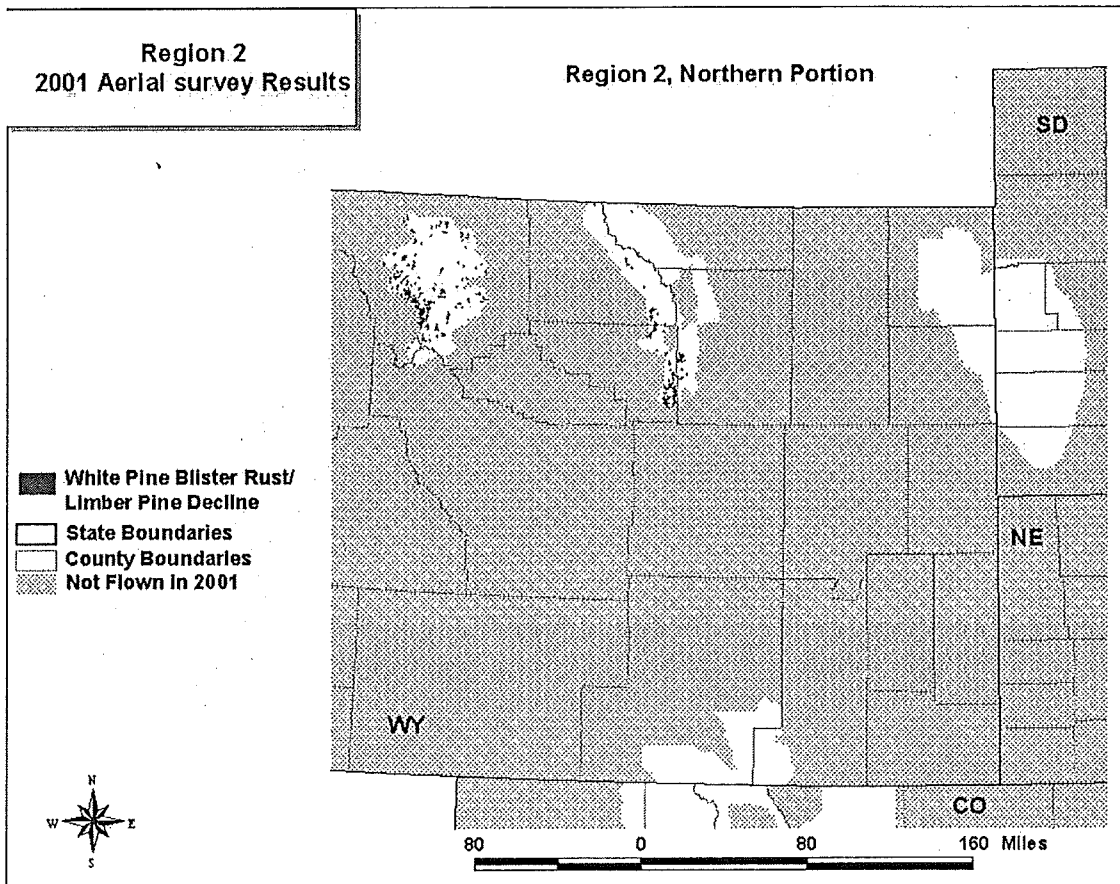
**Spruce beetle, *Dendroctonus rufipennis*.** Although not usually considered a Great Plains tree pest in our area, it is worth mentioning that significant windthrow has occurred in many places in western Colorado and southcentral Wyoming since 1997. The Routt Divide blowdown episode in 1997 has resulted in an outbreak of spruce beetle near Steamboat Springs, Colorado. Beetles infested the fallen timber in 1998 and 1999. Brood beetles emerged from the downed trees in 2000 and 2001 and infested large numbers of standing spruce in the area. Susceptible forests combined with the abundant beetle populations in standing spruce makes a beetle epidemic all but certain in the Steamboat area. We expect dramatic increases in spruce losses in the area over the next decade.

**White pine blister rust, *Cronartium ribicola*:** White pine blister rust occurs at low to moderate infection levels in whitebark and limber pine stands in Colorado, South Dakota, and Wyoming. Some stands have high levels of disease, with more than 50% of the trees infected and dying due to blister rust.

Several projects/surveys are planned to look at white pines in CO and surrounding states during the 2002 field season. Efforts are underway to collect a variety of data on white pines in the central Rockies, the distribution of *Ribes*, the alternate host for blister rust, and to hazard rate limber pine stands for white pine blister rust.

Forest Service aerial surveys show white pine blister rust and other agents (mountain pine beetle, needlecasts, etc.) damaged approximately 46,000 acres in northern Wyoming in the counties of **Big Horn, Fremont, Johnson, Park, Sheridan** and **Washakie** (see figure below).

