Great Plains Tree Pest Workshop

Forest Service Service Center
Rapid City, SD

March 18-19, 1998

Wednesday, March 18, 1998

Meeting called to order by Chairperson Lia Spiegel

Attendees: Kurt Allen (Forest Service – Rapid City), John Ball (South Dakota State University), Roger Bol (South Dakota Dept. of Agriculture), Mark Harrell (Nebraska Forest Service), Jerri Lynn Harris (Forest Service – Rapid City), Marcus Jackson (North Dakota State University), Bill Jacobi (Colorado State University),), David Johnson (Forest Service – Lakewood), Tom Juntti (Forest Service – Rapid City), David Leatherman (Colorado State Forestry Service), Bill Schaupp (Forest Service – Lakewood), Mike Schomaker (Colorado State Forest Service), Laura Stepanek (Nebraska Forest Service), Lia Spiegel (Wyoming State Forestry Division), Jeff Wischer (Kansas Forest Service,) and Jim Walla (North Dakota State University).

1997 minutues were approved as distributed by Lia Spiegel, motion made by Bill Schaupp and seconded by Bill Jacobi.

State and Organizational Reports

Copies were distributed and are attached for those that were not able to attend this meeting. Additional discussion of note is reported below.

<u>Region 2 - US Forest Service Rapid City Service Center</u>

Kurt Allen –

Jackpine budworm outbreak in the Bessey District of the Nebraska National Forest with reports of more than 70 to 80 percent defoliation. The extent of tree mortiality due to the defoliation is unknown at this time. There was a previous outbreak in the 1980s but very little mortality occurred as a result of this defoliation.

Jerri Lynn Harris -

Discussion of various Armillaria plots in the Black Hills National Forest being measured. White pine blister rust plots were established in limber and whitebark pine stands in Wyoming. She also discussed her plan to investigate alternatives to methyl bromide as a nursery soil fumigant. Jeff Wischer mentioned he had a complete file on alternatives to methyl bromide and would be willing to pass along a bibliography to anyone who requests it. He has been using Basamid (*dazomet*) with good success along with crop rotation and fallowing. There does not appear to be a cover crop nurseries can plow in and use as a fumigant.

Region 2 - US Forest Service Lakewood Service Center

Dave Johnson and Bill Schaupp –

There was a major blowdown near Steamboat that will need to be monitored for spruce beetle. A build-up of mountain pine beetle along the front range is also occurring. They also note a problem with subalpine fir decline, due to bark beetles and root diseases, that is under investigation. The Air Force Academy is still selling ponderosa pines that had been heavily infested with pine sawfly. Landscapers prefer these trees due to their bushier form!

Nebraska

Mark Harrell and Laura Stepanek -

They are working on the effectiveness of trunk injection as many arborists are interested in their use. The focus is on solvents and adjuvants that have low phytotoxicity. Greyhound (*abamectin*) applied with the Wedgle appeared to give good control of honeylocust spider mite. They also report extensive injury to trees in eastern Nebraska due to a heavy, wet snow storm that occurred on October 26th. This storm resulted in massive number of tree failures ranging from uprooting to snapped branches. This storm was followed a couple of days later by a period of extremely cold temperatures that resulted in browning of pines.

Kansas

Jeff Wischer –

The major item of note is the finding of a midge (*Cecidomyia spp.*) that came in on stock from Wisconsin. The midge causes pitch flow on Christmas trees. There is also an insect mining needles near the tips, possibly a *Rhyacionia spp*.

Colorado

David Leatherman-

Discussed his two handouts on mountain pine beetle. Astro (*permethrin*) is being used by many arborist for mountain pine beetle control but he still recommends using Sevin (*carbaryl*). Annual treatment may be required on lower elevation ponderosa pine trees, while two-year control for upper-elevation lodgepole pines. He also recommends keeping pets and people away from the treated bark for several hours. EDB's are an issue in Colorado as they have been identified in ground water, however, the problem in many instances may be due to old leaking gasoline tanks. Gypsy moth has not been a major problem for the last several years. He is seeing a problem with cedar bark beetles (*Phloeosinus spp.*). Mark Harrell mentioned that in Nebraska they also experienced a problem with this bark beetles and it was associated with Botryosphaeria cankers. It appears that the bark beetle followed the canker rather than preceded it. The cambium turns a chocolate brown before the cankers form. David mentioned that bark beetles for all species seem to be on the rise. The spruce bark beetle that is affecting spruce in Colorado has been identified as *Ips hunteri*. Colorado experienced the same storm that hit Nebraska in October but without the lower temperatures. Tree damage was limited to branch breakage rather than bud or cambial injury.

Mike Schomaker -

Pollution is a problem as identified in the Forest Health Report. There are fewer lichens in polluted areas and these appear to be a good indicator of air pollution levels.

Wyoming

Lia Spiegel -

She is investigating when thinning can be done without attracting pine engraver beetles. Lia also looked at the effectiveness of an anti-aggregation pheromone in slash piles. It does not appear to work as the slash became thoroughly infested. Gypsy moth caught in two KOA campgrounds.

Colorado

Bill Jacobi -

Extensive rains resulted in heavy infestations of Septoria leaf spot but little Marssonina. Fireblight is also very low at this time. A new study is exploring the possibility of canker transmission on infected wood chips that are used as mulch around trees. The objective of the study is to determine the viability of the fungus on the chips, not if the disease can be transmitted to the tree. He will be looking at the longevity of fruiting bodies on irrigated and dry mulch. Bill also discussed another study on the movement of Cytospora between hardwood species; can it move from aspen to ash, for example. The results so far are mixed. Aspen has significant canker expansion with aspen isolates, cottowood and willow isolates, ash only on ash, cottonwood on aspen and willow, elm only on elm, alder only on alder.

North Dakota

Marcus Jackson -

The incidence of Dutch elm disease has decreased over the last several years. But there has been an increased incidence of black knot on cherry. Forest tent caterpillar has occurred in southeastern North Dakota for the first time in at least 15 years. Ash decline is also a major concern in North Dakota. Many trees did not leaf out until mid-July. This may be due to the cumulative effect of two harsh winters. Many larger diameter (10-inch and greater) trees have died.

Jim Walla -

He has seen underground witches'-brooms form on green ash that have been planted too deep. He will be writing a report on this in the spring. Late season flowering on lilac is a symptom of lilac witches'-broom. It appears to be a common problem on lilacs in eastern North Dakota and is caused by the same phytoplasma as ash yellows - genetically they are the same. However, the ranges of the two problems, ash yellows and lilac witches'-broom differs. He also discussed X-disease on chokecherry. The general symptoms appear to be premature red fall color and a general thinning, not due to leaf abscission but a failure to break bud. They are planning to release a selection of cherry that is X-disease resistant. The distribution of X-disease in the plains was discussed. It is considered to be in every state in the Great Plains.

South Dakota

John Ball-

The decrease in foliage diseases this last year was probably due to the break in the cool wet weather they have been experiencing the last several years. A dramatic increase has occurred in Dutch elm disease, however, up to four-fold increase in some areas. Deer damage increased due to the heavy snowfalls during the winter of 1996-1997. Spruce and pine were defoliated up to ten to twelve feet high as deer were walking on five feet of snow! Branch breakage was also common due to the heavy snowfall. Spruce needleminer is becoming a major problem in eastern South Dakota; several nurseries could not sell their trees due to heavy infestations. Commercial landscapes are noticing frequent replacement of newly planted trees and shrubs in irrigated areas. The decline appears to be due to over-watering.

Ash yellows report

Jim Walla

The study included sampling green ash in 6 states and 3 provinces. South Dakota had the highest incidence of the disease (71%) and Wyoming was the lowest (17%). The next lowest, Alberta, had an average of 18%. Both Alberta and Wyoming had some sampling sites where no ash yellows phytoplasma was detected. Saskatchewan had a much higher disease incidence (49%) than Alberta. This may be due to the fact that Saskatchewan is the western limit of native green ash range in Canada. The overall incidence of the disease was 51%. It appears from the distribution that the disease has been here a long time. However, we do not see many witches'-broom, few over two or three years old, so there still exists the possibility that the disease may a recent introduction. There was an overall significant difference in the incidence of ash yellow phytoplasma in natural (45%), rural (61%) and urban (47%) settings. However, this pattern was not the same for all states. There was no significant difference among crown classes, crown class 1 (21%), 2 (35%), and 3 (45%). Infected trees had larger diameters but the difference was not significant. In terms of growth rate, the non-infected trees had a slightly higher (1-9%) growth rate but again the differences were not significant. The fastest growth occurred on urban trees.

Some additional details regarding the study were discussed. The rule-of-thumb is the witches'-broom occurs on about 10% of the infected trees. The understory of infected windbreaks that Jim examined was mostly small green ash almost all of which were showing symptoms of ash yellows. The study did not identify a definite impact of ash yellows on green ash but this will need to be studied. Jim thinks that ash yellows is going to have an impact and we need to study the impact on different cultivars. There are many possibilities for the minimal impact we are currently observing. It could be due to a relatively resistant host or relatively avirulent pathogen . The minimal impact could also be due to the recent introduction of the pathogen. The test might have detected non-damaging pathogen levels. There are many other possibilities. The implication it is that ash yellows represents a potential threat to our green ash resource. Thus judicious use of ash should be continued along with encouraging species diversity. Further studies include testing cultivars – Jim Walla is planning to study 10 cultivars - and examining potential vectors.

The scheduled field trip was cancelled due to the poor weather conditions and the need for adequate time to complete all the state and organizational reports.

Old business

Sharing insect and disease publications

Bill Jacobi talked about updating the list of extension publication (see attached). Perhaps in the future we can use an e-mail list server to transfer information within the group. He recommended publishing on paper first and then going electronic.

Book revision

Jim Walla discussed updating the book *Diseases of the Great Plains*. It needs to be updated as there are new diseases such as ash yellows that need to be included as well as some diseases, Sirococcus, for example, that can be dropped since they do not appear to be a problem. He suggested forming a committee to look into the possibility of updating the book, go over the diseases that need to be covered, then find the authors. The entire process may take several years. Jim would like to see insects added to the book, however, he does not know who would be willing to author these chapters. The book should be directed to the Great Plains and not focus on the mountains or the northern boreal forests. Jim made a motion that a committee be formed to look into the development of the Great Plains pest book. Bill Jacobi seconded the motion. It was unanimously passed.

Thursday, March 19, 1998

Old business (continue)

Forest health maps

Dave Johnson explained the three draft maps of the U.S. displaying 1998 Forest Lands at risk to Insects and Diseases. These maps were created by the Forest Health Protection (FHP) of the US Forest Service in an attempt to indicate insect and disease "risk" for use by Congress and the Forest Service in planning and budgeting priorities. He requested any revisions we felt were needed in R-2, especially with hardwoods in the plains of Nebraska, Kansas, South Dakota and North Dakota, be passed along to him. Dave Leatherman suggested including cottonwood decline areas. Other suggestions were to include ash yellows, pinyon decline, subalpine fir mortality and spruce beetle among others. These maps also do not include abiotic conditions. There was also the suggestion to request a change in the Forest Service definitions of forested lands to include riparian areas and wooded draws. Values placed on those forest resources should be the same as for timberlands now that we are speaking to the health of the nation's forests and not just productivity. The group continued to discuss their suggestions for improving the maps and Dave Johnson will pass along these suggestions when he attends the national meeting to discuss the final versions of these maps. Lia Spiegel will also write a letter to the Forest Service outlining our concerns and suggestions. A copy of the letter should be included in the in the minutes to be distributed to members of our group (see attached).

Book revision

Committee members to work on the Great Plains insect and disease book are Bill Jacobi, John Ball, Mark Harrell, Dave Leatherman, Jim Walla, Dave Johnson, and Ned Tisserat. It was suggested that Canadians should be also involved in the project. Jim Walla , the coordinator of the project, will make the appropriate contacts.

Lepidoptera larval guide

Dave Leatherman suggested that we continue to work on the lepidoptera larval guide but not to detract from the insect and disease book effort. He has not received any slides since proposing this project. He is still willing to be the collector and recorder for these slides. He will show his slides and collect any people have at this meeting. He is willing to copy and distribute slides as Mike Schomaker did with the herbicide slide collection. Next year there will be another slide show and list available to use for orders from Dave.

Prairie and Plains Forestry Association meeting report

Jim Walla, Marcus Johnson and Kurt Allen attended the first regular meeting. There were about 70-80 people attended the meeting - mostly state forestry personnel who plant trees in rural areas along with NCRS and extension people of the Great Plains. Their next meeting is June 24-26, 1998 in North Platte, Nebraska and will focus on windbreak renovation and technology. The 1999 meeting will be in Wyoming. The Association would like us to be more involved with their group. They feel we would be able to meet with others involved in agroforestry, have a chance to hear their needs and concerns and to share our knowledge and products with them. Jim Walla feels they could use our insect and disease information to improve their tree planting projects and survival. We probably need an extension arm of our group to attend these meetings but the group again felt that meeting in conjunction with them would detract from our productivity and discussions. It was also felt that we should target some of our meetings to try to recruit other members from the Southern Plains states of Texas and Oklahoma. Jim Walla thought we could meet in conjunction with the Prairie and Plains Forestry Association and still get our work done at their meetings. He suggested that we try to coordinate, at least on a scheduled periodic basis (2-3 years), a meeting with the Association. A motion was made by Bill Jacobi and seconded by Mark Harrell to meet jointly with the Prairie and Plains Forestry Association every two to three years depending upon location and agenda. The motion carried. Our best chance of getting onto the agenda is to have our local representative from the hosting state work with their planning committee on proposed topics for us to present at the meeting.

New business

Lia is looking for a complete set of minutes to be passed from president to president. She has 1994-97. Anyone with older official copies should send them to John Ball.

A motion was made to rename our group to "The Great Plains Tree Pest Council" by Bill Jacobi. It was seconded by Mark Harrell. The motion was discussed and approved by the council.

Bill Jacobi nominated John Ball for Chairperson for the 1999 meeting. Nominations closed and John was elected. Bill Jacobi nominated Marcus Johnson for Secretary. Nominations were closed and Marcus was elected. The executive committee of John, Marcus and Lia will make arrangements for next year's meeting site and agenda for Colorado, unless they decide we should meet with the Prairie and Plains Forestry Association in Wyoming.

The meeting was formally adjourned at noon.

Submitted by John Ball, Secretary

Disease and Insect Publications For the Great Plains Region
Compiled September 1997
Bill Jacobi, Colorado State University

Attached are the lists of extension publications from the Great Plain region. I apologize if some states are not included and I would greatly appreciate getting a list from you. If you have already sent me a list and they are not included please try sending them to me again. Sometimes my e-mail does not read attachments so please send snail mail. We will continue to expand this list as you produce new publications. Thank you for your cooperation.

Item Number	Title
NORTH DAKOTA STATE UNIVERSITY	
INSECTS	
E-296	Insects pests of trees and shrubs
E-297	Insect pests of evergreens
E-629	Cankerworm life cycle and control in shelter belts
E-638	Tree Banding for cankerworm protection
ENVIRONMENTAL PROBLEMS	
A-657	Herbicide spray drift
EB-49	Persistence and mobility of pesticides in soil and water
F-528	Spray damage to tree planting
DISEASES	
PP-324	Dutch Elm Disease
PP-454	Diseases of apples and other pome fruits
PP-689	Disease control in cherries, plums, and other stone fruits
PP-697	Deciduous trees diseases
PP-789	Diseases of evergreens and related problems

Department of Plant Pathology, North Dakota State University, Fargo, ND 58105, U.S.A.
Fax: (701) 231-7851 Telephone: (701) 231-8362

The OtHER Bookstore
COOPERATIVE EXTENSION RESOURCE CENTER
115 General Services Building
Colorado State University
Fort Collins, Colorado 80523-4061
(970) 491-6198 FAX (970) 491-2961
email: CERC@vines.colostate.edu

COLORADO STATE UNIVERSITY

INSECTS

5.511	Aphids on shade trees and ornamentals
5.513	Oyster shell scale
5.514	Scale insects affecting conifers
5.521	Elf leaf beetles
5.528	Mountain pine beetle and related bark beetles
5.529	Pine tip moths
5.530	Shade tree borers
5.534	Cooley spruce galls
5.539	Gypsy moth
5.542	*Douglas fir* tussock moths
5.543	Western Spruce budworms
5.544	Ponderosa pine needle miners
5.548	*Leafmining* insects
5.557	Insect and mite galls of woody plants
5.560	Pear slugs
5.566	Peach tree borers
5.567	Ponderosa pine budworms
5.571	Insect and mite pests of honeylocust
5.579	*Poplar twiggall fly*
5.583	Tent-making caterpillars

ENVIRONMENTAL PROBLEMS

2.932	Environmental disorders of woody plants

DISEASES

5.506	Dutch Elm Disease
2.904	Juniper-hawthorn rust
2.907	Fire blight
2.910	Bacterial wetwood
2.920	Aspen and poplar leaf spots
2.925	Dwarf mistletoe management
2.926	Healthy roots and healthy trees
2.930	Sycamore anthracnose
2.937	Cytospora canker
2.939	Honeylocust diseases
2.942	Russian olive decline and gummosis
559A	Aspen: A Guide to Common Problems

Insects, Diseases, and Environmental Problems on Trees and Shrubs
Publications Available from the University of Nebraska
June 1996

Item Number	Title	Item Price	Available Online*
INSECTS			
EC 1548	Common Insect Pests of Trees in the Great Plains	3.00	
G 4	Bagworms	0.25	yes
G 237	Boxelder Bugs	0.25	
G 1107	Elm Leaf Beetle	0.25	
G 1210	Borers of Shade Trees and Ornamental Plants	0.25	
G 1277	Pine Moths	0.25	yes
NF 82	Gypsy Moth	free	yes
DISEASES			
EC 1870	Guide to the Identification of Diseases of Shrubs	0.50	
G 646	Sphaeropsis Tip Blight of Pines	0.25	yes
G 858	Juniper Blight Diseases	0.25	yes
G 575	Dothistroma Needle Blight of Pines	0.25	
G 1120	Fire Blight of Apple, Pear and Woody Ornamentals	0.25	yes
G 1200	Anthracnose Diseases of Shade Trees	0.25	yes
G 1011	Peach Leaf Curl and Related Diseases	0.25	
ENVIRONMENTAL PROBLEMS			
EC 1869	Guide to the Identification of Physiological Disorders of Landscape Plants	0.50	
G 1218	Iron Chlorosis of Trees and Shrubs	0.25	yes
G 1036	Environmental Stresses and Tree Health	0.25	yes
G 1035	Tree Injuries--Prevention and Care	0.25	
OTHER PUBLICATIONS			
G 1251	Biological Control of Insect and Mite Pests	0.25	yes
NF 141	Sources of Pest Management Supplies	free	yes
NF 182	Retail Suppliers of Beneficial Organisms	free	yes
G 292	Home Fruit Spray Schedules	0.25	yes

* Internet site for online publications: http://ianrwww.unl.edu/ianr/pubs/catalog/home.htm
Publications are located in the following categories: Forestry, Insects & Pests, and Plant Diseases.

