Minutes of the Second Meeting of the Great Plains Tree Pest Workshop
Albuquerque, New Mexico
March 8 and 10, 1994

Tuesday, March 8, 1994

Meeting was called to order by Bill Jacobi at 7:30 pm.

In attendance: Dave Johnson (USFS FHM, Golden CO); Rich Dorset (State of SD, Pierre SD); Dave Leatherman (CSU, Fort Collins CO); Mike Schmaker (CSU, Fort Collins CO); Mary Ellen Dix (USFS CSF, Lincoln NE); Judy Pasek (USFS FHM, Rapid City SD); Bill Schaupp (USFS FHM, Rapid City SD); Jose Negron (USFS RMFRES, Fort Collins CO); John Lundquist (USFS RMFRES, Fort Collins CO); Carol Bell (USFS FPM, Missoula MT); Bill Jacobi (CSU, Fort Collins CO).

The first order of business was to determine where the 1995 GPTPW meeting would be held. The group decided to hold the next meeting in Kansas. Since no one from Kansas was able to attend this meeting, it was decided that the new president would call Les Pinkerton and others in Kansas to let them know about the meeting and ask for their help with local arrangements.

Next we elected new officers: Rich Dorset is the new president and Dave Johnson is the new secretary.

The current mailing list was passed around for those present to look through and update where necessary.

We decided to hear state and organizational reports. I distributed reports submitted by Don A Reynard (PFRA Shelterbelt Center), James Walla (Dept. Plant Pathology NDSU), Les Pinkerton (State and Extension Forestry KSU), Bob Bauernfeind (Dept. Entomology KSU), and Ned Tisserat (Dept. Plant Pathology KSU) who were unable to attend. Since we only reserved the room for a few hours, we decided to get through as many reports as we could then pick up where we left off when we reconvene on Thursday.

Rich Dorset (written report enclosed), Mike Schomaker and Dave Leatherman (written report forthcoming), and Mary Ellen Dix (written report included) gave their state/organizational reports.

Mike and Dave passed around a copy of a new publication from CSU titled "Insects that Feed on Colorado Trees and Shrubs" Bulletin 506A. It is $6.75 and copies can be ordered from the CSU Bulletin room (303) 491-6198. The address is Aylesworth Hall CSU, Fort Collins, CO 80523.

Mary Ellen Dix wanted to mention the addition of a new research ecologist to the Lincoln Staff- Dr. Michael Dosskey. She also asked if anyone knew of a green ash defoliator that had a large larvae. She is interested in using something to test if the incorporation of a proteinase inhibitor into green ash inhibits defoliation. She would like large larvae because they are easier to dissect.

Mary Ellen asked that everyone who can please read through a copy of the white paper "Biological Control of Forest Pests in the Great Plains: Status, Needs, and Issues" and provide her with feedback in the next few weeks (I have

included a copy of the white paper with these minutes). She also mentioned that copies of Walla, James and Mary Ellen Dix (Technical editors). 1993. Biological Control of Forest Pests in the Great Plains: Status and Needs--A Symposium. Proceedings of the 4th Annual Meeting Forestry Committee, Great Plains Agricultural Council [Bismark, North Dakota; July 13-16, 1991] Great Plains Agricultural Council Pub. No. 145. 233 pp. can be obtained from Rich Cunningham, USDA ARS, Northern Great Plains Research Center, Box 459, Mandan, ND 58554 (ph: (701) 667-3006.

Bill Jacobi asked that in these minutes the Great Plains Tree Pest Workshop officially compliment the biocontrol task force on putting together the biocontrol symposium and subsequent white paper- a job well done.

Because Mary Ellen will be unable to attend the Thursday meeting- we decided to talk about what the GPTPW should be doing in the near future about biocontrol. A long discussion ensued in which it was suggested that the GPTPW approach riparian ecologists (anyone currently working in riparian systems) about the possibility of forming partnerships and doing biological control work in riparian zones. It was further decided that John Lundquist, Bill Jacobi, and Dave Leatherman would talk to the riparian ecologists in Fort Collins, CO; Judy Pasek and Bill Schaupp would talk to riparian ecologists in Rapid City, SD; and Mary Ellen Dix would talk to riparian ecologists in Lincoln, NE to try and define what and where the members of the GPTPW could be useful in furthering the knowledge about riparian zones and their importance in biological control.

The meeting was adjourned at 10:30 pm.

Thursday, March 10, 1994

Bill Jacobi called the meeting to order at 3:35 pm.

In attendance: Judy Pasek (USFS FHM, Rapid City SD); Dave Johnson (USFS FPM, Golden CO); Carol Bell (USFS FPM, Missoula MT); Bill Schaupp (USFS FHM, Rapid City SD); Rich Dorset (State of SD, Pierre SD); Mike Schomaker (CSU, Fort Collins, CO); Bill Jacobi (CSU, Fort Collins CO); Dave Leatherman (CSU, Fort Collins CO); Ken Lister (USFS FHM, Golden CO); John Lundquist (USFS RMFRES, Fort Collins CO); Jose Negron (USFS RMFRES, Fort Collins CO); Diane Hildebrand (USFS R6, Portland OR).

Meeting began with the continuation of state/organization reports. Reports were heard from Judy Pasek (written report enclosed); Dave Johnson (written report enclosed); Carol Bell (written report enclosed); John Lundquist (written report forthcoming??); Bill Jacobi (written report enclosed).

Special Reports:

Pine tussock moth outbreak 1991, 1992, 1993, and possible 1994 was given by Bill Schaupp.

"Aesthetically pleasing photos of insect and disease pests" given by Dave Leatherman.

Update on the GPTPW herbicide damage slide collection given by Mike Schomaker- If you have any additions to this collections- please forward the slides with a caption of the damaging agent and the host plant to:

Mike Schomaker
Colorado State Forest Service
Colorado State University
Fort Collins, CO 80523

Unfortunately, I had to catch a plane before the meeting officially ended so I can not tell you exactly what transpired after this point- but I am assuming that Bill concluded the meeting at around 5:30 pm and invited everyone to join us again next year in Kansas.

Respectfully submitted

Carol Bell

If you have any comments, suggestions, or would like to become a member of the GPTPW- please contact Dave Johnson- Secretary of the GPTPW in 1994/1995 at the following address:

Dave Johnson
USDA Forest Service
Lakewood Service Center
740 Simms Street
Golden, CO 80401

(303) 236-9541

Pest Management Unit, USDA Forest Service
Northern Region (R-1)

1994 Great Plains Tree Pest Workshop Report, Albuquerque, NM

Organizational News:

The Region 1 FPM staff has opted to bolster the Coeur d'Alene field office by transferring Jim Byler (now Coeur d'Alene field office supervisor and a plant pathologist to boot), Carol Bell (entomologist), and Bob Oakes (technician) from Missoula, MT to Coeur d'Alene, ID. The effective dates of these transfers is May 27, 1994.

Carol's work while in Missoula was primarily focused on the insect pests of eastern Montana and northwestern South Dakota. While she has been given time each year to continue ongoing projects, it is not likely that she will be able to start new projects in the Great Plains.

Situation Summary:

Gypsy Moth (Lymantria dispar) Surveys:

Early detection efforts for the European and Asian gypsy moths continued in 1993. A total of 1310 pheromone traps were deployed throughout the state of Montana by the USDA Forest Service, Animal and Plant Health Inspection Service (APHIS), Montana Department of Agriculture, and the Montana Department of State Lands. One male European gypsy moth was caught in an APHIS trap in Yellowstone county near Billings, Montana. APHIS is planning to intensify trapping efforts near Billings in 1994 to determine if gypsy moths have become established and define their range.

Though only one moth was caught in Montana, gypsy moth catches in adjacent states increased over past years. Two moths were trapped in Idaho near Coeur d'Alene, 10 moths were caught throughout South Dakota, and 2 moths were caught near Yellowstone National Park in Wyoming.

Tip Moths (Rhyacionia species) Thinning Study:

Permanent plots were established during the summer of 1993 to try and quantify the effect of thinning on tip moth related damage in regenerating ponderosa pine stands in southeastern Montana. Thirty plots were established in 6 stands along Cow Creek in the Ashland Ranger District of the Custer National Forest. All six stands had been naturally regenerated after a fire; three of the stands were thinned to a 10X10 spacing during the spring of 1993. The plots will be re measured in 2 to 5 years and more plots will be established as suitable study areas are identified.

Sawflies (Neodiprion autumnalis) Collapse:

As predicted from over wintering egg mass surveys, the sawfly infestation on the Ashland Ranger District, Custer National Forest collapsed in 1993. No new defoliation was visible to the aerial surveyor, and larval populations were practically un detectable. It does not appear that this insect will be a problem in 1994.

1994 Great Plains Tree Pest Workshop Report, Albuquerque, NM

Situation Summary (con't):

Pine Tussock Moth (Dasychira grisefacta) Activity Intensifies:

Pine tussock moth was again detected on the Custer National Forest in 1993. Larvae were abundant in early July near Poker Jim lookout on the Ashland Ranger District and near X/X Spring in the Long Pines land unit of the Sioux Ranger District. By August 1st, the Ashland population collapsed and no defoliation was visible. On the Sioux Ranger District, tussock moth larval populations remained high and in August late instar larvae were abundant and a number of pupae were visible. Aerial surveys detected 629 acres of defoliation within the Long Pines land unit. Defoliation was moderate within the infested area.

In 1993 pine tussock moth damage was reported in Montana, Wyoming, South Dakota, and Nebraska. The simultaneous appearance of pine tussock moth across a large portion of the Great Plains is apparently unique. In order to document this phenomena, entomologists from the 4 states got together and conducted identical damage assessment surveys in affected areas. These surveys will be conducted each year until the population collapses, then for a period of time there after to assess the long term affects of the outbreak.

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

REPORT TO THE GREAT PLAINS TREE PEST WORKSHOP
ALBUQUERQUE, NM
MARCH 9 & 11, 1994

Organization

Permanent Staff: Judith Pasek, Center Leader and Supervisory Entomologist
Willis (Bill) Schaupp, Pest Mgmt Specialist and Entomologist
Jeri Lyn Harris, Plant Pathologist (Effective April 1994)

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

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: Co-located with the Rocky Mountain Forest and Range Experiment Station, 501 E. St. Joe, South Dakota School of Mines & Technology, Rapid City, South Dakota 57701-3995. Phone: 605-394-1960.

RECENT AND PLANNED ACTIVITIES

1. Gypsy Moth Surveys--Each year, detection traps are placed in campgrounds and other sites that have a high likelihood of being introduction sites for the gypsy moth. Over the past few years, gypsy moths have been caught in the Black Hills area of South Dakota and in a few isolated campground areas in Wyoming. Generally, these moths have been attributed to "hitchhikers" that did not establish reproducing populations.

Moths were trapped in both 1991 and 1992 near Rockerville, south of Rapid City in South Dakota. An intensive delimitation survey was conducted in 1993 over approximately 43 square miles through a cooperative effort of USFS, APHIS, SD Dept. of Agri., Pennington Co. Weed & Pest Board, and Coop. Extension Service. A total of 530 traps were placed in a grid pattern, centered on the locations of 7 moths caught in 1992. Two moths were caught in 1993 at widely separated locations within the delimitation block. Delimitation trapping will be conducted again in 1994 in the same vicinity over a somewhat smaller area: the USFS will trap about 16 square miles and the SD Dept. of Agri. plans to trap about 1-2 square miles.

Cooperators reported the following catches of gypsy moth in detection traps for 1993: Nebraska had 10 moths total, with six in two traps in Bellevue, two in

separate locations in Omaha, and two at a garden center in Lincoln; South Dakota had eight moths (besides the two caught in delimitation traps), with one at a garden center in Sioux Falls, one at a nursery center in Dell Rapids, one at a city park in Spearfish, two at the Mammoth Site in Hot Springs, and three at a residence in Rapid City. The RCSC caught one moth in Wyoming at the Newton Creek Campground on the Wapiti Ranger District of the Shoshone National Forest, located between Cody and Yellowstone Park. An additional moth was caught in Grand Teton National Park in Wyoming by USFS Region 4 personnel. Delimitation trapping is being planned by the various agencies for 1994 at all sites where gypsy moths were caught in 1993. (Pasek, Schaupp, Cooperating agencies)

2. **Pine tussock moth outbreaks**--Defoliation by a pine tussock moth, Dasychira grisefacta (Lymantriidae), became apparent on ponderosa pines at several distinct locations in western South Dakota in 1992, and in northwestern Nebraska and central Wyoming in 1993. Areas in southwestern South Dakota that were heavily defoliated in 1992 were revisited in 1993 and found to have about 40% tree mortality attributable to pine tussock moth defoliation. Areas in central Wyoming and northwestern Nebraska that were defoliated in 1993 are being monitored to further document impact of this pest, about which little is known. (Schaupp, Lister)

3. **Black-staining fungus in pine**--Heavy mortality (40-60%) of jack pine saplings in clearcut areas and some nearby mature trees on the Bessey Ranger District of the Nebraska National Forest prompted some detective work to determine what was going on. A black-staining fungus, Leptographium terebrantis, was isolated and identified from roots of symptomatic trees. This fungus is introduced to trees by root-infesting beetles, such as Hylastes spp. and the red turpentine beetle. The fungus grows through the tracheids and rays of living wood, eventually cutting off the flow of water and nutrients, and causing the tree to wilt. Seedling inoculation trials indicated that this black-staining fungus is capable of killing jack pine, a new piece of information about this relatively-recently recognized species.