2001 AERIAL SURVEY RESULTS DEPICTING AREAS WITH WHITE PINE BLISTER RUST OR LIMBER PINE DECLINE IN THE NORTHERN WYOMING FORESTS OF THE ROCKY MOUNTAIN REGION.



## Regional Aerial Survey and Other Projects

- Aerial insect and disease detection surveys are performed annually on federal, private, and state lands in cooperation with our State partners. Approximately 21 million acres were surveyed in 2001 in Colorado, South Dakota, and Wyoming. Some of the more common insect and disease impacts detected by these surveys include bark beetles, defoliators, and subalpine fir decline. The most widespread damage agent detected in 2001 was subalpine fir decline followed by mountain pine beetle. Spruce beetle impacts in Colorado and northwestern Wyoming increased significantly in 2001.
- A draft Environmental Impact Statement dealing with the expanding spruce beetle and mountain pine beetle outbreaks on the Medicine Bow – Routt National Forests was prepared in 2001 with significant involvement by our staff at the Lakewood Service Center and Regional Office. The EIS covers spruce beetle and mountain pine beetle management options for national forest lands around Steamboat Springs. Release of the final EIS is expected in April 2002.
- Long-term root disease monitoring plots in Colorado and South Dakota were re-measured in 2001. Following data analysis, we plan to use this information to calibrate and extend the use of available root disease models for forest ecosystems in the Central Rocky Mountains.
- By request, a training presentation on pine pests was made at the Horticulture Inspection Society's Central Chapter meeting in Wichita, Kansas, in October 2001. The Central Chapter, formed in 1970, covers 13 states including North and South Dakota and Nebraska. The Society's membership is composed of state inspectors, with associated membership categories available to interested parties. The Society works closely with the National Plant Boards and other groups. In 1999, a Western Chapter was formed. These professionals are expert at pest detection and treatment. They play an important role regarding exotic invasive species, as well as established pests, and are always interested in broadening their contacts and knowledge. The Central Chapter has an excellent identification manual on line, as well as a newsletter. Their website is: <http://www.grapevine.net/~scwhite/HIS/>.

## Recent Biological Evaluations

**Schaupp, W. C. Jr., Jorgensen, C.L., and Cadenhead, A.J.** 2002. Bark beetle evaluation – 2000 and 2001. Hahns Peak/Bears Ears and Parks Ranger Districts, Medicine Bow – Routt National Forests, Colorado. USDA Forest Service, Rocky Mountain Region, Biological Evaluation R2-02-04. 49 p.



## Recent Forest Health Publications

**Harris, J.L.; M. Frank; and S. Johnson, Eds.** 2001. Forest Insect and Disease Conditions in the Rocky Mountain Region 1997-1999. USDA For. Serv., Rocky Mountain Region, Renewable Resources. 39 pp.

**Johnson, D.W.** 1999. *Picea engelmannii* Parry ex Engelm. 1863. IN: Schutt, Schuck, Lang, Roloff [eds.]. Enzyklopedie der Holzgewachse (Encyclopedia of Woody Plants). Ecomed Verlagsgesellschaft AG & Co., Landsberg, Germany. 8 pp.

**Johnson, D.W. and W.R. Jacobi.** 2000. First report of white pine blister rust in Colorado. Plant Disease 84(5): 595.

**Koch, L.; Rogers, P.; Frank, M.; Atkins, D.; and Spiegel, L.** 2001. Wyoming Forest Health report, 1995 – 1998, a baseline assessment. Wyoming State Forestry Division and USDA Forest Service. 46pp.

**McConnell, T.J.; Johnson, E.W. and Burns, B.** 2000. A guide to conducting aerial sketchmapping surveys USDA For. Serv., Forest Health Technology Enterprise Team, Ft. Collins, CO. FHTET 00-01. 88 p.

**Negron, J.F., W.C. Schaupp and E. Johnson.** 2000. Development and validation of a fixed-precision sequential sampling plan for estimating brood adult density of *Dendroctonus pseudotsugae* (Coleoptera:Scolytidae). The Canadian Entomologist 132: 119-133.

**Rogers, P.; Atkins, D.; Frank, M. and Parker, D.** 2001. Forest Health Monitoring in the Interior West: A baseline summary of forest issues, 1996-1999. USDA For. Serv., Rocky Mountain Research Station and State and Private Forestry, Regions 1-4. 40p.