G xxxx
EC xxxx

University of Nebraska--Lincoln
IANR Communications and Information Technology
P.O. Box 830918
Lincoln, NE 68583-0918
(402) 472-9713

USDA, FOREST SERVICE, FOREST PEST LEAFLETS

Available: Single copies-Free

From USDA Forest Service
Forest Health Management
Box 25127
Lakewood CO, 80225-5127

Leaflet #	Title	Last Revision
1	Western Pine Beetle	Nov. 1982
2	Mountain Pine Beetle	June 1985
3	Sartoga Spittlebug	1978
5	Douglas-Fir Beetle	1978
6	Hypoxylon Canker of Aspen	Oct. 1979
9	Forest Tent Caterpillar	Nov. 1978
13	Fir Engraver	Sept. 1986
14	Redheaded Pine Sawfly	Nov. 1978
18	Lodgepole Pine Dwarf Mistletoe	Oct. 1984
20	Littleleaf Disease	Oct. 1984
21	White-pine Weevil	March 1995
29	Oak Wilt	Oct. 1983
33	Canker-Rots in Southern Hardwoods	Nov. 1978
43	Butt Rot of Southern Hardwoods	July 1977
44	Brown-Spot Needle Blight of Pines	Aug. 1978
53	Western Spruce Budworm	Nov. 1982
58	Southwestern Pine Tip Moth	Oct. 1982
62	Comandra Blister Rust of Hard Pines	June 1986
67	Variable Oakleaf Caterpillar	May 1979
70	Nantucket Pine Tip Moth	July 1981
71	Locust Borer, The	April 1984
75	Beech Bark Disease	Aug. 1983
76	Annosus Root Rot in Eastern Conifers	Oct. 1984
78	Armillaria Root Rot	Aug. 1986
85	Walnut Anthracnose	Sept. 1981
86	Douglas-Fir Tussock Moth	June 1981
96	Larch Casebearer in Western Larch	Sept. 1985
102	California Five-Spined Ips	Sept. 1987
103	Pales Weevil	May 1984
116	Arizona Fine Spined Ips	April 1981
127	Spruce Beetle, The	Feb. 1991
129	Ips Bark Beetle in the South	Oct. 1983
130	Scleroderris Canker of Northern Conifers	March 1979
133	Anthracnose of Eastern Hardwoods	Dec. 1985

134	Eastern Pineshoot Borer	Nov. 1978
137	Nursery Diseases of Southern Hardwoods	Jan. 1983
143	Dothistroma Needle Blight of Pines	Oct. 1982
145	Black Stain Root of Conifers	March 1995
149	Decay and Discoloration of Aspen	June 1977
150	Heart Rots of Engelmann Spruce and Subalpine Fir in the Central Rocky Mountains	Feb. 1977
152	Cankers on Western Quaking Aspen	March 1995
154	Phomopsis Blight of Junipers	Oct. 1982
155	Roundheaded Pine Beetle	Dec. 1977
156	Spear-Marked Black Moth	July 1977
157	Nursery Diseases of Western Conifers	April 1979
158	Eastern Dwarf Mistletoe on Black Spruce	Aug. 1979
159	Laminated Root Rot of Western Conifers	July 1981
161	Diplodia Blight of Pines	June 1981
162	Gypsy Moth, The	Oct. 1989
164	Phoradendron on Conifers	Jan. 1981
165	Oak Decline	Aug. 1983
166	Sirococcus Shoot Blight	March 1984

THE STATE OF WYOMING

Wyoming State Forestry Division

1100 WEST 22ND STREET CHEYENNE, WYOMING 82002

March 30, 1998

Ann Bartuska, Director
Forest Health Protection
USDA Forest Service
FHP, AB-2S
P.O. Box 96090
Washington, DC 20090-6090

Dear Ann,

The Great Plains Tree Pest Council, consisting of entomologists and plant pathologists from universities, state, and federal agencies throughout the Great Plains states and Canada, meets annually to discuss problems of mutual concern to plains forestry. At the March 1998 meeting of our group, draft maps of the National Forest Pest Health Risk Assessment depicting the risks of insect and disease mortality and growth loss expected over the next 15 years were displayed. Much discussion followed regarding the validity and limitations of these maps. The following comments summarize the discussion and are intended to improve the final product from the National Forest Health Assessment Team.

The criteria used to depict mortality and growth loss are unrealistic. Rarely would losses of this magnitude occur over large landscapes representable at this scale. The risk levels, temporal and spatial scales need to be modified so that potential forest insect and disease impacts can be portrayed reasonably and consistently.

The maps do not consider all forested lands. The term "forest" needs to be redefined to include riparian areas and wooded draws such as occur in the Great Plains. The forest resources of these areas are very important not only for timber and wildlife, but also for windbreak, snow and watershed protection. The Chief of the Forest Service has recently emphasized the importance of riparian and watershed issues pertinent to these forests, yet it appears they have not been considered in this process.

The insect and disease concerns in the riparian and wooded draw forests need to be addressed by this risk assessment. Dutch elm disease, cottonwood decline, oak wilt, ash yellows, Diplodia tip blight, and Dioryctria pine tip moth are some of the major pests of Great Plains forests that should be considered.

Some montane forest diseases that need better representation are comandra blister rust, white pine blister rust, fusiform rust, pitch canker, subalpine fir decline, and pinyon pine decline.

In general, there is a large disparity between the descriptions and conditions depicted on these risk maps and the actual forest insect and disease conditions reported by forest health professionals.

I hope this brief summary of our group's significant concerns will be useful in this process. Please feel free to contact me should you desire clarification or a more detailed representation of the discussion.

On behalf of the Great Plains Tree Pest Council, I thank you for your consideration of our concerns.

Sincerely,

Lia H. Spiegel, Chair
Great Plains Tree Pest Council

cc: GPTPC members
Tom Ostermann, State Forester, Wyoming
Lyle Laverty, Regional Forester, Rocky Mountain Region

Colorado State Forest Service Report To:
Great Plains Tree Pest Council
October 26-28, 1999 Meeting
Sioux Falls, South Dakota

Aerial Surveys
While concentrating on mountainous forests, CSFS surveys of about 5 million acres along the Colorado Front Range did include prairie ponderosa pine stands in the Black Forest east of Colorado Springs. Primary emphasis was placed on sketch-mapping pockets of pine mortality caused by Mountain Pine Beetle (*Dendroctonus ponderosae*). The combined surveys of CSFS and the USFS are expected to note 100,000-150,000 trees which faded in early summer 1999. This constitutes an approximate doubling of numbers noted during 1998 surveys and continues a doubling trend that has occurred since about 1996. Note that surveys are by nature one year behind in measuring true beetle numbers, meaning that if the doubling continued as a result of the 1999 flights, as many as 300,000 trees could be currently infested. It is estimated that about 1,000,000 trees were killed annually during the last Front Range ponderosa epidemic which peaked about 1978.

Of note in the Black Forest were the following maladies in ponderosa pine:

- Hail damage resulting from June storms
- Pine sawfly (*Neodiprion* (*fulviceps?*) defoliation
- Road salt injury to trees along state highways
- Ponderosa needleminer (*Coleotechnites ponderosae*) defoliation
- Mountain pine beetle (less than 1000 faders)

Gypsy Moth
A total of 11 moths (all singles) were caught during the 1999 trapping effort. CSFS put out a total of 972 detection traps. This is much reduced from past years because of a problem in obtaining trapping supplies in timely fashion for the third year in a row. APHIS-PPQ is well aware of the problems and is working to rectify the contractor problems responsible.

The 1999 catches were in Rocky Mountain National Park (in a delimitation trap near a 1998 catch, trapping done by the USFS Lakewood Service Center), Castle Rock (south of the Denver Metro area in the fastest growing county (Douglas) in the U.S.), and 9 scattered about the Denver Metro area in Jefferson and Arapahoe Counties. All these sites will be delimited at the approximate rate of 25/square mile around the catch site in 2000. One cluster of three catches in the northwest Metro area (mostly Arvada) probably involves an egg mass and may be troublesome.

Of concern, Colorado State Agriculture received an alert in late summer about shipments from Badger Evergreen Nursery in Michigan that went to both Iowa and Colorado. Evidence of recent live gypsy moths was found in the Iowa material and the Colorado material is suspect. Only three of the five Colorado cities or towns receiving this material were trapped in 1999. Plans are to trap these areas in 2000 at slightly higher than normal detection trapping rates.

Western Spruce Budworm
This insect is once again appearing in areas from which it has been endemic since the late 1970's. Of note is the east side of the Sangre de Cristo Mountains from Salida south to Stonewall.

Spruce Beetle
The large 14,000 acre area of blowdown resulting from a freak wind in October 1997 north of Steamboat Springs is slowly producing a Spruce Beetle (*Dendroctonus rufipennis*) population. See USFS (Michelle Frank of Region 2) reports for details. Small pockets of shaded, fallen spruce around the edges of the huge windfall areas appear to be producing the highest brood counts and are expected to result in significant adult flights in early summer 2000.

Douglas-fir Beetle (etc.)
Two major infestations totalling several thousand trees exist in conjunction with a Douglas-fir Tussock Moth outbreak west of Sedalia in the early 1990's and the Buffalo Creek Fire near the town of Buffalo Creek. These two beetle population centers, both southwest of Denver on the South Platte Ranger District of the Arapaho-Roosevelt National Forest, are beginning to coalesce. Sprinkle in a pinch of mountain pine beetle, erosion from summer storms, wildfire threat and dwarf mistletoe and you have a nice recipe for Disturbance Casserole. When this outbreak will end and how much of the Douglas-fir resource it will consume are uncertain. Fire and water issues associated with all these events are driving specific, landscape-scale efforts here. Among the land management agencies involved are USFS, Denver Water Board, and CSFS.

Miscellaneous Comments:
-Zimmerman Pine Moth (*Dioryctria zimmermani*) and relatives continue to increase on ornamental pines in Colorado, particularly along the Front Range.
-Cynipid gall wasps on various oaks are an increasing problem and control strategies appear to be lacking. The primary host is Bur Oak and the suspected insect is the Rough Bullet Gall Wasp (*Disholcaspis quercusmamma*)
-Ash bark beetles (*Hylesinus* spp.) and the Lilac-ash Borer (*Podosesia syringae*) continue to plague ornamental ash cultivars such as "Autumn Purple"Ash. CO has yet to confirm the presence of the Banded Ash Clearwing (*P. aureocincta*), although pheromone baits have been formulated and trapping will done in 2000 in the eastern plains of the state.
-Ash seed weevil (*Lignoodes helvolus*) was finally confirmed (thanks to Dr. Whitney Cranshaw) as the answer to the mystery larvae occasionally discovered under ash trees in the fall. They resemble bark beetle larvae and are leaving ash seeds for overwintering in the leaf litter and upper soil.
-Cedar bark beetles (genus *Phloeosinus*) greatly declined during 1999 from previous levels in planted junipers on the plains.
-Pinyon Tip Moth (*Dioryctria albovitella*) continues to be a major pest of native and ornamental pinyon pine, particularly along the Front Range and in southern Colorado.
-Conifer Seed Bug (*Leptoglossus phyllopus*) and relatives abundantly entered homes in both fall 1998 and 1999, leading to many crisis calls from homeowners. They are essentially harmless conifer and deciduous seed feeders in our area.

-Ponderosa pine needlecast, principally *Davisomycella ponderosae*, was widespread between Pueblo and Trinidad along the southern Front Range (i.e. Wet Mountains), south of Pagosa Springs and in southwestern Colorado. This is a rather unusual occurrence in Colorado.

-Juniper-hawthorn (and Cedar-apple?) *Gymnosporangium* rusts produced spectacular telial horns on *Juniperus* hosts in many plantings throughout eastern Colorado. This is attributed to our heavy late spring rains.

-Dutch Elm Disease in general did not cause major problems anywhere during 1999, although all losses are taken seriously by the respective towns or private citizens that own them. Systematic surveys are still conducted on a few CSFS Districts.

-Fungal leaf spots were not as prevalent as one might expect with the late spring rains this year but *Septoria* did occur in abundance on many of the narrowleaf (="lanceleaf") poplars, leading to decidedly early leaf drop in many areas. Yellow riparian corridors from this condition were evident during August aerial surveys

-Winter drying occurred during early spring in a limited number of mountain areas, some of them highly visible travel corridors (for example, along I-70 west of Denver). Lodgepole pine was the primary host affected.

-Eastern Fox Squirrel (*Sciurus niger*) responded to something missing in its diet this year (tree fruits?) and caused widespread bark injury and flagging on a number of trees, particularly Russian-olive, Siberian elm, American hackberry, and Honeylocust. Bark feeding by this squirrel is more expected and less noticeable in winter.

Exotics

-Colorado has yet to officially record its first Asian Longhorn Beetle (*Anoplophora glabripennis*), although unsubstantiated reports continue to surface.

-Another Asian borer, the Smaller Japanese Cedar Longhorn Beetle (*Callidiellum rufipenne*) is reported to be a threat to Colorado, entering on cedar stem poles for a certain type of artificial Christmas tree and on other decorations distributed by the Gerson International Company. These types of materials were distributed to several general merchandise type stores in Colorado and throughout the country. This insect has been found to attack live trees in the US (unlike its habit of attacking only dead material in Asia) and is possibly a threat to the following genera: *Chaemaecyparis*, *Cryptomeria*, *Cupressus*, Juniperus, *Thuja* (=*Thujopsis*), and possibly *Abies*.

-Japanese Beetle (*Popillia japonica*) continues to be trapped in significant numbers in Colorado. Authorities are still uncertain about its ability to overwinter to overwinter in Colorado, but in planned tests at Denver International Airport it has not survived. Regardless of its real or perceived threat, quarantines in place or pending could really hurt certain nurseries within the state and the beetle's true status and potential impacts need to be determined.

Forest Health Monitoring Program

On May 25th, 1999, six CSFS personnel joined the USFS field crews and regional trainers in Logan, Utah for a three and half week training period in order to assist the USFS with the National Forest Health Monitoring program. After training, the CSFS crews began their measurements of permanent plots on June 17 and concluded the season on August 17. A total of 58 Colorado plots were scheduled to be measured in the 1999 season. Four of these were first time (MT1) measurements, 14 were re-measurements (MT3) of 1998 plots, 39 were re-measurements (MT3) of 1995 plots, and access was denied to one plot. The breakdown of these plots by land use class is as follows: 34 timberland, 21 woodland, 2 reserved timberland, 1 access denied. With the measurements taken in 1999, Colorado now has two complete sets of data from its 151 forested plots. This winter, emphasis will be placed on data analysis and queries to determine status and trends.

Other Issues

-The loss of lindane as a control treatment for Mountain Pine Beetle will force more reliance on other direct control methods such as tarping or other solar treatments. Perhaps it will also force the development of other chemical or mechanical techniques. Lindane was not canceled by EPA but was voluntarily pulled from production by the manufacturers in lieu of paying reregistration costs which would be soon required. Existing stocks of properly labeled materials can still be used, but were largely expended in 1999.

-In a related matter, the only two materials registered for preventive treatments against Mountain Pine Beetle are carbaryl (Sevin) and permethrin (Astro). Astro has been used only in the last few years and is a Restricted Use material (i.e. homeowners can not purchase or apply it). It appears to be as effective as Sevin when properly applied but failures have been reported. It is not known if the failures were related to the chemical or to application shortcomings.