L. terebrantis also was identified for the first time from the Black Hills National Forest, in a thinned stand of ponderosa pine regeneration that was experiencing mortality on the Nemo Ranger District. Little is known about how to manage for this disease, but possibilities include replanting with more resistant species and reducing available breeding material for the beetle vectors. (Holah, Schaupp, Wu)

4. **Winter injury**--Ponderosa pines throughout the Pine Ridge Indian Reservation in South Dakota that exhibited brown needle flecking and needle loss were examined in 1992 and revisited in 1993 to monitor progression of this malady. Generally, trees remained in the same condition or improved from 1992 to 1993. Symptoms were prevalent on needles that had flushed prior to 1992, but 1992 and 1993 needles appeared to be healthy. The "Halloween" freeze of 1991 appears to be the most likely cause of the discoloration, and trees are expected to recover. (Holah, Schaupp)

5. **Mountain pine beetle suppression project**--Sanitation/salvage logging and silvicultural treatment was completed on the Bearhouse Suppression Project in spring of 1993. The entire project encompassed almost 6,000 acres where a mountain pine beetle epidemic had been building for several years on the Harney

Ranger District of the Black Hills National Forest in South Dakota. By the summer of 1993, mountain pine beetle populations were in rapid decline; post-suppression ground survey indicated that 1992 attacks (i.e., trees that died in 1993) declined by 93% from 1991. Unsuccessful attacks (i.e., pitchouts) increased by 25%, comprising 78% of the trees attacked in 1992. Based on aerial survey estimates, tree mortality declined by 83% from 1992 to 1993 and the affected acreage declined by 72%. Brood sampling indicated declining populations in the '92-'93 generation as well as for the '91-'92 generation, so tree mortality is expected to continue to decline in 1994. The population decline was attributable to a combination of unfavorable weather conditions and harvest treatments. (Pasek, Schaupp)

6. **Armillaria root disease surveys**--Extensive ground surveys for Armillaria root disease were conducted for the first time in the Black Hills National Forest. Forest acreage occupied by Armillaria on the Spearfish and Harney Ranger Districts averaged 11% and 13%, respectively, considered to be high levels. Twice as many acres were occupied in areas that had been recently managed compared to those that had not received silvicultural treatment for 10 years or more, although the number of disease centers was similar between these groups. Many Armillaria disease centers were found where mountain pine beetle was absent; however, 78% of pine mortality found in small pockets that was caused by mountain pine beetle were located in or near Armillaria centers. The Custer Ranger District in the southern Black Hills had a negligible amount of Armillaria. Speculation as to causes of this low incidence include a history of sparse tree cover, higher fire frequency, or differences in soil type or tree physiology. This information highlights the importance of considering root disease incidence and severity when developing management objectives and planning management activities. (Holah)

7. **Pest considerations in forest planning**--Efforts have been made to incorporate current knowledge of pest management practices and forest health issues into the revision of the Black Hills Forest Plan. Input has included drafting standards and guidelines; obtaining information on the historical role of insects and diseases, introductions of exotic insects and diseases, and threatened and endangered species of insects and snails; writing a specialist report containing information on the current situation for insects and diseases and an effects analysis for the various proposed alternatives; formulating glossary definitions; and making recommendations for monitoring activities. Insects and diseases have frequently been neglected in forest planning efforts; however, representation of these disciplines has been facilitated by the inclusion of RCSC staff on the Interdisciplinary Planning Team for the Black Hills. The draft plan will soon be released for public review and comment. Once approved, the final plan will guide management activities on the Black Hills National Forest for the next ten year interval. (Pasek with assistance from Schaupp, Holah)

8. **Douglas-fir beetle population and damage monitoring**--Population levels of Douglas-fir beetle have been monitored on the Clarks Fork Ranger District of the Shoshone National Forest since an epidemic began following the 1988 Clover Mist Fire (one of the Yellowstone fires). Although brood sampling in fall of 1992 indicated that infestation levels likely would increase again in 1993, the population actually appeared to have declined. Aerial survey indicated that tree mortality in 1993 declined by about 48% relative to 1992 and that the affected acreage declined by abut 60%. Approximately 4,000 Douglas-fir trees

(228 MCF) on about 1,600 acres of Forest Service land in Wyoming died in 1993. Some adult beetles failed to emerge during summer 1993, remaining beneath the bark perhaps because of the unusually wet, cool weather. Many trees that were attacked in 1993 appeared to be pitched out, such that brood development was unsuccessful. Bark sampling in fall of 1993 indicated that brood production was poor, portending an additional decline in population levels for 1994. (Pasek, Schaupp)

9. **Needle cast of lodgepole pine**--Extensive discoloration of lodgepole pine, caused by the needle cast fungus, Lophodermella montivaga, occurred across the southern Bighorn National Forest between Buffalo and Tensleep, Wyoming. Damage was especially severe on young regeneration in clearcut areas. Unusually wet, cool weather in 1992 and 1993 apparently promoted the development of this disease. (Pasek, Wu)

10. **Ips beetle control using pheromone traps**--Small pockets of top-killing and tree mortality continued throughout the Black Hills on ponderosa pine, but was less abundant in most areas than in preceding years. Log decks left for firewood gatherers became heavily infested with Ips beetles in a pre-commercial thinning project area near the southwestern edge of the forest. Lindgren funnel traps baited with ipsdienol pheromone are being used to collect beetles that emerge from log decks in order to reduce the spread to nearby standing trees. (Pasek)

11. **School presentations on insects**--Recently, the RCSC has had an unusually high number of requests for presentations on insects to various school groups. Approximately 25 grade school classes, mostly 3rd through 6th grades, have been visited in the past year or are scheduled for the near future within the Rapid City Public School System. An interactive video-conference presentation is planned for 8th through 10th grade girls at an "Expanding Your Horizons" Conference to be held at the University of South Dakota later this month. (Pasek, Schaupp)

TECHNICAL DEVELOPMENT PROJECTS/PROPOSALS

1. **Armillaria permanent plots**--Permanent plots, established in the Black Hills in 1991 to collect information on Armillaria root disease in ponderosa pine, were remeasured for the first time in 1993. Permanent plots were also established in three stands of Black Hills (white) spruce in the Black Hills in 1993. Plots will be remeasured every two years. Information collected from these plots will be used to validate and calibrate models of root disease spread and impact on tree growth and mortality. (Angwin, Holah)

2. **Risk-rating for Douglas-fir beetle**--A study is being conducted in the Douglas-fir beetle outbreak area on the Shoshone National Forest in Wyoming to gather information on stand conditions that are related to presence of beetle infestations. This information will be used to develop a risk/hazard rating system that will be useful for estimating potential effects of Douglas-fir beetle infestations, prioritizing preventative treatments of Douglas-fir stands, and making decisions regarding suppression activities. Through FPM Technical Development Project funding, this project will be expanded to include other sampling areas in USFS regions 1, 2, and 4 during 1994. (Schaupp, RMS & Regions 1, 2, 4 cooperators)

RECENT RCSC PUBLICATIONS
(as of February 1994)

Holah, J.C. 1993. A new insect-fungal complex of jack pine at Bessey Ranger District, Nebraska National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. RCSC-93-01. 9 p. (In press)

Holah, J.C. 1993. Armillaria root disease and affected acreage of three ranger districts on the Black Hills National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region Tech. Rep. R2-55. 16 p. (In press)

Lundquist, J.E. 1993. Distribution and causes of canopy gaps in white spruce in the Black Hills. USDA For. Serv., Rocky Mountain Forest and Range Exp. Sta. Research Note RM-520. 3 p.

Lundquist, J.E. 1993. Large scale spatial patterns of conifer diseases in the Bighorn Mountains, Wyoming. USDA For. Serv., Rocky Mountain Forest and Range Exp. Sta. Research Note RM-523. 8 p.

Pasek, J.E. 1992. Incorporating pest information into forest planning: personal experience from the Black Hills, pp. 100-108. In: Proceedings of the fortieth annual Western International Forest Disease Work Conference, July 13-17, 1992, Durango, CO. 182 p.

Schaupp, W.C., Jr. 1993. Emergence and overwintering brood of Douglas-fir beetle four years after the Clover Mist Fire on the Clarks Fork Ranger District, Shoshone National Forest, Wyoming. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. RCSC-94-01. 18 p. (In press)

Schaupp, W.C., Jr. 1993. Emergence and overwintering brood of Douglas-fir beetle five years after the Clover Mist Fire on the Clarks Fork Ranger District, Shoshone National Forest, Wyoming. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. RCSC-94-02. 16 p. (In press)

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

REPORT TO THE GREAT PLAINS TREE PEST WORKSHOP
ALBUQUERQUE, NM
MARCH 9 & 11, 1994

Organization

Permanent Staff:	David W. Johnson, Center Leader and Supervisory Plant Pathologist E. Michael Sharon, Plant Pathologist Ken Lister, Entomologist
Geographic 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.

RECENT AND PLANNED ACTIVITIES

1. **Gypsy moth surveys**--Each year, detection traps are placed in campgrounds and other sites that have a high likelihood of being introduction sites for the gypsy moth. Several National Forest recreation sites were sampled for gypsy moth during the summer of 1993. Two traps were placed at each of 14 sites, for a total of 28 traps. All traps were retrieved. No gypsy moths were caught this summer, meaning no followup action will be required on the basis of this year's survey.

The sites were selected on the basis of elevation, presence of hardwood species, and potential for high numbers of out-of-state visitors. The gypsy moth survey is an attempt to discover gypsy moth "hitch-hikers" which escape from vehicles used by out-of-state visitors. We are going to re-examine the criteria and selection of sites in coordination with personnel responsible for gypsy moth detection in Colorado, Colorado State Forest Service, and USDA APHIS, in Colorado and PPQ Office, Wyoming; therefore, sites selected for 1994 may differ from 1993.

2. **Douglas-fir tussock moth**-- On August 24, 1993, an infestation of Douglas-fir tussock moth was discovered in West Creek by Entomologist Ken Lister. It is located at T10S., R70W., Sec.13 & 24, involving about 300 acres. Defoliation was heavy on Douglas-fir and Engelmann spruce. The population of feeding larvae was very high. The infestation was revisited on September 8. It was confirmed that defoliation was complete. Abundant numbers of pupae were found, some adults and egg deposition was observed.

The infestation and subsequent defoliation could be found only on National Forest lands at this time. Private land with homes (summer or/and permanent residences) are only a short distance to the south. The probability of the infestation spreading to include some of those properties next year is high.

Previous outbreaks of Douglas-fir tussock moth have occurred on the Pike National Forest and associated lands. The first report was an outbreak on Cheyenne Mountain near Colorado Springs in 1937, it was reported that all Douglas-fir and white fir were killed on 150-200 acres. The next reported outbreak was in 1947 at Evergreen, Colorado, the severity is unknown, but the area was treated experimentally with DDT. The most recent infestation was discovered in 1984 on ornamental spruce in Evergreen and Conifer, Colorado, in 1984. The next year, several scattered patches of severe defoliation on Douglas-fir were discovered in the Saloon Gulch east of Kelsey Campground. It collapsed without tree mortality.

3. **Survey of biological species of Armillaria and Heterobasidion (Fomes annosus) in Region 2**-- The objective of this project is to determine the biological species of Armillaria and Heterobasidion (Fomes annosus) root diseases in various hosts and ecosystems in the Rocky Mountain Region. This information will then be used to develop better root disease management strategies for our various customers. Starting in 1993, diseased wood samples containing Armillaria and Heterobasidion, collected from throughout Region 2, were sent to the diagnostic lab at the FHM Lakewood Service Center. The pathogens were isolated from the host material and current work involves identification to biological species by mating unknown isolates with known tester strains in culture. The fungal isolates will then be catalogued and kept in cold storage (along with the various tester strains) as part of the Region's new fungal reference collection.