## Recent Service Trip Reports

- LSC-02-01 Integrated pest management projects on the South Park Ranger District
- LSC-01-01 Continuing fungicide laboratory tests for control of Phomopsis blight at Bessey Nursery (Nebraska NF)
- LSC-01-02 Evaluation of Big Creek Lakes Campground Project (Med.Bow/Foutt NFs)
- LSC-01-03 Evaluation of dwarf mistletoe suppression work at Gore Pass, Yampa Ranger District (Med. Bow/Routt NFs)
- LSC-01-04 FY2000 Gypsy Moth Detection Survey (LSC zone)
- LSC-01-05 Interim report on the outplanting project of Phomopsis blighted Eastern redcedar seedlings from Bessey Nursery
- LSC-01-06 Site visit to Sledgehammer suppression project

- LSC-01-07 Site visit to US Air Force Academy
- LSC-01-08 CO aerial survey for 2001
- LSC-01-09 WY aerial survey for 2001
- GSC-01-10, and LSC 01-10 Hail damage and the potential associated pathogens along Sheridan Lake Drive, Mystic Ranger District, Black Hills NF
- LSC-01-11 Dwarf mistletoe suppression work at Gore Pass, Routt NF
- LSC-01-12 Hazard tree assessment and two campgrounds on the Douglas Ranger District, Medicine Bow NF
- LSC-01-13 Douglas-fir tussock moth at US Air Force Academy

## Report to Great Plains Tree Pest Council

April 2-3, 2002  
Casper, Wyoming

Mark Harrell and Laurie Stepanek  
Nebraska Forest Service, University of Nebraska

### Pine wilt

A large number of trees were killed by pine wilt in 2001, with almost 100 trees killed at one location alone near Plattsmouth; but the total number killed seemed less than in 2000. The southeastern corner of the state, generally south and east of Lincoln, is still the area where mortality is the greatest, but the disease has killed trees at several locations in areas to the north and west. The growing concern about the effect of pine wilt on Scotch and Austrian pines is causing many people to look for alternative species for windbreaks and other plantings.

*Monochamus carolinensis*

A preliminary test was conducted to determine whether trunk-injection treatments could be effective in protecting trees from pine wilt. Three insecticide products were tested in the lab for their effectiveness in killing pine wood nematodes. Two products were able to kill or at least immobilize the nematodes when present in concentrations similar to what the nematodes would encounter in a treated tree. The two products, abamectin (Greyhound) and another product still under development, were injected in May 2001 to trees randomly selected within 26 three-tree blocks in a Scotch pine windbreak. This windbreak had lost several trees to pine wilt in each of the previous two years, and it continued to have trees with early pine wilt symptoms. The third tree in each three-tree block was left as an untreated control. All trees treated with the two products survived through the end of 2001. Four trees that had shown early signs of pine wilt – a faded green color – were not included in the blocks and were treated with abamectin, and all four of these trees survived through 2001. Unfortunately, no untreated trees died in the windbreak, so statistically we cannot show that our treatments were effective. But the fact that several trees died in each of the previous year, and the four trees survived that had shown pine wilt symptoms before the treatment, suggest that the treatments may have been effective in protecting trees from the disease. In 2002 these treatments will be tested at three to five additional locations where pine wilt killed trees in 2001.

Additional plans for 2002 and beyond are aimed at determining the likelihood that pine wilt will become a serious problem in western and northern parts of the state. To do this, beetle vector species in eastern and western Nebraska will be identified and the numbers of nematodes they carry from pine wilt killed trees will be determined. Also, the relative degrees of pathogenicity of eastern and western populations of pine wood nematodes will be determined by artificial inoculations into young pine trees, and the normal initial relative health levels of Scotch and Austrian pines in eastern and western Nebraska will be compared by examining growth rates, carbohydrate levels, and/or degrees of water stress.

### White pine mortality

Many white pines have died suddenly in southeastern Nebraska over the past several years. This has been especially common in the fall and winter months, but mortality has occurred in the summer as well. The problem has affected trees from about five years old to nearly mature, and sites have ranged from urban landscapes to Christmas tree plantations. Trees typically have good growth rates, but then turn brown and die within one to two months.

Affected trees often have significant amounts of resin on the bark near the base of the tree. The resin and foliar symptoms are similar to what is described for Procera root disease (*Verticicladiella procera*), but

attempts to isolate the fungus have been unsuccessful. Additional attempts to identify the cause of the problem will be conducted in 2002. The problem seems also to occur in Iowa, but no cause for it has been identified there either.

### **Cercospora blight control test**

Cercospora blight is a serious problem in juniper and redcedar in central and eastern Nebraska. In 2001 a test of the copper fungicide Champ was initiated to try to find an economical alternative to the fungicide Camelot. Blocks of trees were sprayed twice as recommended in five windbreaks near Lexington in central Nebraska. The same trees will be treated again in the summer of 2002 and will be evaluated in the fall. In a preliminary test in 1999 and 2000 Champ seemed to provide some degree of protection for the trees.