Report prepared by:
David Leatherman
Colorado State Forest Service
Entomologist
Forestry Building 214
Colorado State University
Fort Collins, CO 80523
970/491-6303
email: dleather@lamar.colostate.edu

Forest Health Monitoring summary provided by: Michael Schomaker, CSFS Pathologist (same address and phone), email: mschomak@lamar.colostate.edu

USDA Forest Service, Rocky Mountain Region (R2)
Rapid City Service Center, Forest Health Management

Report to the Great Plains Tree Pest Workshop
Rapid City, SD
March 18 & 19, 1998

Organization

Staff: Kurt Allen, Center Leader
Jeri Lyn Harris, Plant Pathologist
Tom Juntti, Forest Technician

Zone: All of Nebraska;
Most of South Dakota except northwest corner;
Approximately 1/3 of Wyoming: east of the Continental Divide and north of the Sweetwater and North Platte Rivers.

Purpose: Provide technical assistance on forest pest problems and forest health issues to federal land management agencies (USFS, NPS, BLM, BIA, DOD) and cooperate with state and other federal agencies to provide assistance on state and privately-owned lands.

Offices: Co-located with the Pactola-Harney District of the Black Hills National Forest, 803 Soo San Drive, Rapid City, SD 57702 Phone: 605-343-1567, Fax: 605-343-7134, E-mail: kallen/r2,blackhills@fs.fed.us (or jharris/, tjuntti/)

Recent and Current Work

Aerial Surveys: Aerial surveys were conducted on the 1)Shoshone, 2)Bighorn, and 3)Black Hills National Forests in 1997. 1)Areas of the Shoshone NF were flown to observe the Douglas-fir beetle outbreak that has occurred on the Shoshone for 9+ years. There were very few new attacks in the Sunlight Basin or the Clarks Fork areas, however there were significant pockets of mortality on the North Fork of the Shoshone River. 2)Mountain pine beetle mortality in ponderosa pine was seen on the eastern edge of the Bighorn NF. Approximately 2/3's of the mortality occurs on the national forest and the rest of the damage is on Wyoming State and private lands. 3)A mountain pine beetle outbreak on the northern Black Hills NF became apparent with '97 aerial survey work. The mortality dramatically increased to more than four times of what was seen in '96 aerial survey flights.

Evaluation of Mountain Pine Beetle Activity in the Black Hills National Forest: Increasing populations of the mountain pine beetle were detected and evaluated in areas on the Spearfish/Nemo District of the Black Hills National Forest. Beetle caused mortality of ponderosa pine increased dramatically from 1996 to 1997, with much of the tree death being in concentrated areas. Survey results indicate that an average of about 7 trees per acre have been killed over the last 3 years. Much of this is in green trees attacked in the summer of 1997. It appears that beetle populations are reaching epidemic levels and that mortality will continue to increase in this area in the coming years. Strategies for dealing with this situation include: do nothing, silvicultural treatments, sanitation/salvage harvesting, infested tree treatment and individual tree protection. The recommendation at this time is for using sanitation harvests to try and lessen beetle caused impacts.

Evaluation of Forest Overstory and Regeneration Conditions at the Bessey and McKelvie Units of the Nebraska National Forest: In May 1997, plots were surveyed in forested areas on the Bessey and McKelvie units of the Nebraska National Forest to check the condition of the overstory and understory. Measurements taken from plots included overstory basal areas, counts of each species in the understory, and the vigor of both overstory and understory trees. Overall, tree vigor is good in both overstories and understories, basal areas are high in untreated and thinned stands and regeneration is scattered and inconsistent. Recommendations include cutting trials, studies on managing red cedar encroachment, determining the best quality seed sources, and comparing current forest acreage with historical amounts.

Nebraska National Forest Collaborative Plantation Management Team: A collaborative group was formed in 1997 to create alternatives and consequences for plantation management to be given to the Northern Great Plains Planning Team. FHM participated with a team of other interested individuals. A history of the plantations was provided along with impacts from insects/diseases and fire on the plantations. Newspaper editorials throughout the state about possible future plantation management provoked several letters from the Nebraska public expressing their concerns. Alternatives were developed along with the positive and negative consequences for each alternative. The group ranked "Manage to maintain 20,000 acres of forest plantations" as the alternative with the most positive and least negative effects. Other alternatives discussed were: "Natural reversion to prairie", "Partial restoration of prairie", and "Active conversion to prairie."

Insect and Disease Survey of the Ramshorn Analysis Area, Wind River District, Shoshone National Forest: Vegetation management plans were developed for the Ramshorn Analysis Area on the Shoshone NF. One goal for these plans is to reduce damages by insects and diseases to acceptable levels. Comandra blister rust, dwarf mistletoe, mountain pine beetle, and spruce beetle activities are the major forest pests of concern in the area. Plots and rating systems were used to inventory dwarf mistletoe and rust diseases. Fading and recently dead trees along the transect were examined for beetle and other disease activities. Comandra blister rust incidence was high in the area with 57% of the lodgepole pine infected. The rust ratings for these infected trees indicated that half of the crowns are topkilled. Dwarf mistletoe was found on 37% of the lodgepole pine in varying degrees of severity. No recent bark beetle activity was found in the area. Current stand inventories were used to evaluate mountain pine beetle risk ratings. Most of the stands' ratings were low to moderate. The spruce stands have a high susceptibility to spruce beetle with large trees and potential windthrow damage in the area. Low incidences of fir decline and white pine blister rust were found in the survey. To reduce disease and beetle activity, recommendations were to harvest lodgepole pine, create multi-aged whitebark pine stands, and reduce the spruce-fir forest type to promote lodgepole pine and aspen.

Technology Development Projects:

1. Establish and remeasure permanent plots for the Pest Trend Impact Plots System (PTIPS) of the West: For the past 7 years, Region 2 has been actively involved in PTIPS to provide data for monitoring and developing computer models of various insect and disease forest problems. In 1997, twelve plots were established in limber and whitebark pine stands to monitor the spread of white pine blister rust disease. Eight more plots are planned for 1998 to meet the requests by wildlife managers for more information on this disease in whitebark pine stands. Armillaria root disease plots on the Black Hills NF will be remeasured this year.

2. GIS-based Landscape Scale Root Disease Incidence Model: Existing data on Armillaria root disease occurrence and recent field data has been coupled with NRCS soil classification, stand inventories, site disturbances, habitat types, and meteorological data in a GIS database. Utilizing spatial statistical analysis, an Armillaria root disease incidence model has been developed for the Black Hills National Forest. This project will be presented to Black Hills forest managers in spring '98. Methods used for this GIS database and spatial analysis may be used for other projects with pest outbreaks or forest decline.

3. Alternative to Methyl Bromide: In cooperation with other USDA Forest Service nurseries, Bessey Nursery will test soilbed treatments that may be used alternatively to methyl bromide. The five proposed treatments to be tested are 1) fumigation with methyl bromide, 2) fumigation with basamid, 3) fallow with a biweekly till, 4) cover crop of Sudan grass, and 5) solarization. Five replication blocks for each of the treatments will be used in a random block design within the nursery. Prior to the treatments, and after each growing season for three years, each block will be sampled to evaluate populations of pathogenic nematodes and fungi. *Apparently Bessey has long history of efforts to find effective treatment, no publications?!*

tough to do w/ Clarke Fleege gone this year.

releases as methyl isocyanate into soil

4. Fir Decline on the Shoshone and Bighorn NFs: Over the past few years, areas of sub-alpine fir decline have been noted throughout the Rocky Mountains of Colorado and Wyoming. From recent aerial survey work, it appears that these areas are increasing in size. The exact causes of the decline are not well understood but it is thought to be a complex of bark beetles, root diseases, and perhaps environmental factors. Pheromone trapping was done on the Bighorn NF, peak beetle flight was in mid July. Western balsam bark beetle is present in sub-alpine fir stands on the Bighorn NF and maybe partially responsible for the decline of the stands. More work is planned for '98 in sub-alpine fir stands with study plots and root disease identification.

Other Site Visits and Surveys:

1. Jack pine budworm outbreak at Bessey District: A dramatic outbreak of Jack pine budworm occurred in the Jack pine stands of the Bessey District of the Nebraska NF. All stands of jack pine had some level of defoliation, with the hardest hit areas having around 75-80% defoliation. Population levels appear to still be increasing. The impact of this outbreak on the trees is unknown. Management and control measures for the budworm outbreak are undecided at present.

** SPBW doesn't hit ponderosa there.*

*** no one knows if Ips increased after last JPB outbreak; it DID after f*

2. Disease problems at Bessey Nursery: Severe winter storms in Spring '97 caused poor germination and mortality to Rocky Mountain juniper and eastern red cedar crops. The greenhouse has had recent problems with *Fusarium* spp. and *Phoma* spp. on Englemann spruce and pine seedlings. Shelterbelt plantings around the nursery are frequently monitored and managed for *Gymnosporangium* rust and *Sphaeropsis* infected trees to reduce the inoculum of these fungi to seed beds.

3. *Sphaeropsis* spp. problem at Custer State Park: A micro-burst hailstorm in July '96 caused severe damage to a visually-prominent area of Custer State Park. The sight was monitored for a year for a possible outbreak of *Sphaeropsis*. The disease was identified on several of the damaged trees in Sept. '97. Park management plans to remove all of the severely damaged trees.

4. Blowdown on the Spearfish/Nemo District of the Black Hills: *Ips* beetle, pine engravers, were found in 50% of the blowdown trees after a severe winter storm in April '97. Recommendations were to try to salvage the trees by spring of '98 and to closely monitor the sites for *Ips* attack on the remaining trees.

5. Winter drying damage was a concern on BIA lands of the Rosebud Agency. Tribal leaders were concerned when they saw extensive decline in the spring of '97. After an evaluation and explanation of the damage to land managers, they were assured that most of the trees would recover from the winter drying damage.

6. Landscape problems at South Dakota's Western Dakota Technical Institute prompted a request for a site visit. Several ornamental trees, especially white ash, plum, honey locust, and sumac, were planted too deep and over-watered. Compounding the problem was the use of a black plastic material for weed control in these plantings. Insect and disease problems were secondary to the damages caused by poor planting.

7. The Spearfish Canyon Foundation called for an evaluation of some declining spruce at a resort and land trust area in Spearfish Canyon. The spruce in the landscape plantings appeared to be suffering from transplant shock. The mature, naturally regenerated spruce of the land trust area had been attacked by red turpentine beetle and possible *Ips borealis*. Continued monitoring and evaluation will occur on spruce decline in Spearfish Canyon.

8. Hazard tree survey and removal was emphasized to recreation managers of the four national forests in our zone. Both the Black Hills and Nebraska NFs had tree failures in campgrounds caused by extensive heartrot. Fortunately, these failures did not cause any harm of damage to recreationists. Further training in hazard tree identification and documentation will be provided to recreation managers.

9. Gypsy moth trapping continued on select recreation areas and corridors of the Black Hills, Bighorn, and Shoshone NFs. No moths were collected in traps on National Forest lands for summer '97.

<u>Recent RCSC Publications:</u>

Allen, K.K. and Harris, J.L. 1997. Evaluation of forest overstory and regeneration conditions at the Bessey and McKelvie units of the Nebraska National Forest. Biological evaluation R2-98-1. 14pp.

Allen, K.K. 1998. Evaluation of mountain pine beetle activity in the Kine Analysis Area of the Black Hills National Forest. Biological evaluation R2-98-05. 12pp.

Harris, J.L.; Allen, K.K.; and Juntti, T. 1997. Ramshorn Analysis Area, Wind River Ranger District, Shoshone National Forest, insect and disease survey. Biological evaluation R2-98-04. 31pp.

03/16/98

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

REPORT TO THE GREAT PLAINS TREE PEST WORKSHOP
RAPID CITY, SD
MARCH 18-19, 1998

Organization

Permanent Staff: David W. Johnson, Center Leader and Supervisory Plant Pathologist
Willis C. Schaupp, Jr., Entomologist
Erik Johnson, Aerial Survey Specialist
Bernard Benton, Computer Specialist

Service Area: Colorado east of the Continental Divide and northwestern Colorado
All of Kansas
Southern Wyoming east of the Continental Divide (generally south of Casper).

Functions: Provide technical assistance on forest pest problems and forest health issues to federal land management agencies (USFS, NPS, BLM, BIA, DOD) and cooperate with state and other federal agencies to provide assistance on state and privately-owned lands.

Office: Located on the Federal Center, Building 20 in Lakewood, Colorado. Mailing address Lakewood Service Center, P.O. Box 25127, Lakewood, Colorado 80225-5127.
Phone: 303-236-9541.
Fax: 303-236-9542.

SUMMARY OF SELECT INSECT AND DISEASE CONDITIONS
ROCKY MOUNTAIN REGION, 1997
Lakewood Service Center

INSECTS

Gypsy moth **Lymantria dispar**

Each year, detection traps are placed in campgrounds and other sites that have a high likelihood of being introduction sites for the gypsy moth. Sites are selected on the basis of elevation less than 9,500 feet, presence of hardwood species, potential for high numbers of out-of-state visitors, and distance from sites trapped by other cooperators. We continue to examine the criteria and selection of sites in coordination with all personnel responsible for gypsy moth detection in Colorado and Wyoming; therefore, sites selected for 1998 may differ from 1997. Some sites are trapped each year, while some are trapped on a less regular basis.

During the summer of 1997, several National Forest recreation sites, Rocky Mountain National Park, Fort Carson, and the Air Force Academy at Colorado Springs were trapped to detect gypsy moth. We assisted the Wyoming State

Division of Forestry with delimitation trapping on F. E. Warren Air Force Base, Cheyenne, in response to the 1996 capture of 12 moths at the Warren Air Force Base. Two single captures of gypsy moth occurred in 1997 in Colorado, made in traps set by the Colorado State Forest Service. At Warren Air Force Base, however, 2 moths were captured in one trap, necessitating a follow-up effort in 1998.

Douglas-fir tussock moth, ***Orgyia pseudotsugata***

The infestation of the Douglas-fir tussock moth, *Orgyia pseudotsugata*, that was reported on the South Platte Ranger District, Pike National Forest, collapsed completely in 1996. No defoliation was detected in wildland forests in 1997. In addition, no moths were trapped in 1997 by the early warning system which uses low-dose pheromone traps.

Douglas-fir beetle, ***Dendroctonus pseudotsugae***

In scattered portions of the Douglas-fir tussock moth infestation mentioned above, it is clear that Douglas-fir beetle, *Dendroctonus pseudotsugae*, activity is still increasing. Several stands adjacent to areas impacted by Douglas-fir tussock moth were found to contain many green, beetle-infested trees in the Spring of 1997. Population trend ratios comparing 1997 brood with emergence from the 1996 generation suggest a strongly increasing population. It is expected that this epidemic of Douglas-fir beetle will subside in a few years after the defoliated trees fully recover.

In the area burned by the Buffalo Creek fire of May, 1996, many trees are currently infested by Douglas-fir beetle. The type of infested tree has changed, however. In 1996, infested trees were mostly or entirely burned; very few attacks were found on scorched trees and none were found on green trees. In 1997, infested trees were either scorched or entirely green; the beetle population appears concentrated along the outer perimeter of the burned area. It is expected that scorched and green Douglas-fir in the area will be attacked in 1998.

A pine-feeding sawfly, ***Neodiprion autumnalis***

Defoliation was again detected on a plantation of off-site ponderosa pines near Colorado Springs on the prairie in sandy soils along I-25 on the Air Force Academy. The sawfly population seemed to have expanded somewhat, being detected on both the east and west sides of I-25 in 1997. As was the case last year, insecticidal treatment was applied by the Air Force Academy staff to about 100 acres.

AERIAL SURVEY MISSIONS

Aerial surveys for insect and disease detection are performed annually on lands requested by resource managers on the National Forest districts and states as well as special project areas for Forest Health Management. Approximately 16 million acres were surveyed in 1997 in Colorado, Wyoming and South Dakota. Of that total, 5.0 million acres surveyed were on state and private lands, 3.0 million acres on other (non-USFS) federal lands, and 8.0 million acres on NFS lands. Some of the more common pests detected include bark beetles, defoliators, root disease centers and areas heavily infested with dwarf mistletoe.

As a result of a large-scale wind event in western Colorado in October, areas of blowdown were sketchmapped and photographed as well. More than 19,000 acres of spruce-fir type was blown down on the Routt National Forest, northeast of Steamboat Springs. It is anticipated that spruce beetles will infest these areas in the next few years and monitoring of the situation is planned.

OTHER PROJECTS

Several landscape scale analyses are currently in various stages of development. The intent of these analyses is to portray the risks and impacts of major forest insects and diseases to resource managers. Forests involved include the Arapaho/Roosevelt and the Medicine Bow/Routt National Forests.