3. **Mountain pine beetle suppression projects** --The mountain pine beetle (MPB) outbreak has ended on the Medicine Bow National Forest in the area of Laramie Peak, which involved associated state and private lands. A cooperative project of sanitation-salvage of green infested and dead trees was initiated in 1988. Approximately 6,000 acres were treated within the gross infestation area of approximately 80,000 acres. Some cutting will continue, but will be limited due to degrade and decay of the beetle trees.

4. **Other insect outbreaks of interest** --An outbreak of pine tussock moth, Dasychira grisefacta (Dyar), was discovered at Pine Ridge, about 30 miles north of Casper, Wyoming. Approximately 5,000 acres of ponderosa pine was moderately or completely defoliated when discovered by one of the ranch owners in July of 1993. Entomologists, Bill Schaupp and Ken Lister visited the site

in late July shortly after it was discovered and again in mid-September. During the September visit, egg deposition and hatch was occurring in the moderate and lightly defoliated areas, but not in the severely defoliated area. Apparently the population was so great, the larvae comsumed their food supply to the extent they starved, and were unable to pupate.
In 1994, the infestation is expected to be severe in the remainder of the pondersa pine type in Pine Ridge. Trees that had been severely defoliated were observed to have set new buds, although slightly smaller. Whether they can recover is unknown. Moderate and severely defoliated trees will be monitored and tree recovery and mortality will be estimated when the infestation collapses and subsides.

5. **Input into the revisions of Forest Plans** --Region 2 continues to promote prevention of unacceptable insect and disease problems. Forest plan revision is the focus of this effort. The cycle of revisions is in the early stage. The development of standards and guidelines has proven to be a real challenge to the RO and the Forests.

6. **Tree hazard training** -- Region 2 works closely with the National Arbor Day Foundation. Through urban and community forestry seminars, we provide expertise in hazard tree analysis and program development.

On federal lands, "custom" programs have been developed for the National Forests and Parks upon request.

The video, "Tree Health Management: evaluating trees for hazard", developed by Region 2, continues to be a best seller for the International Society of Arboriculture. It's in its 5th printing and is now in 8 countries.

A feature article by Michael Sharon was published in the November 1993 issue of Arbor Age; five limitations to hazard tree assessment are addressed.

RECENT PUBLICATIONS (as of February 1994)

Angwin, P.A. and E.M. Hansen. 1993. Pairing tests to determine mating compatability in Phellinus weirii. Mycol. Res. 97:1469-1475.

Hawksworth, F.G. and D.W. Johnson. 1993. You can save your trees from dwarf mistletoe. USDA For. Serv., Rocky Mountain Forest and Range Exp. Sta. GTR RM-225. 11 p.

Holah, J.C. 1993. A new insect-fungal complex of jack pine at Bessey Ranger District, Nebraska National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. RCSC-93-01. 9 p.

Holah, J.C. 1993. Armillaria root disease and affected acreage of three ranger districts on the Black Hills National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region Tech. Rep. R2-55. 16 p.

Lundquist, J.E. 1993. Distribution and causes of canopy gaps in white spruce in the Black Hills. USDA For. Serv., Rocky Mountain Forest and Range Exp. Sta. Research Note RM-520. 3 p.

Lundquist, J.E. 1993. Large scale spatial patterns of conifer diseases in the Bighorn Mountains, Wyoming. USDA For. Serv., Rocky Mountain Forest and Range Exp. Sta. Research Note RM-523. 8 p.

O'Neil, C.G. 1993. Forest Pest Conditions in the Rocky Mountain Region 1991. USDA For. Serv., Renewable Resources, Rocky Mountain Region, Forest Health Mgmt. 31 p.

Pasek, J.E. 1992. Incorporating pest information into forest planning: personal experience from the Black Hills, pp. 100-108. In: Proceedings of the fortieth annual Western International Forest Disease Work Conference, July 13-17, 1992, Durango, CO. 182 p.

Raimo, B.J. 1993. Western spruce budworm - Creede and Del Norte Districts, Rio Grande National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. R2-92-4. 32 p.

Schaupp, W.C., Jr. 1993. Emergence and overwintering brood of Douglas-fir beetle four years after the Clover Mist Fire on the Clarks Fork Ranger District, Shoshone National Forest, Wyoming. USDA For. Serv., Renewable Resources, Rocky Mountain Region Biol. Eval. RCSC-94-01. 18 p.

Schaupp, W.C., Jr., J.E. Pasek, J.M. Schmid, S.A. Mata, and C.K. Lister. 1993. Mountain pine beetle emergence from infested logs during hauling. USDA For. Serv., Rocky Mountain Forest and Range Exp. Sta. Research Note RM-522. 4 p.

Sharon, E.M. 1992. Tree failures:can we reduce the risk? Park and Ground Management 45:4-7.

Sharon, E.M. 1993. Limitations to hazard tree assessment. Arbor Age 13:10-12.

REPORT TO THE
GREAT PLAINS TREE PEST WORK CONFERENCE
Albuquerque, New Mexico
March 8-10, 1994

STATION: USDA, FOREST SERVICE
ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION
CENTER FOR SEMIARID AGROFORESTRY
EAST CAMPUS, UNIVERSITY OF NEBRASKA
LINCOLN, NEBRASKA 68583-0822

PROJECT: IMPROVEMENT OF STRESS- AND PEST-RESISTANCE OF GREAT PLAINS TREE SPECIES

MISSION: TO SELECT ADAPTED TREE SPECIES; TO IMPROVE TREE RESISTANCE TO ABIOTIC AND BIOTIC STRESSES; AND TO DEVELOP IMPROVED INTEGRATED PEST MANAGEMENT STRATEGIES FOR TREES IN THE STRESSFUL ENVIRONMENTS OF THE GREAT PLAINS.

PERSONNEL: MICHELE SCHOENEBERGER, SUPERVISORY SOIL SCIENTIST;
MARY ELLEN DIX, RESEARCH ENTOMOLOGIST;
NED B. KLOPFENSTEIN, RESEARCH PLANT PATHOLOGIST;
BERT M. CREGG, RESEARCH PLANT PHYSIOLOGIST;
CAROL M. SCHUMANN, RESEARCH PLANT GENETICIST;
JENNIFER IRWIN, BIOLOGICAL TECHNICIAN;
MICHAEL KUHL, BIOLOGICAL TECHNICIAN;
TED HOVLAND, FORESTRY TECHNICIAN.

GENERAL INFORMATION:

Agroforestry Team

An interdisciplinary and interagency agroforestry research team (9 scientists from 5 University of Nebraska Departments and the USDA Forest Service) was established to evaluate the role of trees in semiarid agroforestry systems. The team was awarded a two-year North Central Regional ACE research grant to determine the impact of tree windbreaks on the distribution of insect pests and their natural enemies in sustainable agricultural systems began in the Spring 1993.

PROGRESS ON INSECT STUDIES:

Distribution of pests and their natural enemies

Present information on natural control is limited to identification of parasites and/or predators of common insect pests. Very little is known about their biologies or interactions within the ecosystem. Research is currently attempting to identify key potential natural enemies of tree pests common to tree/crop ecosystem and tree/turf ecosystems. Sampling techniques for ground and foliage dwelling arthropods were evaluated in 1990 and 1991 and were used to evaluate the ecosystems in 1992. Impacts of ground cover and pesticides on arthropod populations were evaluated in 1993. Samples for the tree/crop and tree/turf ecosystems are currently being evaluated. (Cooperators: tree/crop - UNL Agroforestry Team, tree/turf - Fred Baxendale UNL Entomology Department).

Stress/Pest/Host Interactions

Ponderosa pine is widely used in windbreaks in the northern and central Great Plains. Pest populations on ponderosa pine are dynamic and constantly adapting to their hosts physiology, climatic conditions, and other changes in the ecosystem. Interactions of these pests with their hosts and drought stress are poorly understood and can influence the success of technologies developed for pest management with ponderosa pine in semi-arid ecosystems.

Field trials on stressed and unstressed pines were initiated in 1991 and continued in 1992. This data is currently being analyzed. We were unable to repeat the tests in 1993 because of adverse weather conditions. Preliminary trials on stressed and unstressed half-sib seedlings in the lath house were conducted during 1992. In 1994, older seedlings will be used and the treatments will be replicated extensively. (Cooperator: Bert Cregg - USDA Forest Service)

History of Biological Control in the Forest Service

A history of the first 100 years of biological control in the USDA is being compiled by USDA agencies. Scientists in the Forest Service have studied aspects of the biological control of many tree pests. Established biological control research studies are at risk because they are widely dispersed and many of the researchers have retired. Scientists who conducted the research or subsequently were involved in related research were asked to write a brief summary of the research or control project and its outcome. Contributions by the individual scientists have been compiled by subject area, location, and year. A draft of this manuscript was completed this fall and the manuscript is currently being reviewed by Forest Service and USDA editors. (Cooperators: USDA Forest Service scientists)

SUMMARY OF FOREST PATHOLOGY RESEARCH:

The forest pathology research is currently combining classical and molecular biological techniques to identify and characterize mechanisms of disease (and insect) resistance and the interacting role of stress. Initial work is focused on Populus spp. to further develop a model system to study disease, insect, and stress resistance in deciduous trees. Transgenic Populus spp. containing various potato proteinase inhibitor II (pin2) gene constructs are being used to study regulation and expression of introduced plant defense genes. The role of proteinase inhibitors in insect and disease resistance is also under investigation in collaboration with Iowa State University (R. B. Hall, E. R. Hart, and H. S. McNabb, Jr.). These studies form a basis for identification, characterization, and functional studies of native defense genes in Populus spp. and (or) other woody species. Information from the Populus model system subsequently will be applied toward understanding plant defense gene function in other deciduous tree. Currently, green ash (Fraxinus pennsylvanica) tissue culture systems are being developed to facilitate future studies of pest and stress resistance (graduate research by Mee-Sook Kim). Long-range goals are to speed up the selection and (or) production of disease-, insect-, and stress- resistant deciduous trees for the Great Plains region (N. B. Klopfenstein).

The genetic basis of western gall rust (WGR) resistance in pondersosa pine (Pinus ponderosa) is being studied in collaboration with North Dakota State University (J. Walla and Z.-M. Cheng). Classical breeding has produced progeny sets to monitor progression of susceptible/resistant host responses and evaluate heritability of WGR resistance. Molecular genetic studies are underway to identify defense genes involved in resistance responses. Information from these genetic studies will advance our understanding of defense responses in conifers and can be used in early selection programs for disease-resistant ponderosa pine (C. M. Schumann).

Recent Publications:

Dix, M. E., J. Walla, J. MacFall, M. Harrell, and N. Klopfenstein. 1993. Biological control of forest pests in the Great Plains: status, needs and issues. pp. 44-52 in Proceedings of the Biological Control of Forest Pests in the Great Plains: Status and needs - a symposium. Great Plains Agricultural Council, Forestry Committee's Forest Biological Control Task Force. Bismarck, ND, June 13-16, 1992. Great Plains Agricultural Council Publication No. 145.

Avila, F. J., J. Martinez, M. Kuhl, and N. B. Klopfenstein. 1992. Transgenic poplar expresses a potato proteinase inhibitor II gene. Abstract proceedings, Biotechnology for crop improvement in Latin America. Caracas, Venezuela. Nov. 1992.

Cregg, B.M. and M.E. Dix. 1992. Influence of moisture stress on ponderosa pine health and shoot borer (Rhyacionia spp.) success. In: Nebraska Academy of Science; 1992 April 10-11; Lincoln, NE [Lincoln, NE] Nebraska Wesleyan University: 8. Abstract.

Dix, M.E. 1992. Status of agroforestry in North America. Proceedings North American Forest Insect Work Conference. [Denver, CO, March 25-28, 1991].

Dix, M.E. and M. Harrell. 1992. Influence of windbreaks on spider abundance in tree/crop ecosystems. In: The Nebraska Academy of Sciences; 1992 April 10-11; Lincoln, NE [Lincoln, NE]: Nebraska Wesleyan University:8-9. Abstract.

Harrell, M.O., M.E. Dix, and W.R. Lovett. 1992. Variation in the susceptibility of ponderosa pines to pine tip moth. In: The Nebraska Academy of Sciences; 1992 April 10-11; Lincoln, NE. [Lincoln, NE]: Nebraska Wesleyan University: 9. Abstract.

Kerl. J. G., R. C. Carman, J. Martinez, and N. B. Klopfenstein. 1992. Expression of foreign genes in a transgenic Populus hybrid. Abstract. pp. 82-83, In: Proceedings - the Nebraska Academy of Sciences. April 10-11, 1992. Nebraska Wesleyan University, Lincoln, NE.