### **Oak anthracnose (?)**

Bur oaks along the southeastern edge of Nebraska over the past several years have shown symptoms that have often been diagnosed as oak wilt. The symptoms include foliage that dies completely or has large necrotic areas, branch dieback, general decline in the tree, and occasionally some streaking in the wood. Recently, however, we began believing the problem is not caused by oak wilt, but by oak anthracnose, or possibly more likely by a disease causing damage similar to but more damaging than oak anthracnose. The leaf symptoms look different from what is normally seen with anthracnose on oak, but very similar to what is seen on sycamore; and trees affected by this often slowly die. A more thorough study of this will be conducted in 2002.

### **Oak lace bug**

Bur oaks over much of southeastern Nebraska were heavily infested with oak lace bugs in 2001, but the insects do not seem to have caused any serious long-term damage.

### **Verticillium wilt**

Mortality in maples from Verticillium wilt seemed higher than usual in 2001.

### **New publications**

Mooter, D.P., M.O. Harrell, and L.J. Stepanek. 2002. Care of newly planted trees. University of Nebraska-Lincoln, NebGuide G94-1195-A (revised), 2 p.

Stepanek, L.J., J.R. Brandle, and M.O. Harrell. 2002. Assessment of microenvironmental conditions related to the use of synthetic sheet mulches for protecting newly planted trees in semi-arid environments. *J. Sustainable Agriculture* 19(4):15-34.

Wilson, J.S. and M.O. Harrell. 2001. Environmental stresses and tree health. University of Nebraska-Lincoln, NebGuide G01-1433-A (revised), 4 p.

### **Web sites**

<http://www.nfs.unl.edu/index.htm>

<http://www.nfs.unl.edu/fpm.htm>

<http://www.ianr.unl.edu/pubs/insects/index.htm#ornamentals>

<http://www.ianr.unl.edu/pubs/plantdisease/index.htm#trees>

<http://www.ianr.unl.edu/pubs/forestry/index.htm>

# Report to the Great Plains Tree Pest Council (2001 Forest Insects and Disease Highlights – Montana)

N. Idaho

~~N. Idaho~~

## Compiled By:

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## Contributors:

Ken Gibson, Bob James, Blakey Lockman, Carol Randall, Larry Stipe, Nancy Sturdevant, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection; Steve Kohler, Brennan Ferguson, Montana Department of Natural Resources and Conservation, Forestry Division

## Insects

Bark Beetles. Following the worst fire season in the Region in more than 80 years, and in response to continuing warmer- and drier-than-normal weather, bark beetle populations continued nearly unabated in 2001. Though fire incidence in 2001 was reduced compared to 2000, a few large fires—especially Moose on the Flathead NF and Fridley on the Gallatin NF—will likely provide additional brood sites for bark beetles. In many areas, and those in particular, we may anticipate building **Douglas-fir beetle** and perhaps Engelmann spruce beetle populations in 2002. In other parts of the state, **mountain pine beetle** populations significantly continued to increase in overmature lodgepole pine stands—specifically the western part of the Lolo NF, the Deerlodge portion of the Beaverhead-Deerlodge NF, and the southeast part of the Flathead. Continued favorable environmental conditions throughout the state have resulted in epidemic populations of several bark beetle species.

Defoliators. Only one **gypsy moth** was caught in the state of Montana in 2001. The moth was caught at the Swiftcurrent campground in Glacier National Park. A delimitation survey is planned near the positive catch in 2002. Aerial surveyors mapped 1,300 acres of defoliation by **western spruce budworm** east of the Continental Divide on the Helena National Forest. There was a significant increase in number of moths caught at several trapping sites, while number of moths caught at other sites decreased slightly or remained relatively unchanged. We expect to see increases in budworm populations in 2002 on the Helena and Beaverhead-Deerlodge National Forests. Defoliation by both **western hemlock looper** and **false hemlock looper** were observed. The false hemlock looper defoliated Douglas-fir on the northwest side of Flathead Lake. The hemlock looper defoliated Douglas-fir east of Missoula near Holloman Saddle and northwest of Lincoln near Black Mountain in Lewis and Clark County. The **Douglas-fir tussock moth** defoliation that occurred on the Flathead Indian Reservation, just south of Saint Ignatius, in 2000, was monitored in 2001. Many of the trees that were heavily defoliated in 2000 had put on a new flush of needles, though many were dead. Some visible defoliation in 2001 was detected in the same area, but was caused by a population of western false hemlock loopers. Scattered **tent caterpillar** damage was again seen in western Montana. A significant area of tent caterpillar defoliation was observed in cottonwood between Lindbergh and Holland Lakes south of Swan Lake.