LISTING OF SERVICE TRIP REPORTS BY THE LAKEWOOD SERVICE CENTER

LSC-97-01 3420 Service Trip Report to Parks Ranger District (re: dwarf mistletoe suppression projects)

LSC-97-02 3420 Site Visits to South Platte Ranger District (re: Douglas-fir beetle, *Dendroctonus pseudotsugae*)

LSC-97-03 3410 Gypsy Moth Detection Survey

LSC-97-04 3420 Service Trip Report to Redfeather Ranger District (re: dwarf mistletoe suppression projects)

LSC-97-05 3420 Letter to US Air Force Academy (re: ponderosa pine decline)

LSC-97-06 3410 Letter to Ft. Carson (re: gypsy moth and ponderosa pine decline)

LSC-97-07 3410 Forest Health Aerial Survey of the Roosevelt NF

LSC-97-08 3410 Forest Health Aerial Survey of the Routt National Forest

LSC-97-09 3410 Forest Health Aerial Survey of the State of Colorado

LSC-97-10 3410 Forest Health Aerial Survey of the Pike National Forest

LSC-97-11 3410 Forest Health Aerial Survey of the Arapaho National Forest

LSC-97-12 3410 Forest Health Aerial Survey of the Medicine Bow/Routt National Forest

LSC-97-13 3410 Letter to Colorado BLM (re: aerial survey)

LSC-97-14 3410 Letter to National Park Service (re: aerial survey)

LSC-97-15 3420 Forest Health Assessment, Clear Creek County

LSC-97-16 3420 Campground Health Assessment, Parks Ranger District

LSC-97-17 3420 Service Trip Report, Collins Creek Timber Sale

LSC-97-18 3420 Evaluation of Hidden Lakes Administrative Study

LSC-97-19 3420 Evaluation of Blowdown, Yampa Ranger District

RECENT PUBLICATIONS (as of January 1998)

Allen, K.K. and J.L. Harris. 1997. Evaluation of forest overstory and regeneration conditions at the Bessey and McKelvie units of the Nebraska National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. R2-98-1. 12 p.

Angwin, P.A. 1996. Literature review of the range of historic variability of insects and diseases on the White River National Forest, Colorado. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. R2-97-02. 24 p.

Angwin, P.A., D.W. Johnson, T.J. Eager, E.L. Smith and W. Bailey. 1996. Piney Analysis Area, Holy Cross Ranger District, White River National Forest- Forest Health Assessment. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. R2-97-01. 80 p., plus appendix.

Eager, T.J. and P.A. Angwin. 1997. Forest Health Assessment- Piney Analysis Area, Holy Cross Ranger District, White River National Forest, p. 116-120. IN: R. Teck, M. Moeur, J. Adams (comps). Proceedings: Forest Vegetation Simulator Conf., Ft. Collins, CO., February 3-7, 1997. USDA For. Serv., Intermountain Res. Sta. Gen. Tech. Rep. INT-GTR-373. 222 p.

Johnson, D.W. 1966. Picea pungens Engelm. IN: Schutt, Schuck, Aas, Lang [eds.]. Enzyklopadie der Holzgewachse (Encyclopedia of Woody Plants). Ecomed Verlag, Landsberg, Germany. 8 p.

Johnson, D.W. 1998. Evaluation of Hidden Lakes dwarf mistletoe pruning study, Routt National Forest, Colorado. USDA For. Serv., Renewable Resources, Rocky Mountain Region Tech. Rep. R2-61. 8 p.

Johnson, D.W. 1998. Evaluation of vegetation health in Big Creek Lakes Campground, Parks Ranger District, Routt National Forest, Colorado. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. R2-98-03. 23 p.

Johnson, D.W. Picea engelmannii Parry ex Engelm. IN: Schutt, Schuck, Aas, Lang [eds.]. Enzykopedie der Holzgewachse (Encyclopedia of Woody Plants). Ecomed Verlag, Landsberg, Germany. (In press).

Johnson, D.W., W.C. Schaupp, Jr., M. Hood and E. Smith. 1997. Cold Springs Analysis Area, Douglas Ranger District, Medicine Bow National Forest - Forest Health Assessment. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. R2-98-02. 51 p. plus appendices.

Johnson, E., S.J. Johnson and D.W. Johnson. 1997. Interpretation of aerial photography of Colorado's forest health monitoring plots 1992-1995. USDA For. Serv., Renewable Resources, Rocky Mountain Region Tech. Rep. R2-59. 11 p. plus appendix.

Johnson, S.J. (Editor). 1997. Forest Insect and Disease Conditions in the Rocky Mountain Region 1996. USDA For. Serv., Renewable Resources, Rocky Mountain Region. 45 p.

Pasek, J.E. and T.M. Juntti. 1997. Comparison of risk/hazard rating systems for mountain pine beetle in Black Hills ponderosa pine forests. USDA For. Serv., Renewable Resources, Rocky Mountain Region Tech. Rep. R2-58. 36 p.

Nebraska Report to the Great Plains Tree Pest Workshop
March 18 & 19, 1998
Rapid City, SD

Mark Harrell and Laurie Stepanek
Nebraska Forest Service, University of Nebraska
Lincoln, NE 68583-0815

1997 Research and Survey Activities

1. Trunk injections

A study was conducted with ArborSystems, LLC to identify solvents and adjuvants that have low phytotoxicity to internal tree tissues. For each of 20 materials, 1 ml was injected beneath the bark of four Siberian elms, and the amount of cambial zone damage was determined a month later. The average area of cambial zone damage around each injection site ranged from 2.25 mm^2 to 101 cm^2. New formulations of systemic pesticides using less phytotoxic materials are being developed.

(same as AVID®)

Greyhound (abamectin) trunk injections were tested for control of the honeylocust spider mite. Fourteen honeylocust street trees along two city blocks in downtown Omaha were used in the test. Seven trees were selected randomly and trunk injected with Greyhound using ArborSystem's Wedgle injector on August 18 as early leaf discoloration from the honeylocust spider mite appeared. On September 9 the degree of foliage damage (discoloration and defoliation) caused by the spider mites was rated for each tree on a scale of 1 to 5, with 1 being the worst rating for any of the trees and 5 being the best. Greyhound-treated honeylocusts had significantly better foliage ratings (mean of 4.1) than the untreated trees (mean of 2.7) three weeks after the treatment (P=0.0228).

An additional, very preliminary test was conducted to see if trunk injections of tebuconazole (Lynx) or myclobutanil (Systhane) could control Sphaeropsis blight of Austrian pine. Three trees were treated with each material. The percentages of new tips killed by Sphaeropsis blight were about 14% and 15% for the treated trees, respectively, and 28% for untreated checks. same result; helps a little

Ned Tisserat did similar work in KS

injected when? @ candle elongation when one would spray (early May?)

2. *Isophrictis* sp. borer of *Juniperus* seedlings

An *Isophrictis* sp. borer (Lepidoptera: Gelechiidae) killed many first-year transplanted eastern redcedar seedlings several years ago in western Nebraska and has again killed many seedlings in new windbreak plantings. The insect may be a previously unknown species. The outbreak several years ago occurred mostly in new plantings that had sunflowers near the seedlings. This pattern has been the same the last couple of years. Evidence suggests the insects spend much of their early development in another plant, probably sunflower, and move to redcedar or Rocky Mountain juniper seedlings just before pupation.

Adult emergence in the lab last year began at the end of June and continued into August. Maximum larval length is 6 to 8 mm. Entrance holes are located on the lower part of the seedling stem. Tunnels in the center of the stem usually extend down but sometimes up from entrance holes and are usually less than 20 mm long. The insect usually girdles the stem from the inside, and the tree often breaks where the girdling occurs. Specimens will be submitted for identification.

3. Fabric mulch

A three-year study of the effects of fabric mulch on the survival and initial growth of hardwood and conifer seedlings in new windbreak plantings is nearly completed. Fabric mulch increased the growth of ash seedlings, but did not significantly increase the survival of ash or the survival or growth of pine seedlings.

Noteworthy Pests and Problems

October snow storm and freeze -- On October 26, 1997, southeastern Nebraska received up to 13 inches of heavy, wet snow. An unusually warm fall had delayed leaf drop on most trees. Nearly every tree from Lincoln to Omaha received at least some damage, and about 5-7% of the trees in the two cities will have to be removed because their damage is so severe. In addition, the temperature dropped to 8°F two days after the snow.* Pines began browning within two weeks. A similar early freeze in 1991 caused similar browning in pine and spruce and caused the mortality of an estimated 500,000 broadleaf trees in western Nebraska.

* Concern for hardwoods in 1998,

* Got below ZERO in western NE !!

Gypsy moth -- No known infestations are present in the state. A previous infestation just south of Omaha was sprayed with Bt in May 1995 and is believed to have been eradicated.

Dioryctria pine moths -- Continue to be the most damaging insect pests of pines in the state. They are now present in the Lincoln area where they had not been before, probably brought to the area on infested nursery stock from western Nebraska.

Sphaeropsis blight -- Caused mortality and severe damage in native ponderosa pine in northern Nebraska following a hail storm.

Recent publications

Harrell, M. O., J. A. Jones, and M. A. Brohman. 1996. Life histories and parasitoids of *Dioryctria* borers (Lepidoptera: Pyralidae) of pines in Nebraska. J. Kans. Ent. Soc. 69(4): 279-284.

Dix, M. E., L. Hodges, J. R. Brandle, R. J. Wright, and M. O. Harrell. 1997. Effects of shelterbelts on the aerial distribution of insect pests in muskmelon. J. Sustain. Agric. 9(2/3): 5-24.

Harrell, M. and D. Mooter. 1997. NFS Storm Damage Bulletins:

1. Immediate Care for Storm Damaged Trees
2. How to Select an Arborist or Tree Service
3. Pruning Storm Damaged Trees
4. Large Tree Pruning and Care
5. Don't Top Trees
6. Recognizing and Correcting Tree Hazards
7. Tree Selection and Placement
8. Tree Planting
9. Care of Newly Planted Trees
10. Storm Damage Resources

Wilson, J. S. and M. O. Harrell. 1998. Winter Injury in Evergreen Trees. Univ. Nebr. Coop. Ext. NebFact NF98-358, 2pp. (in press)

NFS-FPM Web site
http://ffw1.unl.edu/nfs/fpm.html

COLORADO STATE FOREST SERVICE INPUT TO: USDA FOREST SERVICE, RM REGION INSECT & DISEASE CONDITIONS REPORT 1997

INSECTS

Defoliators

Douglas-fir Tussock Moth

Chronic infestations occurred in the older neighborhoods of Denver, with very low populations in Colorado Springs (the other traditional urban forest site along the Front Range). No mountain infestation sites reported.

Western Spruce Budworm

Moderate defoliation continued west of South Fork (Wagon Wheel Gap), and on Poncha Pass and Methodist Mountain south of Salida. Based on moth reports, apparently increasing on the Forbes Trinchera Ranch southeast of Fort Garland. Low and decreasing at most other locations, including the Lake City area where larval sampling revealed populations in the "low" defoliation category. Lots of mortality and associated low-level Douglas-fir beetle activity in heavily defoliated and/or killed stands over the last decade, particularly in the central Colorado.

Pine Budworm (*C. lambertiana*)

Moderate to heavy defoliation noted at scattered locations such as the rest area just south of Wyoming near Livermore along US287, and near Lake City.

Ponderosa Needleminer (*Coleotechnites ponderosae*)

Active infestation areas noted in the extreme eastern part of the Black Forest. This insect has not been evident in the area of over 15 years. Perhaps coincidently, perhaps not, this generally parallels mountain pine beetle activity locally.

Tiger Moth (*Lophocampa ingens*)

Very local, minor populations noted in the northern Front Range near Glenhaven.

Fall Webworm (*Hyphantria cunea*)

Severe defolation occurred locally to narrowleaf cottonwoods along the Arkansas River from Canon City to Salida. Other traditional riparian sites (Poudre Canyon, Idaho Springs, Fort Morgan, Brush, Wray, etc.) also had somewhat spectacular but non-serious infestations.

Snailcase Bagworm (*Apterona helix*)

Scattered reports from West Slope and Front Range, but none considered serious. Seems to be increasingly reported from east of Continental Divide.

Gypsy Moth

Only two single male catches in 1997. One in a detection trap in Fort Collins and one in a delimitation trap in Lafayette. Total of 1787 detection traps deployed on state & private land, 97 delimitation traps deployed around the four 1996 catch sites. No known establilshed infestations occur at this time.

Pine Sawflies

No major problems. Populations of *Neodiprion autumnalis* on the eastern plains, particularly those in the Black Forest, apparently collapsed.

Elm Leaf Beetle

Reported as low to moderate in most low elevation sites. No major problems.

Flea Beetle (*Altica* sp.)

Defoliation of narrow-leaf cottonwood continued in the Gunnison and San Luis Valley areas. This generated considerable interest on the part of area landowners but was considered minor in terms of tree injury.

BrownheadedAsh Sawfly (*Tomostethus multicinctus*)

A late freeze and otherwise detrimental spring weather kept populations at minor levels in their traditional stronghold of Colorado Springs. Does not seem to be achieving pest status in Denver and other new locations like first predicted.

Bark Beetles

Mountain Pine Beetle

Dominate insect issue on private land statewide. Major infestations continue or are developing near Buena Vista, Larkspur, Monument, Shawnee, Conifer/Evergreen, Central City, Rustic, Redfeather Lakes, and Beulah in ponderosa pine and near Vail, Twin Lakes, and Granby in lodgepole pine. (See Erik Johnson's aerial survey report for details and numbers).

Direct control efforts continue in a stretch of transitional forest on the east flank of the Collegiate Peaks west of Buena Vista. This area of roughly 6000 acres involves 1500 landowners. About 3000 infested trees were marked on this area in both 1996 and 1997, with most of these being treated (by a combination of chemical and mechanical methods). An estimated 2000 untreated trees exist uphill on federal land nearby.

Douglas-fir Beetle

Major activity in the vacinity of Buffalo Creek Fire, Sprucewood/West Creek tussock moth outbreak of the mid-90's and near Poncha Pass (250 trees killed in 1997). Scattered activity reported from many other locations but nothing major. Many trees infested by this insect also support a complex that includes *Pseudohylesinus nebulosus* and a *Scolytus* species.

Pine Engraver Beetles (*Ips* spp.)

Lots of activity reported in ponderosa pines near construction sites in Douglas and Jefferson Counties. Species normally involved include *pini, knausi,* and *calligraphus.*

Pinyon Ips (*I. edulicola*)

Commonly reported from Mesa (Unaweep Canyon, for ex.), Montrose, San Miguel and Chaffee Counties. Near Salida a loss of over 5000 trees was reported in association with the mysterious "pinyon decline" condition.

Spruce Ips (*I. hunteri*)

Scattered reports continue in Colorado blue spruce throughout the Denver area with a major infestation at Fitzsimmons Medical Hospital in Aurora (few 100 large trees lost over the last few years due to funding cutbacks and inadequate watering of mature trees). Also in eastern plains cities.

Cedar Bark Beetles (*Phloeosinus* spp., probably including *hoferi, scopulorum neomexicanus,* and possibly others)

A major development on the eastern plains caused the death of at least a few hundred trees in windbreak and ornamental situations. Sites impacted include Yuma, Greeley, Fort Collins, Cheyenne Wells, Burlington, Wray and probably many more rural areas. Since these bark beetles are not particularly aggressive, long-term stress from weather events (mild winters?) over the last several years are thought to be the underlying cause. Beetles and parasitoids were reared from several locations and will be sent off for identification.

*in N.E., Ned Tisserat found rise of these beetles years ago was associated w/ a cancer. (chocolate discoloration under bark w/ white pockets on cambium) *Botryosphaeria cancer *hard to find discoloration *fruiting bodies appear later (Fall) after the action

Balsam Bark Beetles (*Dryocoetes confusus*)

Common statewide within the subalpine fir host type, particularly at the lower elevations of its host's range. Numbers are probably unprecedented in recent history. (See Erik Johnson's aerial survey summary.)

Red Turpentine Beetle (*Dendroctonus valens*)

Common in construction areas along the Front Range, and also in thinning and prescribed burn areas.

Miscellaneous Insects

Chinese Longhorned Borer (see Schaupp)

Imported on dunnage from China. Infested material destroyed.

A Longhorned Borer (*Astyleiopus variegatus*)

Unusual species reared from honeylocust and Siberian elm from Nunn.

Pinyon Needle Scale (*Matsucoccus acalyptus*)

A pocket of 100 infested trees reported from Montrose County.

Lilac-ash Borer (*Podosesia syringae)*

Reported as a major problem in the Douglas County area where planted ash are now big enough and stressed by accumulated string-trimmer damage to support infestations. This is probably true of the entire Front Range where green ash has been overplanted and/or abused over the past 10+ years.

DISEASES

Dutch Elm Disease

At low levels throughout most of the state. Known hotspots include Sterling (30 positive cases), Fort Morgan (11 positives), and Colorado Springs (28 positives). The disposal of elmwood in landfills is becoming a bit of a problem because of the price or because the landfills are full. The blizzard of October 1997 is expected to have created extensive elm broodwood once again east of the Continental Divide, particularly in southeast Colorado.

Road Salt and Dust Control Chemicals

Counties which use these materials on asphalt and unpaved roadways are reporting increased injury to nearby trees. Douglas County uses magnesium chloride and is a particularly good example. Among the problems reported are foliage discoloration, stress leading to bark beetles (particularly in pines) and confusion with mountain pine beetle.

Serviceberry-Juniper Rust (*Gymnosporangium* sp.)

Widespread foliage discoloration (serviceberry) and brooming (juniper) in Pitkin, Garfield, Gunnison, Mesa, and Delta (and probably other) Counties.