Schumann, C. M. and N. B. Klopfenstein. 1992. Contributions of molecular biology to improvement of disease resistance in Great Plains tree species. Proceedings of the "Forest Biological Control Activities in the Great Plains: Status, Needs" symposium. Great Plains Agricultural Council Forestry Committee. July 13-17, 1992. Bismarck, ND. Great Plains Agricultural Publication No. 145.

McNabb, H. S., Jr., E. R. Hart, R. B. Hall, N. B. Klopfenstein, S. A. Heuchelin, K. K. Allen, and R. W. Thornburg. 1992. Use of proteinase Inhibitor II gene for increased pest resistance in poplars. Abstract. p.89 In: Proceedings of the North American Forest Insect Work Conference. March 25-28, 1991. Denver, CO.

Peterson, G. W. and D. F. VanHaverbeke. 1992. Resistance to Dothistroma pini in half-sib families from resistant and susceptible Austrian pines. Abstract #A528. 1992 APS/MSA Joint Meeting August 8 - 12, 1992. Phytopathology Vol. 82, No. 10, 1992.

Cregg, B.M., M.E. Dix, N.B. Klopfenstein, and C.M. Schumann. 1993. Improving stress and pest resistance of trees for agroforestry systems: Challenges and opportunities. pp. 291-297. In: Proceedings of the Society of American Foresters Convention [Richmond, Virginia, October 25-28, 1992].

Dix, M.E.; et al. 1993. Influences of trees on abundance of natural enemies. 1993. In: Opportunities for agroforestry in the temperate zone worldwide. The third North American Agroforestry Conference. 1993 August 15-18. Iowa State University, Ames, IA. 9-10. Abstract.

Dix, Mary Ellen; Irwin, J. 1993. Evaluation of genetic variation and acorn weevil incidence in Bur oak from the Great Plains. In: Nebraska Academy of Science; 1993 April 16-17; Lincoln, NE: Nebraska Wesleyan University: 6-7. Abstract.

Dix, Mary Ellen. 1993. Conservation and enhancement of arthropod natural enemies of insect pests. In: Proceedings of the 44th annual meeting, Great Plains Agricultural Council, Forestry Committee. Biological control of forest pests in the Great Plains: Status and needs -- a symposium; 1992 July 13-16; Bismarck, ND. Fort Collins, CO: Great Plains Agricultural Council; 145:72-76.

Dix, Mary Ellen. 1993. Introduction. In: Proceedings of 44th annual meeting: Great Plains Agricultural Council, Forestry Committee. Biological control of forest pests in the Great Plains: Status and needs -- a symposium; 1992 July 13-16; Bismarck, ND. Fort Collins, CO: Great Plains Agricultural Council; 145: 53-55.

Dix, Mary Ellen; Donthiri, Subhashini. 1993. Opportunities for biological control insect pests in agroforestry systems. In: Society of American Foresters National Convention. American forestry - an evolving tradition; 1992 October 25-28; Richmond, VA. Washington, DC: Society of American Foresters: 278-284.

Irwin, J.P.; Dix, M.E. 1992. Lilac borers and banded ash clearwing borers: identification, life cycle, damage, and control. In: Proceedings of North Central Regional Committee on Insects of Landscape Trees and Shrubs; NCR-98. 1992 October 21-22; Omaha, NE. pp. 1-5

Dix, M.E.; J. Walla; M. Harrell; N. Klopfenstein; and J. MacFall. 1993. Biological control of forest pests in the Great Plains: Status, needs, and issues. In: Proceedings of 44th annual meeting: Great Plains Agricultural Council, Forestry Committee. Biological Control of forest pests in the Great Plains: Status and needs -- a symposium; 1992, July 13-16; Bismarck, ND. Fort Collins, CO: Great Plains Agricultural Council; 145:44-52.

Kerl, J. G., S. Donthiri, M. E. Dix, C. M. Schumann, and N. B. Klopfenstein. 1993. Alternative pest management strategies for Great Plains tree species. Abstract. p. 79, In: Proceedings - The Nebraska Academy of Sciences. April 16-17, 1993. Nebraska Wesleyan University, Lincoln, NE.

Klopfenstein, N. B., H. S. McNabb, Jr., E. R. Hart, R. B. Hall, R. D. Hanna, S. A. Heuchelin, K. K. Allen, N. Q. Shi, and R. W. Thornburg. 1993. Molecular approaches toward understanding and improving defense systems of Populus. pp. 79-91 In: Hall, R. B., R.D. Hanna, and R. N. Nyong'o, eds. Joint Proceedings of the International Energy Agency Joint Meeting of the Task V Activity Groups on Exchange of Genetic Material, Pest/Disease Management, and Joint Trials. Aug. 22-27, 1991. Iowa State University, Ames, Iowa.

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Martinez, J., J. G. Kerl, F. J. Avila, R. C. Carman, M. Kuhl, and N. B. Klopfenstein. 1993. Analysis of genetically engineered poplar to study and improve pest resistance. Abstract. p. 81, In: Proceedings - The Nebraska Academy of Sciences. April 16-17, 1993. Nebraska Wesleyan University, Lincoln, NE.

Dix, M.E., L. Hodges, M.O. Harrell, R.J. Johnson, J.R. Brandle, M.M. Schoeneberger, R.M. Case, R.J. Wright, K.G. Hubbard, and L.J. Young, 1993. Research of the Nebraska Agroforestry Team. In: Proceedings 1993 SAF National Convention. [Indianapolis, Indiana, Nov. 7-11, 1993]. (In Press).

Sunderman, N.J., R.J. Johnson, J.R. Brandle, R.M. Case, M.O. Harrell, L.J. Young, M.E. Dix, L. Hodges, and R.J. Wright, 1994. Role of birds in sustainable agriculture. pp. 13-15. In: Proceedings Nebraska Fruit and Vegetable Growers Conference. [Columbus, Nebraska, Feb 16-17, 1994]. (Abstract).

Dix, M.E., R. Johnson, M. Harrell, R. Case, L. Hodges, R. Wright, J. Irwin, M. Schoeneberger, J. Brandle, R. Fitzmaurice, N. Sunderman, L. Young, and K. Hubbard, 1994. Shelterbelts as insect habitat. p. 17. In: Proceedings Nebraska Fruit and Vegetable Growers Conference. [Columbus, Nebraska, Feb 16-17, 1994]. (Abstract).

Hodges, L., M.E. Dix, J. Brandle, R. Wright, and M. Harrell, 1994. Effects of shelterbelts in insect pests in muskmelon. pp. 19-28. In: Proceedings Nebraska Fruit and Vegetable Growers Conference. [Columbus, Nebraska, Feb 16-17, 1994]. (Abstract).

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Avila, F., J. Martinez, M. Kuhl, R. Carman, and N. B. Klopfenstein. 1993. Potato proteinase inhibitor II gene is expressed by transgenic poplar trees. Abstract. Proceedings of the American Phytopathological Society. 7 - 12 November 1993. Nashville, TN. Phytopathology 83:1412.

Kim, M.-S., J. G. Kerl, C. M. Schumann, B. M. Cregg, and N. B. Klopfenstein. 1994. Micropropagation and regeneration systems for green ash (Fraxinus pennsylvanica Marsh.). Abstract. Proceedings of the 104th annual meeting of the Nebraska Academy of Sciences, Inc. Nebraska Wesleyan University, Lincoln, NE. 22-23 April 1994.

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Center for Semiarid Agroforestry
USDA Forest Service, Rocky Mountain Research Station
Lincoln, Nebraska

Overview of the Center

The Center for Semiarid Agroforestry (CSA) was authorized in the 1990 Farm Bill to be a partnership of the Research, State and Private Forestry, and International Forestry branches of the USDA Forest Service to provide integrated research, applications, technology transfer, and international exchange for agroforestry.

CSA's mission is to advance the understanding, acceptance, and use of agroforestry in agricultural ecosystems to provide tree products and to protect, conserve, diversify, and sustain vital economic, environmental, human, and natural resources.

The Center conducts and fosters research to develop improved multipurpose trees, improved agroforestry practices, and integrated production/conservation systems. An extensive technology transfer and applications program provides new and improved technologies and information to natural resource professionals. International technology exchange provides strategic research support for global agroforestry partners and issues, for mutual benefit.

Agroforestry includes both *production agroforestry* (growing a tree crop in combination with an agricultural crop to increase the overall productive capacity of the land), and *conservation agroforestry* (working trees in agroecosystems primarily to provide environmental services and multiple resource benefits; tree products are secondary).

In agroforestry, trees and shrubs are added to environments that are deficient in woody plants, and benefits are created or enhanced through their introduction. In agroecosystems, these "working trees" must be the right tree, planted in the right place, in the correct design, for a specific purpose.

Examples of agroforestry practices include: alley cropping; trees in pastures; fine hardwood plantations; fuelwood plantations; windbreaks to protect crops, farmsteads, and livestock; living snowfences to control snow drifting onto roads; livestock havens to shelter livestock in pastures; riparian buffer strips to filter contaminated runoff water; and wildlife habitat plantings. Examples of community conservation forestry applications include buffer systems, wildlife habitat, living snowfences, treebreaks, and waste disposal systems.

Agroforestry practices provide multiple resource benefits because they conserve soil and water, protect water quality, enhance wildlife and fisheries, diversify the landscape, enhance aesthetic values, and maintain the environmental quality of agroecosystems. For example, riparian buffer systems maintain water quality, provide tree products, and provide critical habitat and corridors for migratory and local wildlife. Such systems may occupy only five percent of the land area of agroecosystems, yet account for over 50 percent of the biodiversity.

The Agroforestry Center works through multidisciplinary and multiagency partnerships with federal and state agencies, universities, and conservation organizations. Partnerships provide an avenue for cooperative ventures between agencies and organizations to share resources and expertise to attain common goals.

Center for Semiarid Agroforestry
USDA Forest Service, Rocky Mountain Research Station
Lincoln, Nebraska

Overview of the Center's Technology Transfer Activities

The Center's technology transfer programs are targeted to natural resource professionals, and build a bridge between research and applications. Projects and materials are designed to meet practitioners' needs and are delivered through a network of partners and cooperators. Activities include:

Conferences and Workshops - the Center provides leadership for conservation forestry by sponsoring conferences and symposia to assemble knowledge, catalyze new thinking and ideas, identify obstacles, and promote cooperation. Training workshops for practitioners provide new and improved technologies and information in a usable form to assist them in addressing current issues and needs.

Technical Information - Through various media, the Center provides practitioners with the latest technologies and information on agroforestry science and practice. This includes published papers, leaflets, videos, technical guides, providing literature, and publishing "Agroforestry Notes", a numbered series of application notes.

Demonstrations - The Center cost-shares needed demonstrations of proven conservation forestry practices in both rural and community environments, to encourage adoption of new, untried, and innovative technologies.

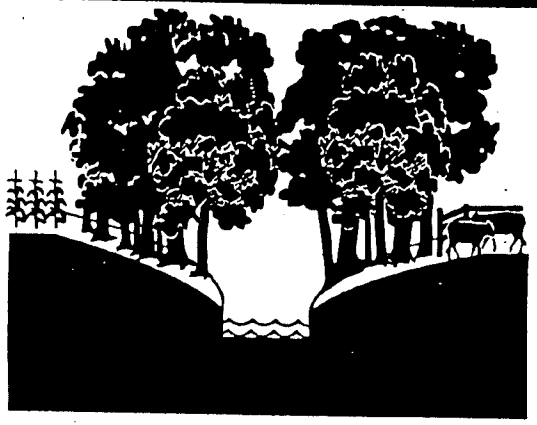
Applications Projects - The Center cost-shares applications projects with cooperators to evaluate and adapt technologies under local conditions, to pave the way for general adoption.

Assessments - The Center cost-shares assessment projects with cooperators to obtain information needed to advance agroforestry. For example, diagnosing the need and potential for agroforestry in different ecoregions, determining the potential for agroforestry to diversify rural economies, and determining motivational factors to get landowners to plant trees.

Technical Support - The Center provides technical support to natural resource professionals through consultations and participation in roundtable discussions and workshops.

Current Information - The Center publishes "Inside Agroforestry," a quarterly newsletter to keep natural resource professionals informed of current information and events.

Public Information and Education - The Center cooperates with other agencies and organizations in sponsoring a National Arbor Day Foundation program entitled— "Conservation Trees for your Farm, Family, and Future" to inform landowners of the benefits of conservation forestry.



The Forest Service Center for Semiarid Agroforestry approaches research needs through a combination of in-house research and multidisciplinary research teams.