## **Diseases**

Root Diseases. Mortality and growth losses from **root disease** continue to be high throughout the state. Root disease-caused mortality is more common west of the Continental Divide, although large patches can be found east of the Divide. The effect of the fires of 2000 on root diseases is one of opportunity. The tree species that are best adapted to low intensity, high frequency fires, are those species that are also root disease-tolerant, such as western larch and ponderosa pine. In the root diseased areas that burned, there is the opportunity to reduce the effects from root disease by planting these species or encouraging the natural regeneration of these species.

Dwarf Mistletoes. Dwarf mistletoe continues to cause losses of approximately 33 million cubic feet annually. Douglas-fir, western larch and lodgepole pine are the tree species most severely affected. Fire greatly influences the distribution of dwarf mistletoes across the landscape. In general, any fire event that kills infected trees will reduce the population of dwarf mistletoe, at least in the short term. Large, complete burns will greatly reduce dwarf mistletoe populations across the landscape and may even eliminate small, localized populations. Small, patchy burns will temporarily reduce the amount of mistletoe, but infected residuals provide a ready source of dwarf mistletoe seeds for the infection of the new regeneration.

White Pine Blister Rust. White pine blister rust continues to be present throughout the range of five-needle pines in the state. Rust severity is highest in the northwestern part of the state where the disease continues to cause extensive mortality in western white pine.

Limber Pine Decline. Limber pine decline and mortality appear to be continuing across scattered locations in central and eastern Montana. Permanent plots to monitor the decline were established in 1996 at various locations near Stanford, Monarch, Clyde Park, and Dewey. Data were not collected from these plots in 2001, but are scheduled for remeasurement in 2002.

Elytroderma needle blight. Elytroderma needle blight is the most damaging foliage disease on ponderosa pine in Montana. Localized areas of heavy infection from Elytroderma needle blight were again seen across western Montana in 2001. Elytroderma has been heavy in several locations in Montana for a number of years: Jette Lake area north of Polson, Bitterroot Valley south of Missoula, and the Belt Creek Canyon east of Great Falls.

## **Abiotic**

Chloride Damage. We received requests for assistance from several locations to evaluate damage to roadside trees potentially due to the use of magnesium chloride as dust abatement. The areas in question were private land in the Seeley/Swan area (Montana DNRC Trip Report); Basin Creek Road on the Butte RD, Deerlodge NF (TR 01-13); and the East Boulder River Road on the Big Timber RD, Gallatin NF (TR 01-14). All three areas had various treatments of magnesium chloride as dust abatement. The trees along the roads had foliage with tip burning, completely red foliage, and branch dieback. These symptoms were concentrated within 20 to 30 feet from the road edges, in all size classes of trees. Symptoms were sometimes more noticeable on the sides of trees facing the roads, but were also commonly found in a spiral pattern within affected trees. The tree species most affected in Montana was Douglas-fir. Foliage was collected from symptomatic trees along the Basin Creek Road and East Boulder River Road and analyzed for chloride levels. Preliminary analyses indicate the chloride content of the symptomatic trees is much greater than in the non-symptomatic trees. Drought is thought to be a contributing factor in the symptoms observed. A more thorough report is forthcoming which will detail the findings and potential implications.

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# Report to the Great Plains Tree Pest Council (2001 Forest Health Highlights - North Dakota)

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## Climatic Extremes

Winter Injury of Conifers. Late winter/early spring discoloration of conifers is common in North Dakota, but the discoloration seemed more severe in 2001. Injury was caused by desiccation (drying of the foliage) and variable fall/winter temperatures in 2000/2001. Most trees appeared to recover by late summer. However, numerous ornamental junipers and a few other trees and shrubs did not recover in central and western North Dakota.

Windstorm. Grand Forks, Hillsboro, and several smaller communities sustained heavy damage to their community forests during a severe windstorm on August 8 in which winds exceeded 100 mph. Grand Forks calculated approximately 6,500 public trees and estimated 19,500 trees of all ownerships across the community required removal or therapeutic pruning treatments as a result of the storm. Hillsboro reported extensive damage to 900 public trees and 2,500 trees of all ownerships. About 9,500 tons of debris was taken to the Grand Forks community landfill as a result of the storm.