Pinyon Decline (cause unknown)

Large areas north of Salida and near Durango continue to support pinyons in various stages of decline and death for which no consistant causal agent can be identified. This would seem to warrant the attention of pathologists, soil scientists or other specialists besides entomologists.

Blizzard (October 1997)

This event caused major limb breakage but is not expected to have caused the freeze injury associated with the Halloween Freeze of 1991.

A Pine Needle Blight (*Sclerophoma* sp. (*pithyophila*?))

Found on ponderosa pine in the Black Forest (north of Falcon) causing needlecast-like symptoms and thin crowns.

Report prepared by: Dave Leatherman Entomologist, CSFS

WYOMING STATE FORESTRY DIVISION
INSECT AND DISEASE CONDITIONS REPORT
1997

Research Activities

Ash Yellows

Wyoming participated in the region-wide survey for ash yellows in green ash. We found the phytoplasma in the roots of trees from 6 of the 9 sites surveyed. Overall it was found in 17% of the trees sampled. This disease causes dieback and witches brooms primarily in white ash to the east but has recently been found in the intermountain west. The effect on green ash in the west is not known.

Ips sp.

In a cooperative study with entomologists in northern Montana, northern Idaho, and central Idaho, experimental thinnings were conducted in the Black Hills using anti-aggregating pheromones to protect leave trees. Although no leave trees were attacked, all thinning slash was heavily infested. This study will be redesigned and tested in 1998 in northern Montana and northern Idaho.

RURAL

Insects

Mountain Pine Beetle

Ponderosa pine southwest of Arlington in Carbon County continue to suffer mortality. Approximately 300 new faders were detected this year. The adjoining lodgepole pine has not yet been infested.

In the Black Hills about 130 trees were killed on state and private lands in Weston County, this is a substantial increase from the previous year. A pocket of about 16 green infested trees near Oil Creek indicate a high localized population, although these trees were removed this winter.

In Johnson county both lodgepole and ponderosa had increases in mortality. Ponderosa pine was especially hit about 230 trees killed on state and private lands.

Pine engraver beetle

A few *Ips* infested trees were detected in the Black Hills, but mortality was generally low.

Spruce beetle

A large pocket of spruce or subalpine fir mortality showed up in the Sierra Madre south of Encampment with about 500 trees on 17 acres killed. This area still needs to be ground checked. Spruce beetle was present in scattered blowdown in the Sunlight Basin and South Pass areas.

Douglas fir Beetle

No calls were received concerning the declining epidemic in Park county. Approximately 15 green infested trees were spotted and cut in a timber sale area near South Pass.

Diseases

Ponderosa pine needle disease

No new needles or trees were affected this year by the undetermined needle disease found the previous two years on ponderosa pine in Weston county.

Subalpine fir decline

Mortality of subalpine fir appears to have decreased in the last year. However, year to year comparisons are difficult due to the fact that subalpine fir retains its red needles for several years. A long-term monitoring study to track subalpine fir mortality and regeneration is planned for an area in southwestern Wyoming particularly suffering from decline.

Aspen foliar diseases

Several foliar diseases including Septoria and Marssonina were prevalent throughout the state due to the extremely wet summer.

Abiotic

Winter damage occurred on about 1200 acres near Spearfish.

URBAN

Gypsy moth

After extensive delimitation trapping around F.E. Warren air force base in Cheyenne, two male moths were caught in one trap approximately half a mile from the nearest positive trap catch of 1996. Extensive delimitation is planned for 1998.

also Sheridan KOA anomally

Green Ash dieback and mortality

Green ash is experiencing problems of decline statewide that are alternately attributed to ash bark beetle and ash/lilac borer. Some communities have stopped planting green ash due to these problems. A statewide survey is planned for 1998 to determine the distribution and extent of damage from each of these pests.

Cytospora

This continues to be a major cause of mortality and dieback in *Populus* spp., particularly in new plantings.

Tubercularia

Reports of this canker on Russian olive are increasing in the Casper area.

Shade Tree Disease Studies in 1997

Dr. Bill Jacobi, Melanie Kallas, Graduate Students Sam Harrison, Jeff Kepley, and Undergraduate student s Amanda Nye-Brennen and Veva McCaig
Department of Bioagricultural Sciences and Pest Management
Colorado State University, Fort Collins CO 80523
970-491-6927
wjacobi@ceres.agsci.colostate.edu

In 1997 we conducted:

1. a third season of determining better IPM procedures for Colorado nurseries
2. continued to study if Cytospora fungi from one tree species can infect another tree species.
3. wrapped up ash yellows survey.
4. the continued development of our tree and turf research facility.
5. initiated the writing of a shrub and tree disease guide for Colorado.
6. initiated water potential study of old growth cottonwoods in Denver CO.

Results:

1. **Nursery IPM**:

Since the year started out dry there was limited damage from Marssonina leaf spot of poplars but considerable damage late in the season from Septoria leaf spot.

We collected spores during the growing season from Marssonina, Septoria, and poplar rust leaf spot fungi to find when spores are produced in relation to meteorological variables so preventative measures can be taken.

We also have determined how to monitor nurseries for common diseases and will be producing a guide to help nurseries do these activities

2. **Cytospora Canker**:

Pathogenicity tests of two fungal isolates from 6 host species are done and preliminary analysis indicates there may be host specific Cytospora species on hardwoods. Ash is specific and Elm and Alder seem specific and Cottonwood, Aspen and Willow seem the same.

We have collected some of the isolates needed for a companion genetics study of Cytospora that will be conducted in conjunction with Gerry Adams of Michigan State if we can find funding.

3. **Ash Yellows**:

We found the phytoplasma responsible for ash yellows in many green ash trees in all sites sampled around the state in 1996. Several samples were sent to Cornell this year for other studies and they confirmed the presence of phytoplasmas. We found 53% of the sampled trees contained the phytoplasma. There was no relation of phytoplasma presence and visible health of the trees. So it seems the phytoplasma is endemic to the state and probably helps kill green ash when they become stressed from other problems.

4. **Tree and Turf Research Facility**:

The facility was completed this summer and treatments and data collection on tree physiology and pest resistance will begin this spring. We also will be looking at how long pathogenic fungal inoculum remains viable in uncomposted wood mulch.

5. **Shrub and Tree Guide**:

   We plan to combine an existing insect guide with a disease guide that is under development on shrubs and trees in Colorado. Both electronic and paper forms are planned with color pictures for diagnosis.

6. **Old Growth Cottonwoods:**

   We are studying the water status of old cottonwoods along a 100 yr-old irrigation canal that runs through metropolitan Denver. The water may be shut off from the canal and we trying to find how long the trees can handle reduced water etc. We hope to use the study to also look at cottonwood's susceptibility to Cytospora under various drought stress scenarios.

Plans for 1998:

1. Establish mulch/inoculum and canker resistance studies at the tree and turf research site.
2. Complete Cytospora pathogenicity study.
3. Continue nursery IPM studies and write up monitoring guides
4. Continue cottonwood drought stress study.
5. Complete a tree and shrub disease identification and management guide for use by arborists, nurseries, and homeowners.
4. Get Honeylocust diseases and construction damage bulletins out to regional states

Forest Tree Disease Studies in 1997

In 1997 we:

1. continued to analyze the spatial relationships of Armillaria root disease and site features in the Black Hills of SD.

2. in cooperation with Forest Health Management, US Forest Service, conducted a preliminary study to see if aerial IR photos would pick up black stain and Ips beetle damage in pinyon and if we can trap potential insect vectors of black stain root disease in southern Colorado.

In 1998 our plans are to:

1. In cooperation with Forest Health Management, US Forest Service, finish analysis of the influence of meteorological, site and soil factors on the spatial small (1/2 mile) and landscape scale distribution of Armillaria root disease on ponderosa pine in the Black Hills.

2. Develop a research project on black stain root disease of pinyon pines in southwest Colorado. We will be looking at spatial relationships with site, soil and management activities.

Publications:

Burks, S., Jacobi, W.R. and McIntyre, G.A. 1998. Cytospora canker development on aspen in response to nitrogen fertilization. J. Arboriculture 24:28-34.

Sclar, D.C., Cranshaw, W.S. and Jacobi, W.R. 1997. Integrated pest management practices in Colorado: A Survey of woody plant nurseries and homeowners, 1995-1996. Colorado State University, Ag Exp. Station, Technical Bulletin TB97-2. 17 pp.

CYTOSPORA CANKER DEVELOPMENT ON ASPEN IN RESPONSE TO NITROGEN FERTILIZATION

by Susan Burks,[1] William R. Jacobi,[2] and Gary A. McIntyre[2]

Abstract. The effect of nitrogen fertilization on Cytospora canker development in aspen (*Populus tremuloides*) was examined in a greenhouse hydroponic system. Aspen trees grown in rock wool or sand were watered with 1 of 5 nitrogen treatments: 0, 55, 111, 185, or 333 mg/L nitrogen as $(NH_4)_2NO_3$. After 6 wk, trees were inoculated with 2 isolates of *Cytospora chrysosperma* in separate wounds. Canker length and width were measured every 2 wk for 6 wk, beginning the 2nd week after inoculation. To assess the effect of prolonged nutrient treatment on canker development, a subset of the original trees was selected to receive treatments for 2 growing seasons, with inoculations at 6 wk after treatments were begun in the 2nd season. Nitrogen deficiency (0 mg/L) contributed to significantly larger cankers in 1 of 4 trials run for 1 growing season and in the 2 trials carried out for 2 growing seasons (P = 0.00–0.006). Canker sizes on trees treated with the other nitrogen rates were not significantly different from each other. Large cankers formed on trees treated with the abnormally high rate (333 ppm), but the differences were not significant from the other nitrogen treatments. Thus, nitrogen deficiencies increase the likelihood of canker expansion, while proper nutrient management allows aspen to defend against canker expansion induced by Cytospora fungi.

Aspen trees (*Populus tremuloides*) are used commonly in western U.S. landscapes, but they are susceptible to infection by several canker-inducing pathogens, including *Cytospora chrysosperma* (Hinds 1985). Cytospora canker is common on many willows and other poplars. Although this disease is stable in native or naturalized areas, canker incidence seems to be increasing in maintained urban landscapes.

Incidence and expansion of cankers caused by *C. chrysosperma* is favored by conditions that stress host trees. These stresses include drought, wounding, excess soil salts, and severe defoliation (Bloomberg 1962; Schoeneweiss 1967; Hinds 1985; Guyon 1996; McIntyre et al. 1996). Cytospora canker is associated with transplant stress, pruning wounds, insect damage, sunscald, and weak branches (Bloomberg 1962; Neely 1984; Hinds 1985; Guyon 1996; McIntyre et al. 1996). Little is known about the effect of soil nitrogen availability on resistance or susceptibility of aspen to infection by *C. chrysosperma*.

Turf competition can influence nitrogen availability and tree growth (Bailey and Gupta 1973 Messenger 1976; Khatamian et al. 1984; Neely 1984). When turf limits only the nutrient availability—without affecting water availability—applied nitrogen will increase tree growth (Smith 1978; van de Werken 1981; Khatamian et al. 1984; Neely 1984; Hansen et al. 1988). However excess nitrogen applied to trees can slow growth and create stress (Fisher et al. 1981; Khatamian et al. 1984). Although little is known about the nutritional needs of trees, their requirements are generally less than those of turfgrass species (Feucht and Butler 1988). Thus, fertilizer regimes designed for turf may impact tree health.

Soil nitrogen levels can influence health and development of both pathogenic microbes and host plants and thereby affect the kind and severity of disease expression (Huber and Watson 1974; Huber 1980a, 1980b). Excess nitrogen can increase plant succulence and increase pathogen nutrition (Dinus and Schmidtling 1971; Suzuki 1973; Rowan 1977; Bavaresco and Eibach 1987; Cadic et al. 1987), whereas deficiency can stress the host and decrease host defense capabilities (Bagga and Smalley 1974; Matson and Waring 1984). Unfortunately, little is known about the effect of nitrogen deficiency or excess on aspen's ability to defend against Cytospora canker fungi and/or disease development. Thus, our objective for this study was to determine if Cytospora canker expansion in aspen was affected by nitrogen deficiency or excess.

Materials and Methods

Three experiments with 2 trials each were conducted to learn how nitrogen fertilization affected canker development on aspen. Two experiments—experiment 1 in year 1 and experiment 2 in yea

2—exposed aspens to various levels of nitrogen for 1 growing season. A 3rd experiment exposed aspens to the nitrogen treatments for 2 growing seasons. Trees were grown in rock wool during the 1st year (experiment 1 and 1st year of experiment 3) and in washed masonry sand for the 2nd year's experiments (experiment 2 and 2nd year of experiment 3) because rock wool used in the 1st-year trials apparently retained excess moisture, which is unsuitable for aspen growth.

Plant material. For experiment 1, 3-to-4-yr-old potted seedling aspens, approximately 2 cm (0.8 in.) diameter above the root flare, were repotted in June into rock wool in 18.9-L (5 gal) black plastic pots. Original potting mix was removed by washing roots before repotting. These trees were allowed to become established for 6 wk before receiving nitrogen treatments, during which time the trees were watered weekly with deionized water. Because of a high rate of mortality following transplanting, half the trees in experiment 1, trial 2 were replaced. Replacement trees had 2 wk of establishment before treatments.

For experiment 2, a 2nd set of aspen trees (from the same source and of the same size and age as those used in experiment 1) was repotted in sand into 18.9-L (5 gal) black plastic pots in April. These trees were allowed to become established for 4 wk before nitrogen treatments were started in May.

For experiment 3, trees from experiment 1 were held over for a 2nd year and repotted in mid-February using washed masonry sand. Only those trees were used that either had not been inoculated or that had wounds sufficiently callused to allow reinoculation. A tree received the same (or the next higher) nitrogen treatment in year 2 as it did in year 1. These trees were allowed to become established for 11 wk before nitrogen treatments were applied in May. Greenhouse conditions ranged from 40% to 90% relative humidity and from 15°C to 34°C (59°F to 93.2°F).

Fungi. Two pathogenic isolates of *C. chrysosperma* were used. Isolates 91-1 and 91-2 were obtained in 1990 from a plains cottonwood (*Populus sargentii*) and a lombardy poplar (*P. nigra* cv. Italica), respectively, growing in Fort Collins, Colorado. Isolates were transferred to acidified potato-dextrose agar (PDA) and grown for 7 days at 23°C (73.4 °F)in the dark before inoculation.

Inoculations. In the 1st year. 5 crushing wounds were made aseptically on each tree through the bark to the xylem with a 13 mm wide (0.5 in.) cold chisel. In the 2nd year, trees were wounded by removing the bark with a 10 mm diameter (0.4 in.) cork borer. Areas to be wounded were wiped with 95% ethanol before wounding, and wounding tools were flame sterilized. A 12 mm diameter (0.45 in.) agar plug of 1 of the 2 isolates was placed on 2 wounds per tree for a total of 4 wounds. The 5th wound received sterile agar as a control. Immediately after inoculation, wounds were wrapped in wax film. Canker size estimates consisted of length plus width measurements of the discolored bark area around each wound. After the last measurement, isolations utilizing wood and inner bark chips from canker or wound margins were made from 10% of the inoculated wounds to confirm the presence of the fungus.

Experiment 1. Nutrient solutions with 5 different levels of nitrogen were used as fertilizer treatments in year 1. These consisted of 0, 55, 111, 185, and 333 mg/L (0, 2.2, 4.4, 7.4, and 13.3 lb/gal) nitrogen in the form of $(NH_4)_2NO_3$. All other nutrient levels were constant across all treatments within + 10% of half the rate recommended by Hoagland and Arnon (1950). Trees were fertilized with a drip irrigation system once a week, beginning July 9 and July 30. Inoculations were made 6 wk after treatments were started. Treatments continued for 6 wk following inoculations for a total of 12 wk or an average of 11.4 L (3 gal) per tree over the course of the experiment. Canker size measurements were made 2 wk after inoculation and were repeated at 4 wk and 6 wk after inoculation. Trees also were flushed weekly with deionized water to prevent salt accumulation. Each trial consisted of 50 trees arranged in a randomized complete-block design with 10 replications. A replicate consisted of 1 tree for each of the 5 nutrient treatments.

One tissue sample for nutrient analysis for each treatment was taken 6 wk after establishment of the 2 trials. Samples consisted of a single excised twig, including leaves, petioles, and stem, from the lower crown of each of 5 randomly selected trees per treatment.

Experiments 2 and 3. In experiments 2 and 3, only 4 nitrogen treatments were used. The 111 mg/L (4.4 lb/gal) nitrogen treatment from the previous season was omitted because leaf nitrogen content and canker size between the 55 and 185 mg/L (2.2 and 7.4 lb/gal) nitrogen treatments did not differ in the first 2 trials. Trees were placed in randomized complete blocks in the greenhouse. Experiment 2 contained 2 trials, with each trial using 48 new trees—12 trees for each of the 4 nitrogen treatments. Experiment 3 contained 2 trials, with each trial using 32 trees from experiment 1—8 trees for each of the 4 nitrogen treatments. Treatments for both experiments were initiated in early May. Because of the low water-holding capacity of the sand, nutrient solutions were administered 3 times per week with no flushing with deionized water, for a total average of 30.3 L (8 gal) per tree over the course of the experiments. Inoculations occurred 47 and 51 days later; canker size measurements began 2 wk after inoculation and were repeated at 4 and 6 wk after inoculation. Trees were rated visually for foliar stress symptoms every 2 wk throughout all trials. Ratings ranged from 1 for healthy green to 5 for dead or leafless trees.