In-house research (RWU-RM-4551) develops genetically improved multipurpose trees that are better able to withstand the insects, diseases, and environmental stresses of the semiarid Great Plains. Utilization of genetically stress- and pest-resistant trees, in combination with natural pest controls and pest management strategies, will result in easier establishment, better suitability to purpose and effectiveness, and a longer working lifespan.

Multidisciplianary research teams consist of CSA, university, and other agency scientists who conduct agroforestry research in subject areas of mutual interest. This research, supported by outside funding, develops improved agroforestry practices, evaluates their ecological interactions and benefits, develops integrated production/conservation systems, and evaluates the environmental, economic, and social impacts of mixed agricultural/agroforest systems at different scales and climate scenarios. Overall, agroforestry research provides information at the organism, farm, watershed, and landscape levels that is needed to develop an ecosystem-based approach to sustainable agricultural land use.

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In-House Research

Multipurpose Tree Improvement

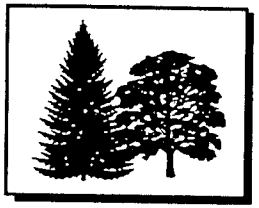
Genetic improvement of multipurpose trees is accelerated through a combination of long-term field trials, breeding, and utilization of biotechnologies and micropropagation. The tree improvement program incorporates research results on tree adaptations and tree defense systems.

Tree Adaptations to Stress

Ecophysiological techniques are utilized to screen and select better adapted trees to withstand environmental stresses, and characterize the key factors (traits) that contribute to stress tolerance.

Tree Defense Systems

Molecular genetics research seeks to identify genes responsible for pest resistance and understand their function. This knowledge enables the development of techniques to accelerate screening and selection of pest resistant trees.



Tree Health Management

Research develops economically-sound and environmentally-stable integrated pest management strategies through identification and characterization of natural enemies of tree pests, and understanding stress and pest interactions.

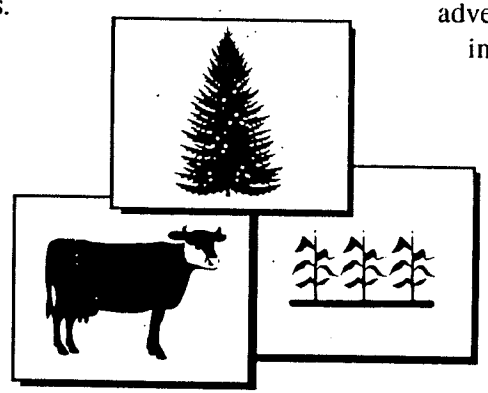
Multidisciplinary Team Research

Ecological Interactions

Research seeks to quantify and understand the microclimatic and insect/bird/mammal interactions between agroforestry practices and agricultural crops. This knowledge will facilitate management to enhance positive interactions and assess how biodiversity contributes to sustainability.

Riparian Buffer Systems

Guidelines are developed for the restoration and management of forested riparian systems to optimize their capacity to mitigate nonpoint source water pollution and provide other multi-resource benefits.



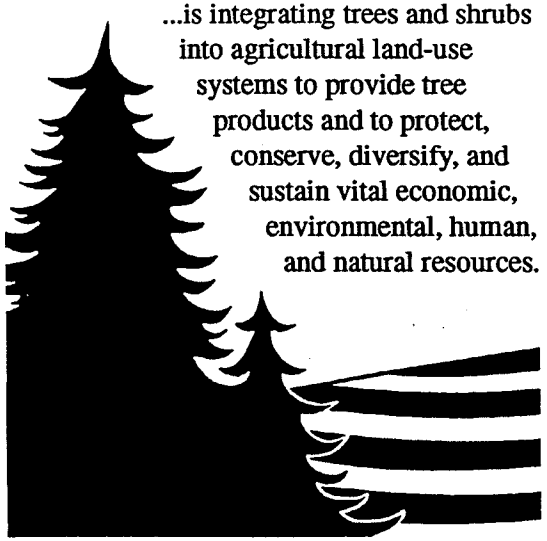
Climate Change Impacts

Process models are developed to predict the impacts of climate changes in Great Plains agroecosystems, and determine how adverse impacts can be mitigated by integration of agroforestry practices.

Integrated Production/ Conservation Systems

Research designs and evaluates integrated systems that blend and balance agroforestry practices with improved agricultural practices, to develop diversified production systems that contribute to environmental, economic, and social stability.

Agroforestry...



...is integrating trees and shrubs into agricultural land-use systems to provide tree products and to protect, conserve, diversify, and sustain vital economic, environmental, human, and natural resources.

CSA's Mission

The Agroforestry Center is a partnership of the Research, State and Private Forestry, and International Forestry branches of the USDA Forest Service. Integrated programs focus on the needs and opportunities for conservation forestry in agroecosystems.

Our purpose is to conduct research, develop technologies, establish demonstrations, and transfer technologies and information for natural resource professionals to use to improve agricultural productivity and sustainability, mitigate the environmental impacts of agriculture, and enhance environments for people and wildlife.

The Center works through cooperation and partnerships with federal and state agencies, universities, and conservation organizations. Partnerships provide an avenue for cooperative ventures between agencies and organizations to share resources and expertise to attain common goals.

Research Staff

Dr. Bill Rietveld
CSA Program Manager

Dr. Michele Schoeneberger
Research Program Leader & Soil Scientist

Dr. Bert Cregg
Research Plant Physiologist

Dr. Mary Ellen Dix
Research Entomologist

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Research Ecologist

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Research Plant Pathologist

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Agroforestry Research

Center for Semiarid Agroforestry

RM-4551: Improving Stress and Pest Resistance of Trees for the Great Plains

USDA-Forest Service
Rocky Mountain Research Station
Center for Semiarid Agroforestry
Lincoln, Nebraska

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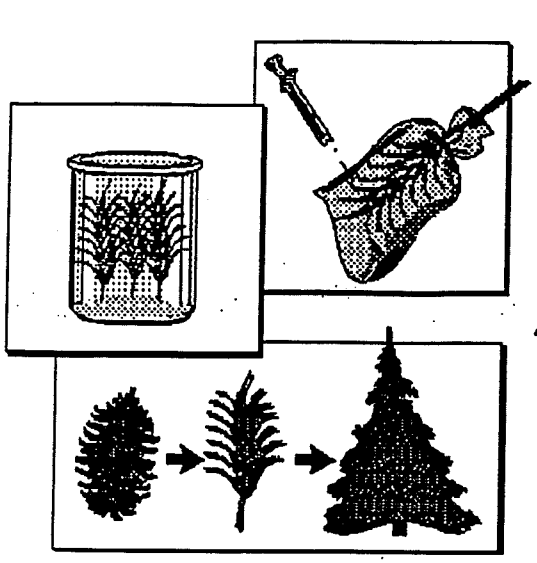
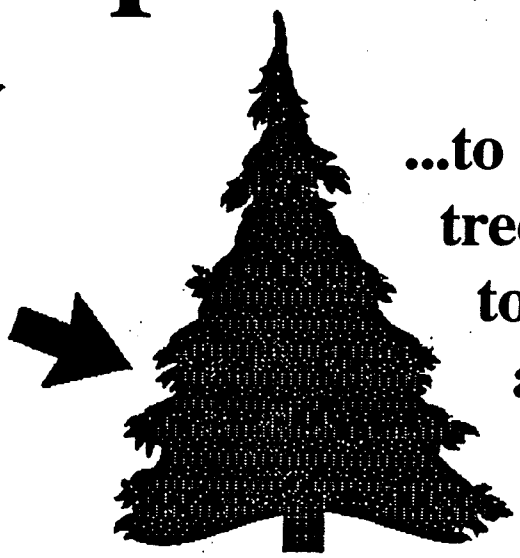
Tree Improvement





...to improve tree resistance to insects and disease

The Problem

Presently used tree species and ecotypes are not adequately adapted to withstand the environmental extremes and pests of the semiarid Great Plains.

Solutions

Continue long-term provenance testing, evaluate new species, develop breeding populations, and refine methods to vegetatively propagate desired germplasm.

Provenance Testing

Long-term tree improvement research over the past 40 years has provided recommendations on the best species and ecotypes to plant in the Great Plains. Many provenance trials are now mature and continue to yield valuable long-term data and plant materials with confirmed resistance or susceptibility to specific pests for both tree planting programs and new research avenues (i.e. juvenile/mature correlations).

Propagation Research

Researchers are developing micropropagation techniques for ponderosa pine, interior Douglas-fir, and green ash to capture germplasm with desired tracts. The resulting plant materials and propagation systems will be used to investigate mechanisms of pest and stress resistance.

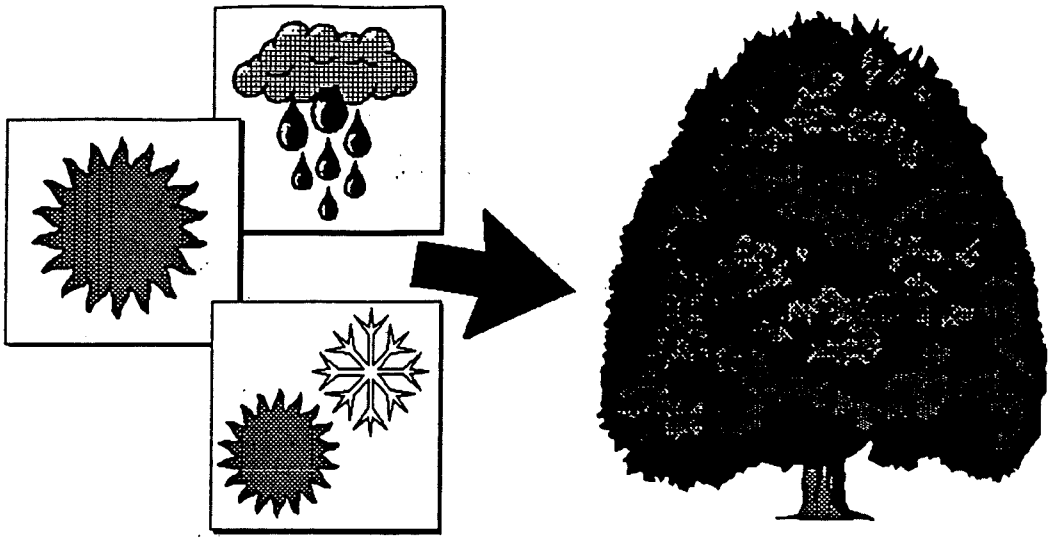
Tree Breeding

Although a large amount of genetic diversity is desirable in trees that will be planted in many different areas, specific research studies often require trees of defined genetic background. Making controlled crosses between trees with known traits of interest is one way to produce plant materials of defined genetic background. This approach is currently underway to investigate disease resistance in ponderosa pine.

For more information contact:

- Dr. Carol Schumann, Research Geneticist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 401-437-5178.

Tree Adaptations to Stress



...to improve stress tolerance of trees for agroforestry systems

The Problem

Environmental Stresses:

- reduce survival of planted seedlings
- shorten tree longevity
- predispose trees to insects and disease
- reduce tree effectiveness

A Solution

Stress Physiology Research:

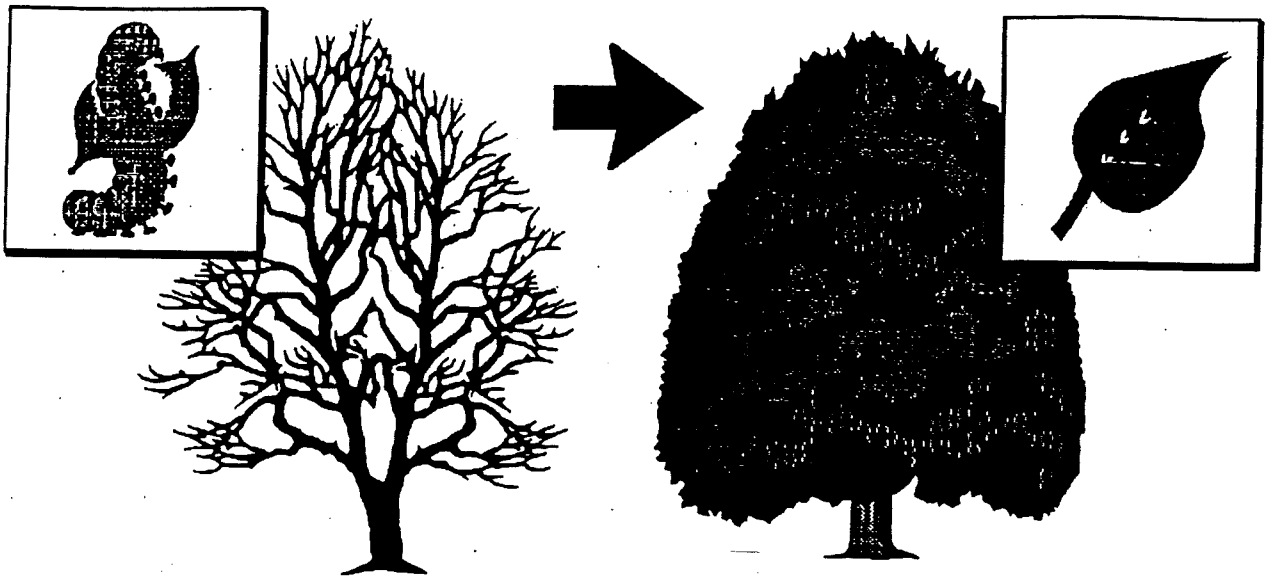
- identifies and characterizes important stress resistance traits and screens ecotypes to identify trees adapted to environmental extremes

Research on tree adaptations to stress at the Center for Semiarid Agroforestry is directed at identifying genetic variation in stress tolerance of important tree species used in agroforestry systems such as ponderosa pine, Scots pine, green ash, and eastern redcedar. By studying trees that are tolerant of environmental stresses, as well as those that are not, mechanisms which are most important to ensuring tree survival and growth under stress can be identified. Current research is focused on identifying genetic variation in drought tolerance of ponderosa pine and green ash and understanding the mechanisms responsible. The traits being examined include plant water relations, gas exchange, biomass allocation patterns, and leaf morphology. This research will result in criteria to improve and accelerate future tree selections.