## Insects

Forest Tent Caterpillar. Small pockets of forest tent caterpillars (FTCs) have been consistently causing problems in eastern and north-central North Dakota since 1997. These insects caused defoliation of aspen and other hardwoods in parts of the Turtle Mountains in 2001. Aspen was defoliated most (moderate to complete defoliation) in the Turtle Mountains, while bur oak and green ash were lightly to moderately defoliated. FTCs seemed to avoid boxelder in the Turtle Mountains in 2001. An aerial survey conducted in July 2001 showed that 3,045 acres in the Turtle Mountains were defoliated by FTCs. An egg mass survey was completed at several locations in the Turtle Mountains in October. The results of the survey suggest that there will be heavy (more than 50%) defoliation between Harts Lake and Lake Francis and by Hartley-Boundary, moderate/light (25-50%) defoliation at Sandy Lake Campground and south of Pelican Lake, and light/very light (less than 20%) defoliation at Long Lake, Lake Metigoshe, and the International Peace Garden. Larval viability can be confirmed in the spring with a follow-up survey of the areas where high and moderate egg mass counts were seen in October.

*Northcentral in Canada*

Yellowheaded Spruce Sawfly. Damage (consistent with that caused by the yellowheaded spruce sawfly) was found less than 10 miles north of Bismarck in August. This is much further south than reported in recent years. All spruce species grown in North Dakota are potential hosts to yellowheaded spruce sawflies. Many small to moderately aged spruce trees in the northern half of the state are lost each year to these insects.

Cottony Maple Scale. Several silver maple and linden trees in Fargo and West Fargo were heavily infested with this insect in 2001. This insect could cause more damage in 2002, but it is rarely a serious problem for more than two years.

### **Exotic Insect Threats:**

Gypsy Moth. No gypsy moths were caught during the 2001 trapping survey in North Dakota. There were no gypsy moths caught in North Dakota during the last two years.

Japanese Beetle. Two Japanese beetles were caught in Bismarck in 2001. One beetle was caught in north Bismarck and one beetle was caught in south Bismarck. Both beetles were caught in North Dakota Department of Agriculture traps.

### **Diseases**

Sphaeropsis Shoot Blight. A 2000 survey of the Towner State Nursery found that 26 of the 32 ponderosa pine windbreaks in the nursery showed symptoms of Sphaeropsis shoot blight. A management plan for the disease at the nursery includes annual monitoring of disease levels, a systematic removal and replacement of ponderosa pine windbreaks, locating ponderosa pine crops in fields with minimal exposure to the disease, and possible fungicide applications to prevent infection of nursery crops. Three windbreaks were removed during the summer of 2001 and at least three more should be removed in 2002.

*Sphaeropsis sapinea* will often cause shoot blights, but can cause cankers and death of larger branches when trees are injured. This fungus caused injury to pines in Bismarck following hailstorms last summer. The hailstorms occurred in early June and substantial damage from *Sphaeropsis sapinea* was seen by September.

Canker Diseases. Branches on many trees in western North Dakota and other parts of the state failed to leaf out last spring and others leafed out only to die soon after. The temperature fluctuations during the fall and winter of 2000/2001, along with low soil moisture in some areas, may have been important factors contributing to the high number of cankers seen in some parts of western North Dakota. *Cytospora chrysosperma* was found on willows and poplars. *Tubercularia ulmea* was found on several tree and shrub species. The causal agent was not identified for other cankered trees.

Root Diseases. An unidentified problem has been killing Laurel Willow (*Salix pentandra*) in Fargo and West Fargo in recent years. Attempts to isolate a pathogen have been unsuccessful.

A *Phytophthora* sp. was isolated from the root of a spruce tree in 1998. The isolate was lost due to contamination, but laboratory supplies have been acquired by the NDSU Plant Diagnostic Laboratory to attempt isolations of *Phytophthora* spp. from spruce roots.

### **Forest Health Monitoring in North Dakota:**

North Dakota entered the Forest Health Monitoring program in 2001. The North Dakota Forest Service provided two people to help collect data (soils and downed woody debris) on the P3 plots in North Dakota. Five plots were visited and data was collected from three of those plots (at least one subplot must be identified as "forest land" for data to be collected). The North Dakota Forest Service will provide two people to collect ozone data in 2002. A Baseline Assessment for North Dakota will be developed over the next 5 years.

**New Personnel:** North Dakota is in the process of hiring a Forest Health Specialist and an Extension Forester (with special emphasis given to collaborative programming between them).

**Report for Great Plains Tree Pest Council meeting, Casper, WY, April 2-3, 2002**  
From Jim Walla, Plant Pathology Department, North Dakota State University

**1. Ash yellows of green ash (cooperators include Cheng, Guo)**

Research to evaluate the tolerance of commercial ash cultivars to ash yellows is continuing. A second year of evaluation of seedlings inoculated with 10 phytoplasma isolates from ND plus 3 standard strains was done in 2001, and all plants were assayed for phytoplasmas. Much changed from 2000. Seedlings inoculated with isolates from lilac were severely stunted in 2000, but most of that effect was gone in 2001. Isolates 6 and 7 had some indications of being the most aggressive in 2001. This will all have to be sorted out to select a highly aggressive and a moderately aggressive isolate for host tolerance testing.