At the end of experiments 2 and 3, 50% of the trees were measured for basal diameter and height, and diameter at the wound. All trees were removed from their pots and the percentage of dead root tissue was determined visually. Roots were then oven dried at 110°C (230°F) and weighed. Live root weight was calculated based on total weight and percentage of dead tissue.

Statistical analysis. To adjust for large variances and skewed data (some cankers expanded much more than others), data were transformed by $\log^{10}$ and analyzed for variance with SPSS Manova software (1986). Treatment data, based on the last reading of canker size, were analyzed by year, trial, group, block, and isolate over time. Data from experiments 2 and 3 were analyzed with and without covariants of live root tissue dry weight, percentage of dead root tissue, and leaf tissue nitrogen content. Measurements also were analyzed independently with respect to possible treatment effects. The 2 trials in experiments 2 and 3 were combined in the analysis because there were no differences between the trials. Thus, the results are presented as the combined experimental data, not as separate trials.

Results

Significantly larger cankers (P = 0.006) formed on aspen trees receiving no nitrogen than formed on trees receiving 55 to 333 ppm nitrogen in trial 1 of experiment 1 (Figure 1). In the 2nd trial of experiment 1, the trend among canker means was the same as in trial 1, but the treatment differences were not significantly different. In experiment 2, cankers on trees receiving no nitrogen for 1 season in the 2 trials were not significantly larger than on trees with nitrogen treatments (Figure 2). However, cankers on trees in experiment 3 (those trees treated for 2 seasons) were significantly (P = 0.001) larger on trees receiving no nitrogen (Figure 3). Cankers on trees receiving 333 ppm nitrogen in experiments 2 and 3 were large but not signifi-

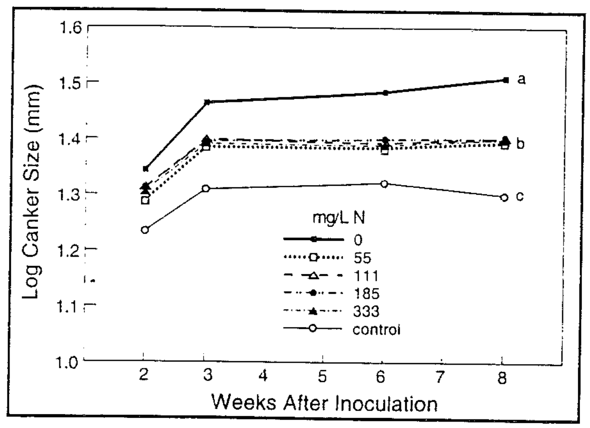


Figure 1. Canker development on aspen treated with various levels of nitrogen during 1 growing season and inoculated with *C. chrysosperma* at the beginning of the same season (experiment 1, trial 1). Mean canker size consists of canker or wound length plus width, transformed by $\log^{10}$, *n* = 40. Isolate values were combined. Differing letters denote significant mean differences of last reading by LSD mean separation, *P* = 0.006. Control wounds consisted of wounds inoculated with sterile agar.

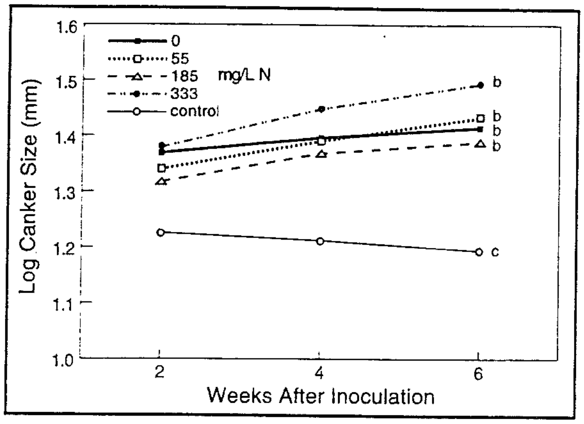


Figure 2. Canker development on aspen receiving various levels of nitrogen for 1 season (experiment 2, combined trials). Trees were inoculated with *C. chrysosperma* after 6 wk of treatment. Mean canker size consists of canker or wound length plus width transformed by log^{10}, *n* = 96. Isolate values were combined. Differing letters denote significant mean differences on last reading by LSD mean separation. *P* = 0.006. Control wounds consisted of wounds inoculated with sterile agar.

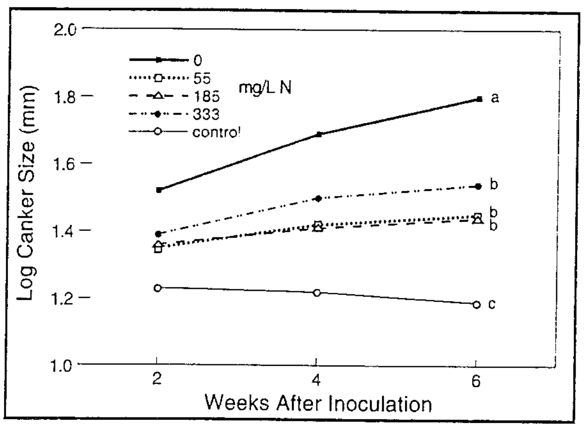


Figure 3. Canker development on aspen receiving various levels of nitrogen for 2 seasons (experiment 3). Trees were inoculated with *C. chrysosperma* during the 2nd season. Mean canker size consists of canker or wound length plus width transformed by log^{10}, *n* = 64. Isolate values were combined. Differing letters denote significant mean differences on last reading by LSD mean separation. *P* = 0.006. Control wounds consisted of wounds inoculated with sterile agar.

cantly larger than the cankers on trees exposed to the other nitrogen treatments (Figures 2 and 3).

The degree of stress symptoms was not different among treatments or experiments except for more severe symptoms on trees provided with no nitrogen for 2 yr (experiment 3).

In experiment 1, the percentage of cankers that expanded ranged from 70% on trees receiving no nitrogen to 23% on trees receiving 55 mg/L (2.2 lb/gal) nitrogen. Overall, 57% of the cankers across both trials failed to expand. Nonexpanding cankers were not substantially different in size than the control wounds. Thus, expanding cankers on single trees greatly influenced treatment means. In experiments 2 and 3, the percentage of expanding cankers ranged from 100% of those on trees receiving no nitrogen to 60% of those on trees receiving 55 mg/L (2.2 lb/gal) nitrogen. Under the highest nitrogen treatment, the percentage of expanding cankers ranged from 2% to 70%, so there was no correlation with nitrogen treatment. All efforts to isolate the pathogen from inoculated wounds were successful.

Nitrogen levels in aspen tissue increased with increasing levels of nitrogen fertilizer, but not all increases were significantly different from each other (Figure 4). Two covariants—the percentage of dead roots and live root dry weight—were correlated to canker size among trees treated for 1 season ($P = 0.036$ and $P = 0.009$, respectively). These correlations, however, explained little of the variation within treatments and had little effect on overall significance levels. Neither of the covariants was correlated with canker size among trees treated for 2 seasons, and no statistical differences were apparent among height and diameter measurements over the range of nitrogen applications.

Discussion

Cytospora canker size was significantly larger on trees receiving no nitrogen for 2 seasons than on trees receiving nitrogen for the same amount of time. Increased disease severity associated with aspen under nutrient stress parallels that observed in aspen under other stress conditions such as drought, wound, and transplant shock (Bloomberg

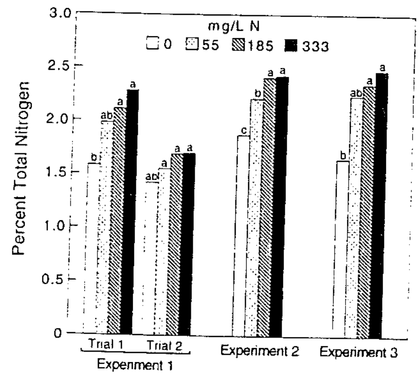


Figure 4. Aspen leaf tissue nitrogen levels in experiment 1 (1 season) and in the combined trials of experiment 2 (1 season) and 3 (2 seasons). Differing letters within a group/trial denote significant mean differences at $P = .05$ using LSD mean separation $n = 5$ per treatment.

1962; Hinds 1985; Guyon 1996; McIntyre et al. 1996). The lack of canker expansion among trees receiving moderate levels of nitrogen suggests that tree resistance mechanisms may involve host response to nutrient deficiencies, rather than fungal stimulation via nutrition. The expansion of cankers at the high level of nitrogen indicates that excess nitrogen may stress aspen, but because this rate is not normal, excess nitrogen is not likely a predisposing stress of aspen.

Cankers on trees receiving no nitrogen for 1 season in trial 2 of experiment 1 and in experiment 2 failed to expand significantly as the cankers did in 1 trial in experiment 1 and in both trials of experiment 3. This may be the result of residual nitrogen from fertilizations received at the nursery before the initiation of the trials. Trees for the trials were received and potted 2 and 4 wk, respectively, before treatment. Apparently, a 2-to-4 wk establishment period followed by a 6-wk treatment period is not sufficient for aspen to manifest nutrient response. Based on our results, a minimum period of water-only establishment of 6 to 11 wk, followed by a 6-wk treatment period, appears necessary for reliable responses, while the best response was after treatment for 2 growing seasons.

The failure of aspen cankers to expand in many trials regardless of treatment is most likely a result of trees not being stressed and thus being able to defend against the canker pathogen.

No consistent, significant differences occurred between treatment responses of the 2 isolates of *C. chrysosperma*, nor were there consistent treatment differences related to root mass. Root weights were expected to relate to canker size because there was so much variation in canker expansion within treatments, but this was not the case. Even though there were root mass differences, these were not related to canker expansion. Unfortunately, root mass does not measure the health of roots, nor does it determine whether the roots are functional or are contributing to drought stress.

We still do not know how long trees can tolerate nitrogen deficiencies without becoming stressed. This research demonstrated that 2 seasons are sufficient to deplete nutrient reserves in young trees. In larger trees, the time necessary for depletion may be different. A larger root system on established trees may facilitate utilization of limited soil nutrients, but a larger crown also may increase the nitrogen depletion rate. Together, the response is unknown. Further research is needed to answer this question.

Treatments in these trials were designed to cover a wide range of nitrogen levels because little work has been done to identify optimal nutrient levels for aspen trees. Levels within this range need to be further tested to establish optimal nitrogen levels so that excess nitrogen is not applied. Until this occurs, fertilization recommendations will continue to be based on rough guesses and extrapolation of data from other nonwoody plant species. An approximate conversion of the rates of nitrogen used in this study to rates applied to turf are 55 mg/L = 2.2 lb, 111 mg/L = 4.4 lb, 185 = 7.4 lb, and 333 mg/L = 13.3 lb of nitrogen/1,000 ft^2.

The implications for trees in the field from our results with young aspen are twofold. Prolonged nutrient deficiency may increase disease expression and, given readily available inoculum, may increase disease incidence as well. However, normal nitrogen concentrations in most soils are high enough to prevent predisposing stress in young trees to infection by Cytospora canker fungi. Thus, variations in nitrogen content of soil are not likely the reason for the high incidence of Cytospora canker on aspens in landscapes.

Acknowledgments. We recognize the assistance of J.R. zumBrunnen for statistical advice and Earl G. Ruppel and John A. Hendrix for reviewing the manuscript. Funding for this project was through the Colorado Agricultural Experiment Station, journal article number 157451.

Literature Cited

Bagga, D.K., and E.B. Smalley. 1974. *The development of Hypoxylon canker of* Populus tremuloides: *Role of interacting environmental factors.* Phytopathology. 64:658–662.

Bailey, A.W., and R.K. Gupta. 1973. *Grass-woody plant relationships.* Can. J. Plant Sci. 53:671–676.

Bavaresco, L., and R. Eibach. 1987. *Investigations on the influence of N fertilizer on resistance to powdery mildew (*Oidium tuckerii*), downy mildew (*Plasmopara viticola*) and on phytoalexin synthesis in different grapevine varieties.* Vitis 26:192–200.

Bloomberg, W.J. 1962. *Cytospora canker of poplars: Factors influencing the development of the disease.* Can. J. Bot. 40:1271–1280.

Cadic, A., F. Lemaire, and J.P. Paulin. 1987. *Nitrogen nutrition and susceptibility to fire blight (*E. amylovora*) of* Pyracantha *cv. Mohave: A preliminary study using a hydroponic system.* Acta Hort. 217:149–155.

Dinus, R.J., and R.C. Schmidtling. 1971. *Fusiform rust in loblolly and slash pines after cultivation and fertilization.* USDA. For. Serv. Res. Paper SO-68. 10 pp.

Feucht, J.R., and J.D. Butler. 1988. Soils and plant fertility, pp. 13–30. **In** Landscape Management. Van Nostrand Reinhold Co., New York, NY.

Fisher, R.F., W.S. Garbett, and E.M. Underhill. 1981. *Effects of fertilization on healthy and pitch canker-infected pines.* Southern J. App. For. 5:77–79.

Guyon, J.C. 1996. *Effects of environmental stress on the development of Cytospora canker on aspen.* Plant Dis. 80:1320–1326.

Hansen, E.A., R.A. McLaughlin, and P.E. Pope. 1988. *Biomass and nitrogen dynamics of hybrid poplar on two different soils: Implications for fertilization strategy.* Can. J. For. Res. 18:223–230.

Hinds, T.E. 1985. Diseases. **In** DeByle, N.V., and R. R. Winokur (Eds). *Aspen: Its ecology and management.* USDA For. Serv. Gen. Tech. Rprt. RM-119. 283 pp.

Hoagland, D.R., and D.I. Arnon. 1950. *The water-culture method for growing plants without soil.* Calif. Agric. Exp. Sta. Circu. #347. Univ. Calif. Berkeley, CA. 32 pp.

Huber, D.M. 1980a. The use of fertilizers and organic amendments in the control of plant disease, pp. 357–394. **In** Pimental, D.D. (Ed). Handbook Series in Agriculture. Sect. CRC Press, Inc., Palm Beach, FL.

Huber, D.M. 1980b. The role of mineral nutrition in defense. **In** Horsfall, J.G., and Cowling (Eds). Plant Disease: An Advanced Treatise. Academic Press, New York, NY. 5:381–406.

Huber, D.M., and R.D. Watson. 1974. *Nitrogen form and plant disease.* Annu. Rev. Phytopathol. 12:139–165.

Khatamian, H., J.C. Pair, and R. Carrow. 1984. *Effects of turf competition and fertilizer application on trunk diameter and nutrient composition of honeylocust.* J. Arboric. 10:156–159.

Matson, P.A., and R.H. Waring. 1984. *Effects of nutrient and light limitation on mountain hemlock: Susceptibility to laminated root rot.* Ecology. 65:1517–1524.

McIntyre, G.A., W.R. Jacobi, and A.W. Ramaley. 1996. *Factors affecting Cytospora canker occurrence on aspen.* J. Arboric. 22:229–233.

Messenger, S.A. 1976. *Root competition: Grass effects on trees.* J. Arboric. 2:229–230.

Neely, D. 1984. *Grass competition for N around landscape trees.* J. Environ. Hort. 2:86–88.

Rowan, S.J. 1977. *Fertilizer-induced changes in susceptibility to Fusiform rust vary among families of slash and loblolly pine.* Phytopathology. 67:1280–1284.

Schoeneweiss, D.F. 1967. *Susceptibility of weakened cottonwood stems to fungi associated with blackstem. Plant Dis. Rptr.* 51:933–935.

Smith, E.M. 1978. *Fertilizing trees and shrubs in the landscape.* J. Arboric. 4:157–161.

SPSS, Inc. 1986. SPSSX User's Guide. Chicago, IL. 988 pp.

Suzuki, K. 1973. *Studies on the susceptibility to poplar leaf rust influenced by different nutrient conditions (I): Changes of susceptibility induced by nutrient deficiency.* J. Jap. For. Soc. 55:29–34.

van de Werken, H. 1981. *Fertilization and other factors enhancing the growth rate of young shade trees.* J. Arboric. 7:33–37.

[1]Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102-0180

[2]Department of Bioagricultural Sciences and Pest Management
Colorado State University
Fort Collins, CO 80523

Zusammenfassung. In einem Gewächshaus-bewässerungssystem wurden die Auswirkungen von N-Dügung von die Entwicklung des Pappelkrebses (Cytospora chrysosperma) auf Zitterpappelen (Populus tremulus) untersucht. Mit je einer aus fünf N-gaben: 0, 55, 111, 185, und 333 mg/L M wurden die Bäume, die auf Steinwolle oder Sand wachsen, behandelt. Nach sechs Wochen wurden die Bäume mit zwei Krebs isolaten in verschiedenen Wunden behandelt. In zwei von drei Versuchen während einer Wachstumsperiode und bei allen Versuchen über zwei Wachstumsperioden führte der N-Mangel zu deutlich größeren Krebswunden. Während aller anderer N behandlungen veränderten sich die Krebswunden nicht signifikant.