For more information contact:

- Dr. Bert Cregg, Research Plant Physiologist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.

Tree Defense Systems



...to improve tree resistance to insects and disease

The Problem

Insect and disease pests shorten the lifespan of trees used in agroforestry systems.

A Solution

Tree Defense Systems Research:

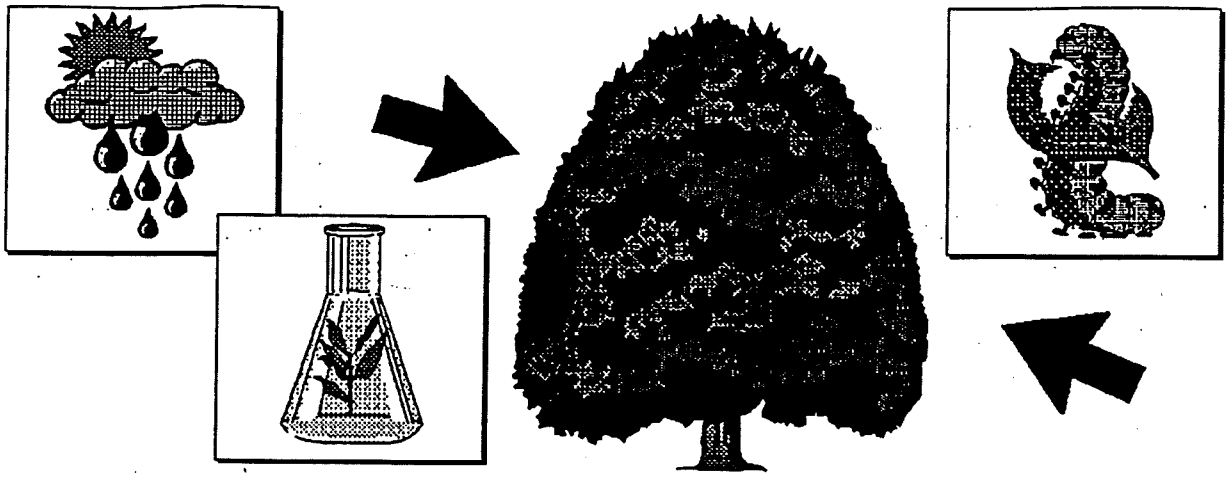
- will increase resistance by understanding how resistant trees defend themselves against diseases and insects.

Developments in biotechnology provide opportunities to study disease and insect resistance in trees at the molecular level. Two approaches are being used at the Center for Semiarid Agroforestry. One approach uses the process of genetic engineering to transfer plant defense genes into selected tree species in order to study and understand mechanisms of resistance. This project involves inhibitor genes that have been transferred to poplar trees which delay pest development. The second approach involves identifying plant defense genes of ponderosa pine that respond to individual strains of a pathogen that causes western gall rust. These studies will accelerate the production and selection of pest resistant trees for planting and breeding programs.

For more information contact:

- Dr. Ned Klopfenstein, Research Plant Pathologist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Carol Schumann, Research Geneticist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.

Tree Health Management



...to develop effective integrated pest management systems for agroforestry ecosystems

The Problem

We lack knowledge of pest biology and have a poor understanding of the interrelationships among environmental factors, tree pests, and natural controls.

A Solution

Develop strategies for integrated pest management through understanding of:

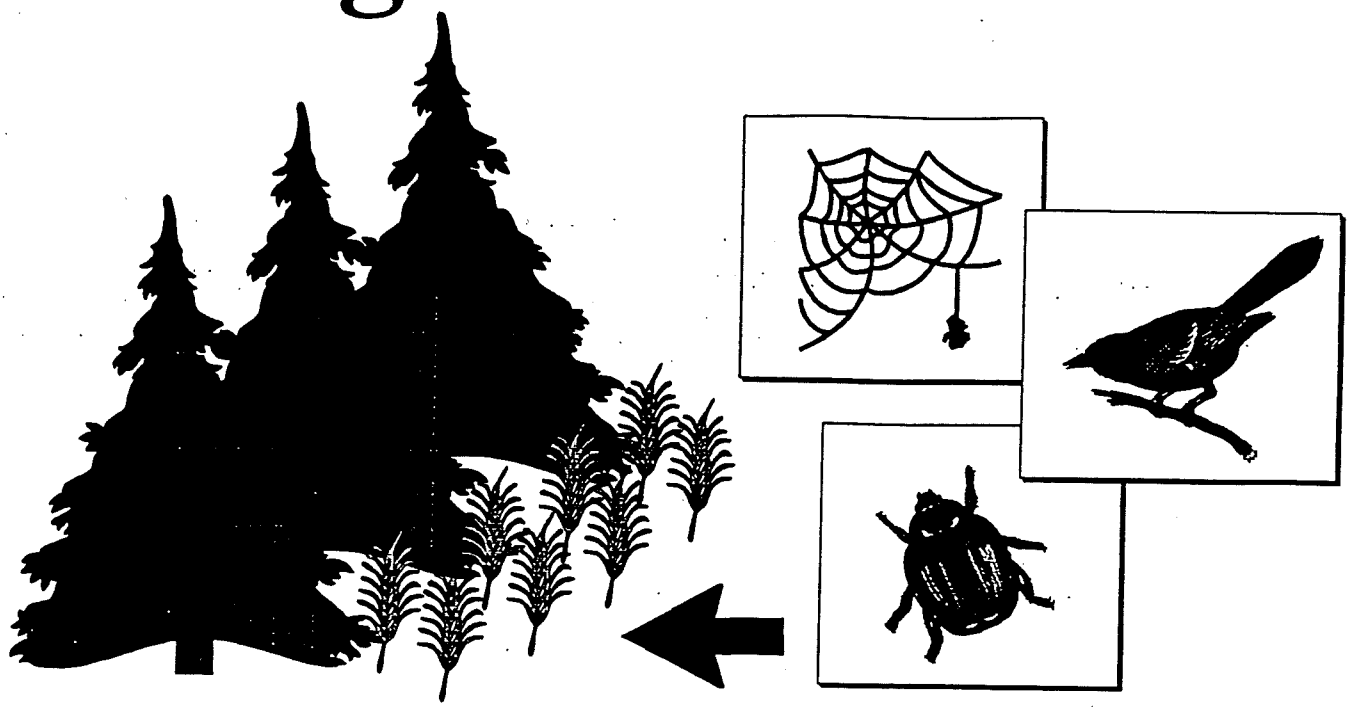
- pest biology and epidemiology woody plant mechanisms
- relationships between host tree stress and susceptibility to pests
- natural enemy population dynamics

Conservation trees provide protection for birds and predatory arthropods that consume pest insects, thus reducing the need for pesticides. Because of inadequate genetic screening and selection, planted trees frequently lack the adaptive capacity to resist or tolerate a wide variety of stress/pest complexes that limit early survival and cause premature mortality. Many tree plantings also have limited biodiversity. Because of decreased vigor and early mortality of planted trees, the resources expended to establish these plantings are wasted, and environmental benefits are lost. Tree health research will provide management strategies to: 1) ameliorate the tree health and shortened longevity problems of existing planted trees; 2) select trees that are better adapted to resist or tolerate present and anticipated pests and environmental stresses; and 3) ensure that future plantings enhance the biodiversity of the ecosystem.

For more information contact:

- Dr. Mary Ellen Dix, Research Entomologist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Ned Klopfenstein, Research Plant Pathologist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Michele Schoeneberger, Research Project Leader and Soil Scientist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.

Ecological Interactions



...to understand and optimize the ecological benefits of agroforestry practices in agroecosystems

The Problem

In order to develop guidelines for integrating agroforestry practices into sustainable agricultural land-use systems, we need to understand roles of each component and how the components interact within the system.

A Solution

Ecological Interactions Research:

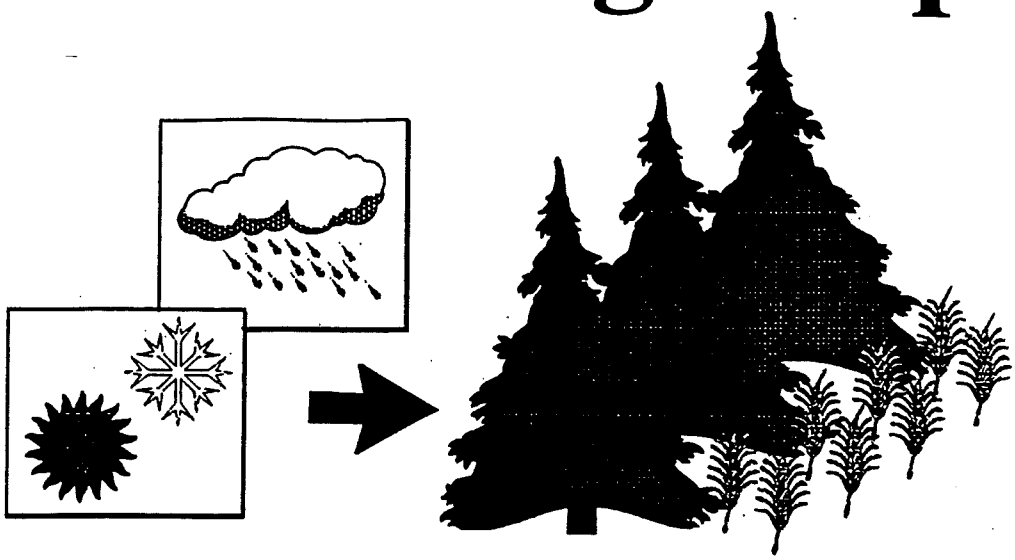
- identifies important ecological interactions created by agroforestry plantings within the agroecosystem.
- provides an understanding of specific interactions so that agroforestry plantings can be designed to optimize beneficial interactions (i.e. biological pest controls).

The Center for Semiarid Agroforestry, and partners in five Departments at the University of Nebraska, are conducting research to understand microclimatic and insect/spider/bird/mammal interactions with adjacent cropping systems. Data will be used to develop models and guidelines for utilizing agroforestry practices to enhance the sustainability of agricultural land-use systems.

For more information contact:

- Dr. Mary Ellen Dix, Research Entomologist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Robert Wright, Department of Entomology, South Central Research and Extension Center, University of Nebraska, Clay Center, NE 68933-0816, 402-762-4439.
- Dr. Mark Harrell and Dr. Ronald Johnson, Department of Forestry, Fisheries & Wildlife, University of Nebraska-Lincoln, Lincoln, NE, 68583-0814, 402-472-2944.

Climate Change Impacts



...to determine how agroforestry practices mitigate the adverse impacts of climate change on agroecosystems

The Problem

Global increases in greenhouse gases are predicted to adversely alter the climate within the agriculturally-important Great Plains with potentially severe impacts on agricultural and agroforest systems.

A Solution

Global Change Research:

- helps predict the ecological amplitude of conservation trees needed to be resilient to predicted climate changes.
- develops process models of mixed forested and agricultural landscapes to identify and predict the potential effects of changing climate on sustainability of agroecosystems in the Great Plains, as well as the potential of agroforestry to mitigate some of these impacts.