19 ash cultivars will be inoculated with these two phytoplasma isolates to select a moderately tolerant and a highly tolerant green ash cultivar for use as rootstock for field testing of the cultivars for tolerance to ash yellows. This requires production of the cultivars on their own roots, which is progressing very slowly at this time.

**2. X-disease of chokecherry (cooperators include Cheng, Guo, Knudson, Neill, Reynard):**

Ratings of disease symptoms was not done in 2001 due to a hail-storm that essentially defoliated all the plants in the field trials. Field ratings are planned for 2002.

Production of clonal materials of about 20 putatively tolerant chokecherry plants is progressing. Adequate numbers of almost all clones are out of tissue culture and growing in the greenhouse. Plans are to grow them to a size big enough to graft inoculate by the 2003 growing season and to inoculate and out-plant them at that time.

Graft inoculations of 10 isolates were made in 2001, but the results are not very promising. Many of the root-grafts did not take. Many of the plants grew very poorly, but it did not appear to be caused by X-disease. Test inoculations will be repeated in 2003 to try to identify graft inoculation methods that are more reliable.

**3. Juneberry diseases (cooperatively with Jackson)**

Sixteen planted and natural stands of juneberry (=Saskatoon, Amelanchier sp.) across ND were examined in 2001 to identify potential problems for producers. Although many diseases, insects, and other potentially damaging factors were observed, no substantial damage was associated with most of the observed pests, and the number that may require control is likely limited. Serious damaging factors, in descending order of prevalence among sites, were berry insects, stem cankers, animal browse, leaf spots, blackleaf, hail damage, branch dieback, Gymnosporangium leaf rust, powdery mildew, stem decay, and root rot. A juneberry leaf disease (tentatively Phyllosticta leaf spot) that could easily be mistaken for Entomosporium leaf spot was commonly found. A fungal leaf spot tentatively identified as Rhytisma was found on juneberry leaves; this genus has never been reported on a Rosaceous host. A canker pathogen (tentatively Sphaeropsis canker) that has not been noted in reports of juneberry problems in the adjacent Prairie Provinces of Canada appears to be quite serious in ND, while Cytospora canker, which is noted as important in the Prairie Provinces, was present, but not observed to be a problem in ND. As the survey

progressed, diseases and insects that were not identified at previous sites in the survey were seen at each new site, suggesting that a number of additional diseases and insects are likely present.

**Recent Publications**

Guo, Y.H., Cheng, Z.-M., and Walla, J.A. 200\_. Rapid PCR-based detection of phytoplasmas from infected plants. HortScience (Accepted).

Jackson, M.B., Walla, J.A., and Hatterman-Valenti, H.M. 200\_. Development of junberry as an agroforestry crop in North Dakota. Proc., Seventh Biennial Conference on Agroforestry in North America and Annual Conference of the Plains and Prairie Forestry Association, August 13-15, 2001, Regina, Saskatchewan, Canada. (In Press).

# Forest and Shade Tree Disease Studies

## Spring 2002

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### Shade Tree Disease Studies:

1. Continued a fourth season of monitoring tree growth, canker resistance, tree water potentials, soil moisture, and turf production under three irrigation treatments at the Tree and Turf Research Facility.
2. Continued a study to determine if wood chip mulch is a potential inoculum source for canker pathogens.
3. Continued the water potential study of old growth cottonwoods along the Highline canal in Denver CO.