NCR-193 Maintaining Plant Health: Managing Insect Pests and Diseases of Landscape Plants
1997 State Report - Colorado/Entomology

Whitney Cranshaw, Dan Gerace, Karen Kramer, Jason Bishop, Andrea Tupy
Department formerly known as Entomology
Colorado State University

State Insect Highlights

Japanese **beetle** trapping has intensified following their detection during 1996 in five counties. Slightly over 200 beetles were captured during 1997 (80 near a single Boulder County nursery and about 20 near Denver International Airport). Beetles, albeit in low numbers, have been detected in almost every county where trapping has occurred.

On a brighter note **gypsy moth** detections are down and remain low. Only six were detected last year, with only one of these being a captured at a site in two sequential years.

"Bug of the year" honors probably would go to **honeylocust plant bug**, which caused very extensive damage over a broad area of the state. **Honeylocust spider mite** populations were very delayed in development due to relatively cool weather and very heavy rainfuall in midsummer. Peak populations, as in 1995, occurred in mid to late September rather than the "normal" midAugust peak.

Cicadas also were unusually abundant. Most common, as usual, was **Putnam's cicada**, but several other species emerged to draw attention.

In forested areas of the state **mountain pine beetle** is making a major comeback. Ponderosa pine in many areas of the northern Front Range are sustaining outbreaks. Outbreaks also are present in lodgepole pine around Vail and in parts of Grand County. Around the area of a 1996 forest fire in Douglas County there are problems developing with **douglas-fir beetle**.

THE FLOOD. Extremely wet weather blanketed most of the state for about five weeks in late summer, setting August rainfall records. Most dramatic was the flooding of Ft. Collins, spawned by an 8 to 11 inch rainfall during the evening of July 28, which extensively damaged Colorado State University - perhaps most notably all the agriculture-related collections of the Library.

Selected Management Research Summaries

A NOTE ON IMIDACLOPRID AND BEES: In a study on greenhouse tomatoes two ranges were established. One was treated with a soil imidacloprid treatment; the other left untreated. Bumblebee colonies were placed in each and at the end of 8 weeks the colony health was evaluated. Those in the imidacloprid treated greenhouse were decimated. Anecdotal effects of soil treatments of imidacloprid on bees have also been received.

CONTROL OF GALL PRODUCTION BY COOLEY SPRUCE GALL ON SPRUCE, FT COLLINS, CO 1997: Trials were conducted on mature spruce in a shelterbelt planting at the Colorado State Forest Service Nursery, Ft. Collins, CO. Plots consisted of single branch terminals that hosted at least one overwintered female. Experimental design was a randomized complete block with six replications. Treatments were applied to point of run-off on May 9. Overwintered females had matured and were producing eggs, which hatched approximate 6-10 days subsequent to treatment, coincident with bud break. Each treated branch ultimately produced in excess of ten new terminals. Plots were evaluated 10 June by noting the number and size of galled terminals on each treated branch. A rating scale was given to the size of galled terminals: 5 for a fully formed gall, 3 for a partial/half gall, and 1 if only slight crooking was observed. For each plot a gall intensity rating was determined that was a function of number of galls by their size.

Treatment and rate	Average gall rating/terminal[1]
Dursban Pro 1 pt/100 gal	1.0 b
Sunspray 2 gal/100 gal	2.2 b
Sevimol 1 qt/100 gal	2.5 ab
M-Pede 2 gal/100 gal	3.2 ab
Azatin XL 16 fl oz/100 gal	5.2 ab
Merit 75WP 0.53 oz/100	6.0 ab
Trilogy 90EC 1 gal/100 gal	8.5 ab
Untreated check	13.2 a

[1] Gall rating is determined by multiplying the number of galls per terminal by a rating factor reflecting the size of each gall - 5 for fully-formed galls, 3 for half/partial galls, 1 for terminals with slight crooking. Original data presented; log + 1 transformation used in analysis. Numbers not followed by the same letter are significantly different (P = 0.05) by SNK.

POPLAR-WILLOW BORER CONTROL TRIAL, MEEKER, CO 1996-1997: Trials were conducted at the Upper Colorado Environmental Plant Center on cloned willow shrubs, approximately 12-ft crown diameter, being used for propagation. All applications were applied as a drenching spray of the lower canes on 24 May, 28 June and/or 22 July, 1996. Experimental design was a randomized complete block with 8 replications. Adult weevil emergence had begun by the time of the first application date but feeding activity, as indicated by the amount of new sawdust produced at wounds, was greatest in late June. Evaluations of effectiveness were made by counting the number of wounds with fresh sawdust on 10 June, 1997.

Note: On 4 replications a soil drench treatment of imidacloprid at a rate of 1 fl oz BayNTN 2F in 2000 ml as drench of base of plant on the 24 May application. Less than 0.5 tunnels per clump were observed on these plantings.

Treatment	Application dates	Borer tunnels/clone[1]
Dursban 4E 1 qt/100 gal	5/24, 6/28	0.375 b

Dursban 4E 1 qt/100 gal	5/24	1.000 b
Astro 24 fl oz/100 gal	5/24	0.000 b
Dursban 4E 1 qt/100	6/28	1.375 b
Astro 24 fl oz/100 gal	6/28	0.875 b
Dursban 4E 1 qt/100 gal	7/22	0.875 b
Untreated Check		4.875 a

[1] Numbers not followed by the same letter are significantly different (P = 0.05) by SNK.

CONTROL OF LILAC/ASH BORER, BOULDER, CO 1997: Trials were conducted on established green ash, approximately 8-in dbh, planted around the periphery of a parking lot in Boulder, CO. Treatments were applied 22 May, 1996 and were timed to coincide approximately 10 days after sustained flights were first detected in pheromone trap sampling. Treatments were applied to the trunk and main branches in the lower 10-ft of the trees. Evaluations were made 5 Jun, 1997 by counting all fresh exit holes in the treated area of the trees.

Insecticide and rate/100 gal	New exit holes/tree
Dursban Pro 1 qt	2.2 b
Astro 16 fl oz	1.8 b
Azatin XL 12 fl oz	1.8 b
Untreated Check	7.2 a

RESCUE TREATMENTS FOR CONTROL OF LEAFCURL ASH APHID, FT. COLLINS, CO 1997: Trials were conducted on potted green ash, approximately 6-ft in height, that which showed high levels of terminal infestations by leafcurl ash aphid. Plots consisted of 10 trees, arranged in a completely randomized design. Applications were made to infested terminals on 20 June, using a hand-operated compressed air sprayer to point of run-off. Evaluations were made 25 June, examining a single symptomatic terminal from each tree and counting all living aphids remaining.

Treatment and rate/100 gal		Aphids/Infested Terminal[1]
Merit 75	0.53 oz	14.00 d
Orthene T&O	2/3 lb	78.50 c
Acetamiprid 70W	0.025 lb ai	44.50 c
CGA-215944 50W	10 oz	
+ 0.05% Silwet		241.17 b
Delta 50SC	8 fl oz	148.17 b
Untreated check		521.33 a

[1] Original data; data log transformed for analysis. Numbers not followed by the same letter are significantly different (P = 0.05) by SNK.

CONTROL OF PINYON SPINDLEGALL MIDGE, FT. COLLINS, CO 1997: Trials were conducted on established pinyon located on the campus of Colorado State University that had sustained high levels of infestation for several years. Initial emergence of adults was observed on 19 June. Treatments were applied the following day using a pump mister sprayer to point of run-off. Individual plots consisted of single branches, with plot design a randomized complete block with 4 replications. Evaluations were made 25 July by examining all the new needles on 10 terminals/plot and calculating the percentage of galled needles.

Treatment and rate/100 gal		Percentage galled needles
Merit 75	0.53 oz	10.36 ab
Tempo 2	45 ml	30.10 a
Delta 50SC	8 fl oz	22.99 ab
Delta 50SC	4 fl oz	30.97 a
Orthene 75S	2/3 lb	18.88 ab
NAF-313 (Spinosad)	8 fl oz	7.08 b
Untreated check		36.12 a

Original data; data log transformed for analysis. Numbers not followed by the same letter are significantly different (p=0.05) by SNK.

AMERICAN WALNUT APHID CONTROL, FT. COLLINS, CO 1997: Trials were conducted small grove of walnut in Ft. Collins, CO that was heavily infested by a late season outbreak of American walnut aphid. Plots consisted on individual leaves, which were sprayed September 1 with a hand-pump mister to wet the leaf surfaces. Plot design was completely randomized with four replications. Evaluation took place four days after treatment (September 5) and consisted of counting all aphids on four center leaflets on each treated leaf.

Treatment and rate/100 gal	Aphids/leaflet
Delta 50SC 8 fl oz	1.00
Orthene 75S 2/3 lb	0.50
Merit 50WP 0.53 oz/100	0.44
CGA 25144 5 oz/100	0.31
Untreated check	32.13

CONTROL OF HAWTHORN MEALYBUG, FT. COLLINS, CO, 1997 TRIAL 1: The experiment was conducted on established hawthorn, heavily infested by hawthorn mealybug, growing at the Plant Environmental Research Center, Colorado State University, Ft. Collins, CO. Individual plots consisted of single infested branches and plot design was a randomized complete block with five replications. Treatments were applied to May 17, after it was observed that migrations from overwintering sites on the trunk had largely ceased and the mature females had settled around buds and small terminal twigs. However, differences between populations on untreated branches between the two evaluation dates suggest that substantial migrations continued during late May. Applications were made to point of run-off using a hand sprayer. Evaluations of treatment effects were made 22 May and 3 June by counting all mealybugs on the terminal 18-in of treated branches.

Treatment and rate/100 gal	Mealybugs/terminal[1] 22 May[2]	3 June[3]
M-Pede 1 gal	8.2 bcde	11.4 ab
Sunspray UFO 2 gal	8.2 de	6.8 ab
Conserve (NAF-313) 0.046 lb ai/100	8.8 b	13.8 a
M-Pede 1 gal + Conserve (NAF-313) 0.046 lb ai	21.6 de	21.8 a
Sunspray UFO 2 gal + Conserve (NAF-313) 0.046 lb ai	0.4 e	2.0 c
M-Pede 1 gal + Conserve (NAF-313) 0.023 lb ai	6.8 bcde	12.4 ab
Sunspray UFO 2 gal + Conserve (NAF-313) 0.023 lb ai	3.8 de	5.2 abc
M-Pede 0.5 gal + Conserve (NAF-313) 0.046 lb ai	10.6 bcd	10.0 ab
Sunspray UFO 1 gal + Conserve (NAF-313) 0.046 lb ai	26.2 a	13.4 ab
M-Pede 0.5 gal + Conserve (NAF-313) 0.023 lb ai	12.6 b	16.0 a
Sunspray UFO 1 gal + Conserve (NAF-313) 0.023 lb ai	8.8 cde	12.4 ab
Merit 0.53 oz	5.6 cde	2.0 bc
Dursban Pro 1 lb ai	21.0 bcd	21.8 a
Untreated check	3.0 de	29.2 a
Trilogy 1 gal	25.4 a	26.4 a

[1] Average number of insects observed on the terminal 18 inches. Average of 5 replications.
[2] Original data. Data transformed (weighted least squares) for analysis. Numbers within a column not followed by the same letter are significantly different by SNK.
[3] Original data. Data transformed (log + 1) for analysis. Numbers within a column not followed by the same letter are significantly different by SNK.

CONTROL OF HAWTHORN MEALYBUG, FT. COLLINS, CO, 1997 TRIAL 2: The experiment was conducted on established English hawthorn, heavily infested by hawthorn mealybug, growing at the Plant Environmental Research Center, Colorado State University, Ft. Collins, CO. Individual plots consisted of single infested branches and plot design was a randomized complete block with four replications. Treatments were applied May 26, to point of run-off. At application adult females were present and all were swelling rapidly with maturing eggs.

Treatment and rate/100 gal	Mealybugs/terminal[1] 3 June	16 Jun
Untreated check	38.3 b	41.5 c
CGA 29144 10 oz + Silwet 0.02%	63.5 a	40.5 b
CGA 29144 5 oz + Silwet 0.02%	26.0 cd	25.8 c
Deltamethrin 4 fl oz/100 gal	34.8 bc	32.8 b
Deltamethrin 8 fl oz/100 gal	47.3 bc	22.3 c
Acetamiprid 0.125 lbs ai	24.8 e	18.3 d

Acetamiprid 0.025 lbs ai	35.8 de	20.0 d
Sunspray 2%	47.5 b	68.8 a

[1] Average number of mealybugs/18-in terminal. Original data presented; data transformed by weighted least squares for analysis. Numbers within a column are significantly different (P = 0.05) by SNK.

CONTROL OF BLACK TURFGRASS ATAENIUS, LOVELAND, CO 1997: Trials were conducted at a golf course in Loveland, CO with a history of problems with black turfgrass ataenius. Plots were 7-ft x 7-ft, arranged in a completely randomized design with 4 replications. Applications were made May 29, shortly after peak flight of the first generation. Liquid treatments were applied in a volume of 5 gal/1000 ft^2 and a light drizzle preceded and was concurrent with the applications. Evaluations were made July 22 by lifting an 18-in X 18-in turf flap from the center of each plot and counting all larvae and pupae.

Treatment and Rate		BTA larvae/ft^2
MACH 2 2.5G	1.5 lb ai/A	0.56 a
MACH 2 2.5G	2.0 lb ai/A	1.56 a
MACH 2 2F	1.5 lb ai/A	0.97 a
MACH 2 2F	2.0 lb ai/A	0.11 a
Merit 75W	6.4 oz/A	0.56 a
Untreated check		16.89 b

Numbers not followed by the same letter are significantly different (P = 0.05) by SNK.

Recent Related Publications

Cranshaw, W.S. 1997. Attractiveness of beer and fermentation products to the gray garden slug, *Agriolimax reticulatum* (Muller) (Mollusca: Limacidae). *Colorado State Agricultural Experiment Station Technical Bulletin TB97-1*. 7 pp.

Sclar, D. Casey, W.S. Cranshaw and W.R. Jacobi. Integrated pest management practices in Coloraodo: A survey of woody plant nurseries and homeowners, 1995-1996. *Colorado State Agricultural Experiment Station Technical Bulletin TB97-2*. 17 pp.

Cranshaw, W. 1997. Part I: Bugs for Hire. *Grounds Maintenance*. 32(3): 44-52.

Cranshaw, W. 1997. Part II: Microbials, extracts and IGRs. *Grounds Maintenance*. 32(4): 45, 48, 52, 56.

Cranshaw, W. 1997. Pest Control: Horticultural Oils. *National Gardening*. July/August: 20, 22, 54.

Cranshaw, W. and D. Gerace. 1997. Tobacco Budworm. *Colorado Green*. 13(3): 28-29.

Cranshaw, W. (primary author and project coordinator). 1997. 4-H Entomology, Members Manual. *Colorado State Cooperative Extension Publ. MD1500B*. 93 pp.

1997 Forest Health Summary
North Dakota

Prepared by: Marcus Jackson

The Environment

The 1997 season began with heavy tree-splitting snows followed by an ice storm and the worst spring flooding on record for North Dakota. In many locations, the flood waters subsided before active tree growth began, resulting in little damage to mature trees. Saplings were damaged in areas where ice flow was heavy. Flood waters have been accumulating around Devil's Lake in northeastern North Dakota since 1994. An estimated 1,000,000 trees have been damaged or killed. The costs for clean-up and replanting are expected to exceed $2 million dollars.

During May and much of June, a large portion of the state experienced drought conditions. Only the southeastern and southwestern portions of the state appeared to get adequate rainfall during that period. During July most of the state received good levels of moisture, with 6" or more in much of the north, but south-central North Dakota remained some-what dry throughout much of the summer. In that area, bark beetles and canker pathogens caused considerable damage to the drought-stressed trees.

Disease and Insect Concerns of the 1997 Season

Diseases:

Dutch elm disease - Since Dutch elm disease (DED) has spread to all of the major stands of native elms in North Dakota, efforts to slow the impact of the disease has moved to community and conservation trees. Although the three largest cities in North Dakota reported a drop in American elm (*Ulmus americana*) losses to DED during the 1997 season, small cities and towns continued to see rapid losses in elms soon after the disease was introduced into their communities. Elm windbreaks also continued to be lost quickly after DED was introduced into the plantings.

Black knot - The ornamental, Canada Red Cherry (*Prunus virginiana* 'Schubert'), is showing increased injury due to black knot infections in North Dakota. The reason(s) for the increased incidence is (are) not fully understood, but sanitation (prompt removal of infected limbs) of ornamental chokecherries and nearby native chokecherries is important in limiting the spread of the black knot pathogen.

Rhizosphaera needlecast - Rhizosphaera needlecast has historically been a greater problem in eastern North Dakota than the western areas of the state. This disease is still a serious threat to blue spruce (*Picea pungens*) in eastern areas. In addition, Rhizosphaera was identified in two communities in northwestern North Dakota during the 1997 season.

X-Disease - This most serious problem of chokecherry in North Dakota is receiving continued research at NDSU. Resistance appears to be present in the plots used for X-disease research.

Juniper blight - Junipers in south-central North Dakota have been injured or killed by a blight for several years. Dr. Jim Walla is currently investigating the cause of this problem. No causal agent has been identified for this blight.