Global Change Research at the Center for Semiarid Agroforestry is directed at providing agroforestry-based strategies to mitigate the adverse impacts of hypothesized global climate change on Great Plains agroecosystems. This multidisciplinary, multiagency team effort is comprised of researchers from two research units (RWU-RM-4551 and RWU-RM-4301) in the USDA-Forest Service, Rocky Mountain Station, and several Departments from the University of Nebraska-Lincoln and Iowa State University, as well as coordinating with other researchers at NCAR (Boulder, Colorado) and the Agrophysical Research Institute in Russia. Current work is focused on examining the effects of windbreaks on crop productivity under climate change in order to assess their potential to mitigate adverse climate change impacts on crop production. Research is also examining the consequences of climate change on biodiversity in forested riparian systems in the Great Plains.

For more information contact:

- Dr. Michele Schoeneberger, Research Project Leader & Soil Scientist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Bill Easterling, Director of the Great Plains Regional Center for Global Environmental Change & Associate Professor, Department of Agricultural Meterology, University of Nebraska, East Campus-UNL, Lincoln, NE 68583-0728, 402-472-6283.
- Dr. James Brandle, Associate Professor, Department of Forestry, Fisheries, and Wildlife, University of Nebraska, East Campus-UNL, Lincoln, NE 68583-0814, 402-472-6626.

Riparian Buffer Systems

...to protect and enhance water quality

The Problem

Agricultural lands are the largest single source of nonpoint source water pollution in the Great Plains and the Nation.

A Solution

Forested Riparian Buffer Systems:

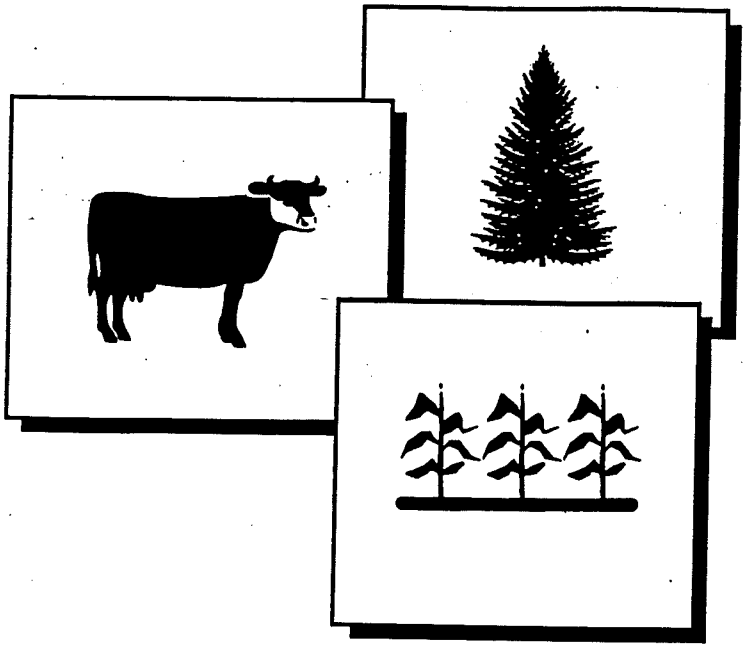
- act as a buffer between the terrestrial and aquatic ecosystems by filtering, trapping, and degrading nonpoint source pollutants before they enter the waterway.
- provide many additional benefits such as enhanced wildlife and fish habitat, aesthetics, recreational opportunities, fuelwood, and other specialty wood products.

The Center for Semiarid Agroforestry, in cooperation with many partners, is researching and providing information on the mechanisms by which trees and their associated organisms in riparian buffer systems mitigate nonpoint source pollution (i.e. sediments, nutrients, pesticides, and animal wastes from adjacent lands). CSA is also examining how trees enhance terrestrial and aquatic ecosystems and contribute to economic (traditional and specialty wood products) and ecological diversification in agricultural landscapes. Results of this research will provide guidelines for the design, composition, placement, and management of native and man-made forested riparian buffer systems in semiarid agroecosystems. These guidelines, in turn, will be used by State Forestry agencies and other service and regulatory agencies in the development of best management practices for sustainable development in agroecosystems.

For more information contact:

- Dr. Michele Schoeneberger, Research Project Leader and Supervisory Soil Scientist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Michael Dosskey, Research Ecologist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, NE 68583-0822, 402-437-5178.
- Dr. Kyle Hoagland, Associate Professor, Department of Forestry, Fisheries, and Wildlife, University of Nebraska, East Campus-UNL, Lincoln, NE 68583-0814, 402-472-8182.

Integrated Production/ Conservation Systems



...where agroforestry is blended and balanced with other land-use practices to attain agroecosystem sustainablility

The Problem

Diverse, healthy, productive, and sustainable agroecosystems are a shared goal, but attaining that goal is complex because of the diversity of interacting needs and stakeholders.

A Solution

Integrated Production/Conservation Systems Research:

- provides decision-making tools to evaluate the ecological, economic, and sociological needs of an agroecosystem thereby assisting in the selection and integration of the appropriate agroforestry and farming technologies within that system (whole-farm to watershed).

Agroforestry has tremendous potential to couple ecological sustainability with economic stability in Great Plains agroecosystems through the environmental services (water and air quality, soil conservation, enhanced crop production) and products (fuelwood, timber, and specialty products) it can provide. In order for agroforestry to provide optimal benefit to an agroecosystem, it must necessarily be coordinated with other land-use practices and needs of the landowner. Integrated Production / Conservation Systems Research at the Center for Semiarid Agroforestry is directed at providing management tools and strategies needed to incorporate agroforestry into the development of sustainable land-use systems. This multidisciplinary, multiagency team effort is comprised of researchers at the Center for Semiarid Agroforestry (USDA-FS) and the Center for Sustainable Agricultural Systems (University of Nebraska-Lincoln), as well as researchers from several other University departments.

For more information contact:

- Dr. Michele M. Schoeneberger, Research Project Leader & Soil Scientist, USDA Forest Service, Rocky Mountain Research Station, Center for Semiarid Agroforestry, East Campus-UNL, Lincoln, Nebraska 68583-0822, 402-437-5178.
- Dr. Charles A. Francis, Director of the Center for Sustainable Agricultural Systems and Professor, Department of Agronomy, University of Nebraska, East Campus-UNL, Lincoln, NE 68583-0910, 402-472-2056.

Agriculture Canada

Prairie Farm Rehabilitation Administration
Administration du Rétablissement Agricole des Prairies

Telephone: (306) 695-2284
Fax: (306) 695-2568

OUR FILE NO.: 1128-3

PFRA Shelterbelt Centre
Box 940
Indian Head, Saskatchewan
S0G 2K0

February 17, 1994

Ms. Carol Bell
TCFPM
P.O. Box 7669
MISSOULA, Montana, 59807

Dear Ms. Bell:

Re: Summaries for Great Plains Tree Pest Workshop

Please find listed below; summary of 1993 activities, proposed 1994 activities and most common insect problems noted in 1993.

Summary of 1993 Activities

A major effort was undertaken in 1993 to study the biology and control of the woolly elm aphid, *Eriosoma americanum*. The woolly elm aphid is considered a minor pest of American elm but can cause serious damage to the roots of saskatoon seedlings.

Nymphs of the woolly elm aphid were first recorded on unfolding leaves of American elm on May 10, 1993. Each leaf curl was initiated by an average of 4 stem mothers (range 1 to 18). Within each leaf curl, wingless stem mothers continued development and began producing offspring by May 26, 1993. By mid-June, infested leaves had up to 500 aphids. Colonies were preserved in alcohol and further estimates on colony size and development will be determined after samples are examined. The first winged aphids were noted in the leaf curls on June 17, 1993. The flight period was monitored using yellow pan traps placed in saskatoon plantations. Winged aphids were collected in pan traps from the last week in June through mid-July with the peak collection in the pan traps on July 2, 1993. Winged aphids were noted on saskatoon leaves the first week of July. Colonies were observed on saskatoon roots in mid-August with the first winged aphids recorded the last week in August. Yellow pan traps were stationed beneath American elm trees throughout September to monitor the fall flight period. Samples from these traps are still to be sorted.

In co-operation with Lloyd Harris of Saskatchewan Agriculture and Chris Pruski of Alberta Agriculture, Lorsban 4E (chlorpyrifos) was tested as a root drench to prevent establishment of woolly elm aphid on saskatoon roots. Newly established plantings at Edmonton, Alberta and Indian Head and White City, Saskatchewan were treated along with two plantings of 3-year old plants at Saskatoon, Saskatchewan. Rates of 0.05, 0.1 and 0.2ml L were tested with 1 L of solution applied per plant. Treatments were applied during the first week in July and evaluated in late August and early September. No significant control was achieved by the chlorpyrifos

treatments at Indian Head, Edmonton, and at one site at Saskatoon. At White City and the second Saskatoon site, a degree of control was achieved with the root drench, but was considered unsatisfactory overall. Based on this year's results, chlorpyrifos is not recommended as a prophylactic root drench treatment for woolly elm aphid on saskatoon.

Post-harvest root drenches of Diazinon 12.5 EC (diazinon) at 5ml/L, Cygon 240 EC (dimethoate) at 2.5ml/L, and Malathion 500 EC (malathion) at 2ml/L were tested on established saskatoon plants. Treatments were applied early September at White City and Saskatoon, Saskatchewan at a volume of 10L solution per plant. Root infestations were evaluated in late September. All three treatments caused a 80 to 100% reduction in infestation ratings in comparison to the check. Leaf burn was noted on Diazinon treated plants at both test locations. Plants will be evaluated to determine if phytotoxic symptoms carry-over to 1994.

Proposed 1994 Activities

1. Repeat life history studies on woolly elm aphid to obtain two years worth of data.

2. Conduct additional insecticide trials on saskatoon seedlings to control woolly elm aphid.

3. Conduct inventory of fruit infesting pests on various shrubs; choke cherry, buffaloberry, sea-buckthorn, pin cherry, Nanking cherry, high bush cranberry and Mongolian cherry.

1993 Pest Problems

In 1993 we received approximately 300 insect inquiries at the PFRA Shelterbelt Centre requesting information on insect pests of trees and shrubs. These inquiries provide us with a good idea of insect problems in Saskatchewan. I have listed the most common inquiries received in 1993.

Poplar bud-gall mite
Bronze birch borer
Elm aphids
Spruce spider mite
Yellow-headed spruce sawfly
Ash plant bug
Cooley spruce adelgid
Cankerworm
Spruce budworm

If anyone has any questions on our studies, please do not hesitate to call me at (306) 695-2284.

Sincerely

Don Reynard

Donald A. Reynard
Entomology Technician
Investigation Section

DAR/bl

GREAT PLAINS TREE PEST WORKSHOP
ALBUQUERQUE, NM
MARCH 7-10, 1994

1994 ACTIVITIES REPORT FROM
SOUTH DAKOTA DIVISION OF FORESTRY
BY: Richard Dorset

1993 STATUS
MAJOR PESTS OR PROBLEMS ENCOUNTERED:

Gypsy Moth - The large delimiting survey in the east central Black Hills, headed by the USFS, R-2, Rapid City Service Center, turned up largely negative. Only 2 male moths were found, one at the far north edge and one in a campground on the south end of the delimited block. However, in detection traps, 3 males were found in Rapid City, one was found in a park in Spearfish, 2 in one trap in Hot Springs, one in a landscape nursery in Sioux Falls, another in a nursery outside of Sioux Falls, and several just across the border in Iowa in the far Southeast corner of the state.

Ponderosa Pine Sawfly - We are still having problems with heavy populations in the fringes of the Northern Black Hills. Individual and small groups of trees up to about 1/4 acre in size are now dead and dying. The wet cool weather this past spring slowed caterpillar development to the point where the new foliage was almost fully developed by the time the caterpillars were in their 4th and 5th instars. This slow caterpillar development simply caused the damage to be hidden by the new foliage and therefore not as noticeable to the general public. Although, they did not defoliate the new growth it is my belief the same amount of damage was done to the older foliage this year as in the past few years, causing further stress and probably more mortality. The caterpillars although still around are hardly noticeable anymore in the Central and Southern Hills. As a side note, a very large number of adult males were seen flying in the far Southern Black Hills in September.

Pine Tussock Moth - Two separate infestation in the Southern Black Hills, which started in 1991, apparently totally collapsed by 1993, at least there was almost no evidence of any life stages by September. However, the center of both infested areas experienced severe mortality.

Western Tent Caterpillar, Eastern Tent Caterpillar - Early spring defoliation to Prunus spp. as well as Currants was extremely heavy in several counties all across South Dakota. Some of the heavier infested areas appeared to be in the southwest corner of the state, especially in scattered localities along Pine Ridge area, and numerous locations along the Missouri and James rivers.