### Results:

1. **Tree and turf growth:**
  - Tree water potentials of green ash and honeylocusts were significantly affected by irrigation amounts. Water potentials of trees in low irrigation areas differed from moderate (80% Et) and high (160% Et) irrigation amounts.
  - Stomates never closed on either species even during our hot dry summer
  - Honeylocust and green ash diameter and height growth was less on 40 & 80 % than 160% ET.
  - Turf grass growth was positively affected by higher irrigation amounts.
  - Soil moisture was less at the 1 & 2 ft. depth under grass alone than trees and grass at the 40% rate.
  - Soil moisture was less at the 1 ft. depth under grass alone Vs grass and trees at the 40% ET Vs 80 & 160% ET.
  - Soil moisture was not different between 80 and 160 % ET.
2. **Wood chip mulch:** The study at our Tree and Turf facility is continuing to determine if uncomposted wood chips can harbor inoculum of canker pathogens (*Thyronectria*) and how long the fungi remain viable. Low and high irrigation treatments (40% and 160% ET) did not affect viability. So far colonized branch pieces have contained viable fungal tissue for 98 weeks. Position on or in mulch has given us variable results. Percent moisture of wood at time of collection did not explain viability. We hope to look at actual infection hazard and what composting will do to the pathogens. We also are interested in cooperating with folks on the risk potential for invasive pests in wood chip mulch from pallets and other foreign wood products.
3. **Evaluation of Wisconsin elm hybrids:** Hybrids from the Wisconsin breeding program were evaluated four years after planting for growth, form. Several selections seem to have outstanding form and growth rates. No new news on these trees other than field mice love to girdle the trees if you have weed barrier around the trees.
4. **Cytospora Canker:** In cooperation with Gerry Adams at Michigan we are analyzing our *Cytospora* canker fungi isolates of different "species" and hosts to see if the DNA will tell us if the fungi are different. No new news on this topic.
5. **Old Growth Cottonwoods:** We are studying the water status of old cottonwoods via pressure bombs, soil moisture from neutron probes and observation wells, along a 100 yr.-old irrigation canal that runs through metropolitan Denver. The best estimate of when cottonwood trees start to be drought "stressed" would be when leaf water potentials are less than -0.3 MPa. It has taken 6-8 weeks from when the canal was turned off for trees to reach -0.3 MPa. Trees recover or reduce water stress 24 hr after water is added to the canal, but we do not know how long this recovery lasts. We do not know how long water needs to be present to relieve drought stress in mid summer. It appears that soil moisture > 20% will keep trees non-stressed (> -0.3 MPa) and soil moisture less than 10% will allow leaf water potential to decrease below -0.30 MPa. Precipitation events of 1 inch or more increases leaf water potentials but the response is short lived and an increase in soil moisture was not noted.

## **Plans for 2002:**

1. Continue mulch/inoculum, canker resistance, studies at the tree and turf research site. The irrigation-tree study is probably not going to continue because I cannot find funding.
2. We have some funding to look at the impact of NaCl and MgCl on woody plants in Colorado. This is a cooperative project with Grant Cardon in Soil and Crop Sciences. We are looking for more funding to make this project happen. We are also looking for cooperators.
4. Continue cottonwood -canal drought stress study.
5. Organizing a national elm trial in conjunction with NCR 193 is on hold since I have over extended my self on other efforts.

## **Forest Tree Disease Studies in 2001**

1. We finished working on spatial relationships of **Armillaria root disease** and site features in the Black Hills of SD. We have two manuscripts in review.
2. In cooperation with Forest Health Management, Rocky Mt Research Station, US Forest Service, BIA, continued a landscape scale study to see if aerial IR photos would pick up **black stain root disease** and Ips beetle damage in pinyon, and determine if there are any site or stand conditions related to the incidence of these damages. We finished a study looking at the impact of black stain root disease on the pinyon pine ecosystem based on analysis of vegetation cover and pinyon mortality rates. We hope to have two publications out on this topic this year. We hope the large spatial study will be wrapped up this year.

## **In 2002 our plans are to:**

1. Get the two papers published on landscape scale distribution of *Armillaria* root disease on ponderosa pine in the Black Hills.
2. Complete the landscape scale research project on black stain root disease of pinyon pines in southwest Colorado. We plan to publish two papers on the small-scale ecosystem impact of the disease section of this project. We also have a paper on potential insects vectors in review.
3. Continue to facilitate coordination of folks working on white pine blister rust on five needle pines of the Central Rocky Mountains.
4. U.S. Forest Service funding is making it possible to develop a preliminary (2001-2004) hazard model of white pine blister rust to five needle pines in Colorado. "We" (six different FS workers and CSU) will be mapping white pine locations, determining fire impacts on five needle pines, writing a *Ribes* ID guide, monitoring meteorological conditions in currently infested areas, and several folks will be establishing plots to determine the status of five needle pines and also assess white pine blister rust.

## **Publications:**

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Kepley, J. B. and Jacobi, W. R. 2000. Pathogenicity of *Cytospora* fungi on six hardwood species. *J. Arboriculture.* 26: 326-332.

Omdal, D.W., W. R. Jacobi, and C.G. Shaw, III. 2001. Estimating large-root biomass from breast-height diameters for ponderosa pine in northern New Mexico. *West. J. Appl. For.* 16:18-21.

Omdal, D.W., C.G. Shaw, III, and W. R. Jacobi. 2001. Evaluation of three machines to remove *Armillaria*- and *Annosum*- infected stumps. *West. J. Appl. For.* 16:22-25.