Insects:

Forest tent caterpillar - A forest tent caterpillar (FTC) infestation was discovered in the Sheyenne State Forest in southeastern North Dakota. Basswood (*Tilia americana*) was heavily defoliated, while bur oak (*Quercus macrocarpa*) was lightly defoliated. Approximately 25 acres of the infested area and surrounding woodlands were surveyed for FTC egg masses during January of 1998. Only three egg masses were found.

Fall webworm - Fall webworm was present throughout North Dakota during the summer of 1997. The insect caused the greatest damage in western areas of the state. Many deciduous species were disfigured by this insect, with the greatest damage to chokecherries. Infested ornamental trees created the greatest concern due to the unsightly nests.

Special Topics

Gypsy moth survey - The trapping schedule used for the 1997 North Dakota Gypsy Moth Detection Program was developed by the North Dakota Gypsy Moth Committee. This committee was coordinated by Dave Hirsch, USDA, APHIS, PPQ and consists of representatives from USDA APHIS, USDA Forest Service, North Dakota Department of Agriculture, North Dakota City Foresters, and the North Dakota Forest Service. The forest risk category determines the trapping locations and frequency outlined in the schedule.

Trap Breakdown by Risk Category*

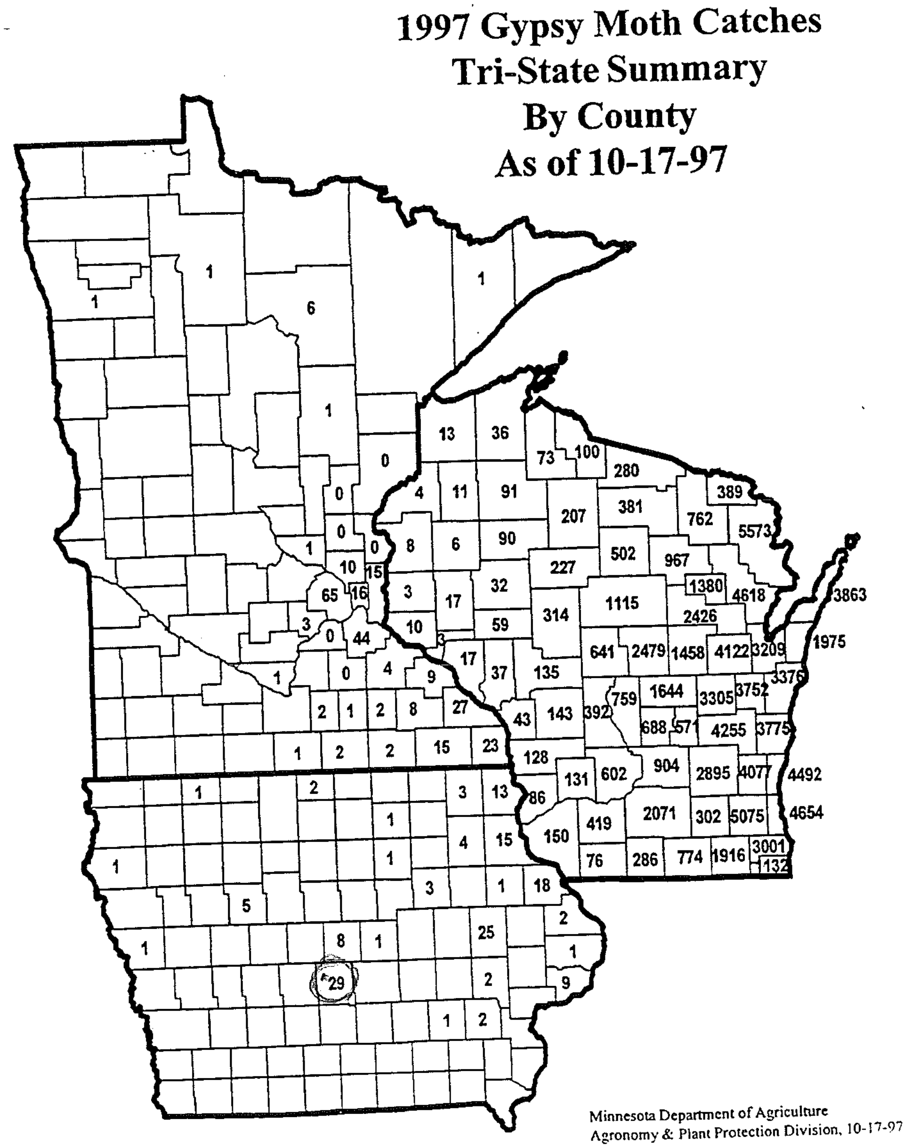
Category	Number of Traps
Low Risk	26
Moderate Risk	125
High Risk	46
Special Detection Survey	153
Total	350

first capture in many years for detection

One gypsy moth specimen was detected from a total of 350 traps placed in 36 of the 53 North Dakota counties. The moth was discovered at the KOA campground on the west end of Jamestown and was identified by a USDA-APHIS identifier in New Orleans.

*Data from state and federal agencies compiled and summarized by Dr. Phillip Mason, North Dakota Department of Agriculture.

In the October 1997 issue of the "Forest Insect & Disease Newsletter," the Minnesota DNR reported that the leading edge of the gypsy moth infestation is "moving much faster than predicted by USDA models." See map for the number of moths caught by pheromone trapping in counties within the states of Minnesota, Iowa, and Wisconsin.



Ash decline - Green ash trees throughout North Dakota failed to break bud last spring (on individual branches and on entire trees). Many of these trees did not break bud until mid-July. Similar symptoms were seen in other mid-western and northern plains states. An Iowa Plant Pathologist (Mark Gleason) attributed the problem to "cumulative effects of winter injury in the two preceding winters (1995-96 and 1996-97)."

// similar conclusio by WYD

In addition to the environmental stresses that green ash must endure in North Dakota, many insect and disease problems affect these trees throughout the state. Ash plant bugs, borers, and bark beetles are important insects often found on declining ash, while diseases include ash anthracnose, cankers, ash yellows, and possibly verticillium wilt. An unusually large number of approximately 10" DBH urban-grown green and white ash trees have been dying over the last two years. Although the cause of death of many of these trees is not fully understood, deep planting, nonhardy cultivars or rootstock, graft incompatibility, and other biotic and abiotic factors may be important in the decline.

Herbicide injury - There has been a high level of interest in preventing and identifying herbicide injury to trees and shrubs in both urban and rural areas. Although information on herbicide injury identification is somewhat limited, available information on identification and prevention of herbicide injury will be compiled into a bulletin for distribution to interested individuals and organizations.

Notes:

(1) During the 1997 season, the lilac witches broom phytoplasma was verified to be present in North Dakota for the first time (Dr. Jim Walla)
(2) First documentation of fireblight on raspberry in North Dakota during the 1997 season (NDSU Plant Pest Diagnostic Lab).
(3) *Pholiota squarrosa* (possibly for first time in North Dakota) noted growing around green ash (Dr. Jim Walla).
    -this fungus may be causing a root rot disease of green ash.

1998 Report - North Dakota
Great Plains Tree Pest Workshop, Rapid City, SD, March 18-19, 1998

Report from J.A. Walla, Plant Pathology Dept., NDSU, Fargo 58105
phone 701-231-7069, FAX 701-231-7851, email: Walla@Badlands.nodak.edu;
web: www.ndsu.nodak.edu/instruct/walla

1. Ash yellows of green ash. (w/Jacobi, Tisserat, Harrell, Ball, Neill, Reynard, Guo, & Spiegel)

The ash yellows phytoplasma was found in green ash roots in systematically sampled sites throughout six U.S. states (CO, KS, ND, NE, SD, WY) and three Canadian provinces (AB, MB, SK) in the Great Plains and Rocky Mountain regions of North America. The phytoplasma had not previously been reported from CO, KS, WY, AB, MB, or SK. The phytoplasma was identified using immunofluorescence with an ash yellows phytoplasma-specific monoclonal antibody in 102 of the 106 sites and 51% of the 1,041 trees systematically sampled in 1996 and 1997. The phytoplasma was detected at all 90 sites sampled in CO, KS, MB, ND, NE, SD, and SK in 1996 and 12 of 16 sites sampled in AB, SK, and WY in 1997. Incidence in trees ranged from 17% of the sampled trees in WY to 71% in SD. No clear association was detected between incidence of the ash yellows phytoplasma and crown condition, incremental growth rate, or tree diameter. There was a significant, but loose, association between the presence of strong immunofluorescence and presence of deliquescent branching, epicormic sprouts, and basal sprouts. However, the association with deliquescent branching was negative.

An apparently unreported symptom of ash yellows was identified. It is essentially an underground witches'-broom.

During surveys of PSFP windbreaks for stem decay, the presence of ash yellows witches'-brooms was noted on both planted and regenerating green ash. In some windbreaks, witches'-brooms were present on more than 50% of the planted green ash. No brooms clearly older than four years old were observed, but there were some dead trees with witches'-brooms. In some windbreaks, it appeared that a very high percentage of the green ash seedlings had witches'-brooms.

Helen Griffiths (Cornell), in a study of genetic variation in the AshY phytoplasma by Sinclair and Griffiths, assayed ash yellows phytoplasmas from the Great Plains and Rocky Mountains. Samples from two trees near Durango, CO were positive, one tree from Bridger, MT was positive, three trees from Saskatchewan, and four trees in North Dakota. In general, all of the isolates were characteristic of the Midwestern AshY strain. AshY was not detected in Ft. Collins or Pueblo Co., CO samples, in one sample from Bridger, MT, or in one sample from Saskatchewan.

2. Lilac witches'-broom (LWB). (With Guo)

LWB is caused by the same phytoplasma as AshY. Late-season growth (witches'-brooms?) was observed on common lilac in three PSFP windbreaks in southeast ND in August and September, 1997. Immunofluorescence assays using the ash yellows phytoplasma-specific monoclonal antibody were positive for samples from two of the three windbreaks. PCR using a universal phytoplasma-specific primer was done with one of the positive samples; the assay was positive. This is the first finding of LWB west of Wisconsin. Previous seasons' witches'-brooms and late season flowering were not seen. It is not known if the late-season shoots were symptoms of LWB or if something else caused the late-season growth and it was coincidence that the plants were infected.

3. X-disease of chokecherry. (with Guo and Cheng, NDSU Plant Sciences, and Knudson, PMC)

We are working to identify X-disease-resistant chokecherry plants in a USDA Plant Materials Center chokecherry germplasm collection. Plants were identified as early as 1993 as being potentially resistant to X-disease. In 1996, 44 plants remained in the "select" category, and 33 remained in 1997. In 1996, the X-disease phytoplasma was found in each of the 44 putatively resistant plants that had few or no disease symptoms, so those plants can maintain vigor despite infection. The 1997 ratings were made September 4 as compared to mid-August in other years, and our symptom ratings do not clearly differentiate between red leaves associated with X-disease and other causes such as normal fall senescence. By Sept. 4, there did appear to be fall coloration, so it appears likely that the 1997 ratings were not as reliable as 1996. Publication of the results will be delayed until ratings can be repeated in mid-August of 1998.

During five years of monitoring in an experimental planting that is very severely damaged by X-disease (about 50% have died), the select plants have maintained good vigor and have developed few symptoms. They appear to be resistant (tolerant?) to X-disease. We are preparing for a germplasm release of these materials in 1998 as a "select class" for seed propagation. The next step is to test whether they are really resistant. Dr. Cheng has successfully propagated several of the select clones through tissue culture. We plan two steps in testing resistance. Initially, we will propagate clonal material and inoculate small plants in the greenhouse. Promising materials from the initial challenge inoculations will be planted in a field trial to establish not only the disease resistance of the select plants, but their suitability for various planting situations as well.

A monoclonal antibody specific to the X-disease phytoplasma was developed; this provided the needed intermediate step to allow large-scale screening of germplasm for X-disease infection. The screening process involves assessment of visual symptoms to identify obviously infected plants, immunofluorescence with the monoclonal antibody as an intermediate step to identify plants without symptoms, but with an intermediate or high phytoplasma titer, and PCR to identify plants with a very low phytoplasma titer.

4. Lirula needle blight of spruce.

Lirula needle blight can cause serious damage to spruce in North Dakota. Studies of the life cycle of the pathogen provided information for timing of fungicide applications to control the disease. Several trials over many years at four sites were done. Final ratings on a 1994 fungicide trial were taken in 1996. Results were consistent with earlier data that application of the fungicide chlorothalonil in early June and early July, or only in July, provides excellent control of Lirula needle blight.

Based on examination of specimens and previous descriptions of the genus *Lirula*, there appear to be at least four *Lirula* species that occur on *Picea* in North America, only one of which (*L. brevispora*) is currently published. The previously described *Lophodermium filiforme* is likely a taxon distinct from *Lirula macrospora*, with which it has been considered synonymous. A different taxon occurs on *P. rubens,* and another on *P. sitchensis.* Seven taxa of *Lirula* on *Picea* are suggested in Europe and North America, as compared to the two currently described.

Research is underway to 1) characterize apparent field resistance; 2) understand variability in morphology and life cycle in the pathogen; 3) understand the mechanism of control by late season fungicide applications; and 4) determine whether outcrossing occurs in the life cycle of the fungus.

5. Stem decay of green ash

Green ash in 30 ND windbreaks planted from 1935-42 have been examined for stem decay periodically since 1978. In 1997, 70% of 25,000+ trees present in 1978 remained alive, whereas 90% remained alive in 1987. In 1997, 13.4% had outward indicators of decay, as compared to 6.1% in 1987 and 0.4% in 1978. The decay fungi fruiting on the outside of the tree when the surveys are made continue to change in dominance over time, with three species (*Phellinus punctatus, P. conchatus, Pereniporia fraxinophila*) now each very common. Mushrooms of a possible root rotting fungus (*Pholiota squarrosa*) were observed in many of the windbreaks.

The trees in these windbreaks are rapidly declining, but the cause is not known. Some possibilities include overcrowding, overtopping, the severe drought of the late 1980s, the severe cold of the mid 1990s, ash yellows, root rot, and stem decay.

6. Other current projects and observations

A) Disease control by alternative windbreak planting design; B) Western gall rust of pines and Other stem rusts of pines; C) Lophodermium needle blight of pines; D) Rhizosphaera needle cast of spruce; E) Unknown juniper disease (dieback); F) Unknown aspen disease (stunt); G) Sphaeropsis shoot blight and pine wilt of pines (in China).

Elm yellows was found in Fargo and Bismarck in 1997. The tree in Bismarck had the typical wilting, yellowing leaves and butterscotch color and wintergreen odor of the cambium. The tree in Fargo has had a witches'-broom for several years. The crown is thin and has a few small dead branches in the upper crown, but no symptoms typical of elm yellows in North America; these symptoms are typical of the disease in Europe. Helen Griffiths of Cornell found that phytoplasmas from both trees fit the North American type of the elm yellows phytoplasma.

DED remained at higher level than recent past, but down from 1996.

Completed Citations and Publications Since Last Report:

Guo, Y.H., Cheng, Z.-M., Walla, J.A., and Zhang, Z. 1998. Large-scale screening for X-disease phytoplasma infection in chokecherry. HortScience (In Press).

Guo, Y.H., Cheng, Z.-M., Walla, J.A., and Zhang, Z. 1998. Diagnosis of X-disease phytoplasma in stone fruits by a monoclonal antibody developed directly from a woody plant. J. Env.Hort. 16:33-37.

Walla, J. A. 1998. Variation in morphology of *Lirula* on *Picea* in North America. pp. In Proc. IUFRO conference, Quebec City, Quebec, Canada. (In Press).

Walla, J.A., Jacobi, W.R., Tisserat, N.A., Harrell, M.O., Ball, J.J., Neill, G.B., and Reynard, D.A. 1997. Studies of ash yellows in the Great Plains region of North America. (Abstr.) European J. For. Path. 28:83.

Walla, J.A., Jacobi, W.R., Tisserat, N.A., Harrell, M.O., Ball, J.J., Neill, G.B., and Reynard. D.A. 1997. Studies of ash yellows in the Great Plains region of North America. (Abstr.) European J. For. Path. 28:83.

Studies of ash yellows in the Great Plains region of North America

J. A. Walla[1], W. R. Jacobi[2], N. A. Tisserat[3], M. O. Harrel[4], J. J. Ball[5], G. B. Neill[6] and D. A. Reynard[6]

[1]North Dakota State University, Plant Pathology Department Fargo, North Dakota 58105, USA, [2]Colorado State University, [3]Kansas State University, [4]University of Nebraska, [5]South Dakota State University, and [6]6PFRA Shelterbelt Centre, Agriculture Canada

Following earlier discoveries of the ash yellows phytoplasma in the Great Plains region of North America, sampling of *Fraxinus pennsylvanica* (green ash) was carried out to study its incidence and impact. Using immunofluorescence with an ash yellows phytoplasma-specific antibody (source: Dr T.A. Chen, Rutgers University), the ash yellows phytoplasma was found at an average of 57% of 900 systematically sampled trees. It was present at each of 90 sites distributed across five USA states (Colorado, Kansas, Nebraska, South Dakota, North Dakota) and two Canadian provinces (Mannitoba, Saskatchewan). No clear association was found between incidence of the phytoplasma and growth rate or crown condition of the sampled trees.