Elm Sawfly - an interesting find, our Pierre district forester brought in about a dozen adults, all collected in one day from around one tree. No caterpillars were ever found.

Oak Lace Bug, Hawthorn Lace Bug(?) - Populations of these and other lace bugs were much higher than usual in several locations, mostly in southern counties. Hawthorn lace bugs(?) were found defoliating and mottling Cotoneaster hedges. Several patches of oaks, primarily in the southeast, were turned a bronze color by mid August.

Pine Pitch Nodule Maker - The ponderosa pine in several shelterbelts were found to be heavily infested, rough estimates of 75% of the shoots infested, in the Northeast area of the state. This area is usually where the highest populations seem to be found, although long term damage to the trees is hard to determine.

Pine Tip Moth - Young ponderosa pine in shelterbelts throughout the state are often hard hit. Most of the trees in a 2Ø+ year old stand near Yankton are mostly dead or no higher than 8-1Ø feet tall and very scraggly and will never outgrow the tip moths. Even though there is still apparently a high population throughout the state it appeared this year that damage was not as severe as in the past few years.

Pitch Moth - An interesting find that still hasn't been fully identified occurred in Custer. On several "sick tree calls" on medium aged and older Black Hills or White spruce we discovered numerous pitch masses on the main trunks that were identical to those caused by pitch moths. When we took the time to look these pitch masses could be found on other spruce trees both in Custer and in the Southern Black Hills. Exactly what these are is still not known as larva could not be found at the time we inspected the trees.

Apple Scab - With all the wet spring weather apple scab, primarily on ornamental crabapples was <u>extremely</u> heavy throughout eastern South Dakota. Many trees were 9Ø-1ØØ% defoliated by late June or early July.

Oak Anthracnose - Reports and observations of this disease, like apple scab were up significantly over last year. However, unlike apple scab, very few sightings involved any serious defoliation, mostly light defoliation and leaf spotting.

Harbin Pear black leaf blight - I still do not <u>know</u> exactly what this is but it showed up again all around the eastern 1/2 of the state. My suspicion is that it may be caused by a Pseudomonas.

Rhizosphaera Needle Cast - This disease is <u>not</u> commonly found in South Dakota, or if it is it hardly ever produces fruiting bodies. In 11 years I have only seen fruiting 2-3 times. 1993 was different. About half of all spruce samples sent in or collected for diagnosis had good fruiting bodies on the needles. It is my belief the disease is really not common but the wet spring weather in 1992 and 1993 has caused a minor epidemic.

Ash Anthracnose and other leaf diseases - Other than the above I only mention these because of their somewhat surprising scarcity this year, especially since we had so much weather conducive to these types of diseases.

Russian Olive Canker - this is another group of diseases that was surprising this year because of the lack of observations and reports. Only a few years ago there was a lot of public concern that we were going to lose all our Russian Olives due to disease. Now, although there is still some flagging and branch dieback around it is nowhere near as prevalent as 2-4 years ago.

Dutch Elm Disease - I am not really sure what to call this anymore, whether Ceratocystis or Ophiostoma, and whether ulmi or novo-ulmi, but whatever it is, it was about normal across the state. A few of our districts still provide about a dozen communities with inspections each year.

Fireblight - As might be expected with as much moisture as we had last spring, fireblight reports were up, primarily in eastern South Dakota. Not only were reports received from apples and crabapples but we also saw several Cotoneaster hedges moderately to heavily infected.

Phomopsis Blight on Cedar - Normally we get a few calls every year when someone's shelterbelt is moderately to heavily infected. This year we saw and received numerous requests for help by mid June, mostly from the flooded southeast. Fortunately the wet weather also helped the cedars as by late August most of the infected and brown twigs had been covered up by healthy new growth. Interestingly, the division Nursery, which had a severe epidemic in 1992, experienced very little definite Phomopsis blight during 1993.

Plum Pockets - More of an interesting disease than any kind of real problem, numerous reports were received mostly from the northeast and north central areas. It has been several years since any reports or observations of this disease have been seen. I suspect the high moisture levels enhanced the disease.

Herbicide Damage - As usual this 'problem' caused the single most common request for assistance. Enough said.

Flooding 1 - The division received a number of assistance requests, primarily from the east central, south central and southeast areas of the state, concerning pines, all species, that had a large number of browning needles. For the most part this occurred from late winter to mid summer. As happened in the early 198Ø's most of this occurred in shelterbelts in low lying areas or that had poor drainage and had either high water or been flooded during the spring and early summer of 1992. It is my belief that this years browning and twig dieback is mostly associated with 1992's flooded conditions.

Flooding 2 - Extreme spring flooding in much of Eastern South Dakota occurred. Most of the tree damage from these floods is really expected to show up this year (1994), especially in completely dead hardwoods and in a continuation of the pine "decline" mentioned above.

Freeze Damage - Crabapples and apples in several areas of the state, but primarily from Pierre west, were found in the spring with large plates of bark sloughing off the main stem and large branches, much like the Bradford Pear(?) we saw in Lincoln during the 1993 meeting. In this case the bark has been killed down to the xylem. However, the foliage often did not start to wilt until mid to late summer, and some branches on some trees may survive a few years. It is my belief this is some sort of freeze damage, probably caused by some rapid weather fluctuation. Whether this is still left over from the October '91 blizzard, the spring '92 late freeze or some freezing whether combination during the winter of '92/'93 is not known.

Red Belt - Four areas of ponderosa pine on two hillsides on the edges of the Northern Black Hills experienced this weather related phenomena. From the patterns on the hillsides I suspect there were actually two separate episodes.

Tornado - A tornado hopscotched its way across the Northern Black Hills just outside of Lead. Our district was involved in estimating damage and assisting with a salvage sale. An inspection of the root systems in one of the 'spots' discovered numerous roots with what appeared to be latent Armillaria infections, including some with completely dead roots. Also, a number of the spruce (pine tended to uproot whereas spruce either snapped or uprooted.) appeared to have rot in the root collar and upper roots.

1994 PROJECTS AND ANTICIPATED WORK

Rapid Sample Diagnosis and Field Assistance - a recent in house insect and disease program evaluation indicated this is the number one support desired and used by the district offices. Therefore, more emphasis will be placed on getting around to all the different districts at least once and up to three times this year.

1-2 Day Pest Workshop - the evaluation mentioned above further indicated that the second priority the districts would like, is some sort of regular (probably annual) 1/2-2 day pest workshops. While not yet worked out, I am currently planning on trying to put one together for sometime next fall.

Nursery Survey - This is an annual occurrence and is designed to help the nursery managers spot developing problems while they can still be dealt with.

Pine Sawfly Inspection - Because the populations still have not collapsed this pest will probably again need watched and take some timed.

Insect and Disease Display - Should time allow (a perennial problem), division personnel will be collecting insects, and hopefully disease samples, to be used for a state fair display sometime in the future.

Forest and Shade Tree Pathology Research Activities during 1993-94 and Planned for 1994

Bill Jacobi
with graduate student
Daniel Omdal
Department of Plant Pathology and Weed Science
Colorado State University, Fort Collins, CO 80523
(303) 491-6927

I. Shade Tree Research

A. Relationship of nitrogen and Cytospora & Thyronectria cankers:
Susan Burks - M.S. Graduate Student in absentia

B. Environmental relationships with Cytospora Canker of Aspen
John Guyon, Competed thesis and we are working on two manusripts

C. Current Research: Soil Flooding/ Low Oxygen as Predisposing Stresses to Canker Fungi.

We have completed three experiments of short term (6-8 wk) flooding of potted Honeylocusts and found no significant effect on the size of Thyronectria cankers. We are currently writing a draft of a manuscript for J. Arboriculture.

We started (July 1993) a long term (two seasons) pot study simulating the over watered yard vs the adequate watered yard. Redox potentials of soils will be taken weekly to measure what is happening in the soil. Summer and Fall inoculations will assess changes in resistance to canker expansion.

D. Future shade tree research.

We are in the process of establishing a new research nursery to study the interactions of irrigation practices, turf, and insect and biotic and abiotic diseases of selected shade trees.
The water system is in and functional and we plan to plant trees and turf in the spring 1994. This is a major undertaking and experiment in truly cooperative work with soil hydrologists, turf specialists, entomologists, and pathologists. We'll see how we do. We are desperately looking for money to get the rest of this nursery established.

The nursery will also contain areas for screening elm hybrids for resistance to cankers, cold damage , and foliar insects. I am interested in cooperating with researchers in screening hybrid elms for elm leaf beetle and canker resistance.

The area is not large enough for all the massive screening that we need to do to look for abiotic and biotic disease resistance in our commonly used shade tree species. Thus, I will have to find more room for this activity some where else.

II. Forest Tree Research

A. Comandra Blister Rust

We have submitted a manuscript describing weather relationships to the temporal occurrence of Comandra blister rust of lodgepole pine. We have found new climatic data that further explains the type of weather

systems involved with potential infection episodes. No new studies are planned. Two other papers on this disease were published in Phytopathology in 1993.

B. Aspen Sprout Dieback

In cooperation with the Rocky Mountain Forest and Range Experiment Station Region 2 FPM, Soil Conservation Service, Agronomy Department, CSU, and various national forests in Colorado, we are attempting to identify the climatic and site conditions associated with the dieback of two-to eight year-old aspen sprouts. Site parameters included in the study are soil conditions, soil moisture trends, weather data, site characteristics and previous stand condition. This disease induced mortality has occurred in 10% of the clearcut stands from New Mexico to northern Colorado. The two fungi found associated with the dieback in Colorado were Cytospora chrysosperma and Dothiora polyspora. A research note on the involvement of these pathogens is available from the Rocky Mountain Forest and Range Experiment Station.

We are now analyzing massive amounts of data and trying to relate all the various information. Hopefully this will be done by then end of March 1994. We have found climatic data that indicates some sites were probably drowned by late snow melts and others were affected by droughts. Why portions of stands survived and others were totally killed is not totally clear yet. Soil information can explain these difference in some cases and in others it is not very definitive.

C. Armillaria Root Disease
Dan Omdal, Ph.D. Graduate Student

In cooperation with the U.S. Forest Service Region 2 and 3 FPM, and the Rocky Mountain Forest and Range Experiment Station, we are studying various aspects of managing Armillaria root disease on the Jemez Ranger District, Santa Fe National Forest, New Mexico and the Southern Ute Indian Reservation, Colorado.

To develop a hazard rating system for Armillaria root disease, Dan rated the amount of root disease on about 90 Ponderosa on the Jemez District, and 120 white fir and Douglas fir on the Southern Ute reservation. Trees were pushed over by bulldozer and roots excavated. Many above ground measures of vigor were recorded before the trees were pushed over so correlations could be run between above ground vigor ratings and amount of root disease. Analysis of data is done and the first draft of a manuscript is completed.

Determining the susceptibility of various tree species native to the area to indigenous isolates of Armillaria spp. was completed in the fall 1992 via seedling inoculations and field inoculated trees. The paper reporting these results is in final form and should be submitted to a journal shortly.

C. Future forest tree research.

Forest disease work will consist of manuscript and proposal writing and continuing studies on aspen sprout dieback and Armillaria root disease. I would be interested in cooperating on studies dealing with the relationship of Armillaria root disease occurrence and site conditions, the relationship of environmental stresses and diseases, and the relationship of diseases and wildlife.
We (a couple of pathologists, soil scientist, spacial modeler) have resubmitted a proposal to look at landscape scale site relationships and the occurrence of Armillaria root disease in the Black Hills. We will have one or two new graduate students start on this project this year. Unfortunately we have no funds to

get these folks out to the field so we are trying to find funds to supplement their stipends. Any cooperation on this activity would be appreciated.

III. Publications

Jacobi, W. R. 1993. Insects emerging from lodgepole pine infected with Comandra blister rust. U.S.D.A. For. Serv. Research Note RM 159 3 pp.

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1994 Report - North Dakota
Great Plains Tree Pest Workshop, Albuquerque, NM, March 7-10, 1994

Compiled by J.A. Walla, Plant Pathology Dept., NDSU, Fargo 58105

Dr. R.W. Stack, Professor
J.A. Walla, Research Associate
P.A. Mason, Graduate Student (Stack)
B.D. Moltzan, former Graduate Student (Stack)

1. ASH YELLOWS ON GREEN ASH (Walla, C. Ash [MN], M. Draper [NDSU])

Ash yellows (AshY), recognized as a significant disease of *Fraxinus* spp. in the U.S.A. in the 1980's, was confirmed in 1992 in green ash (*Fraxinus pennsylvanica* Marsh.) in two Minnesota cities bordering North Dakota (C.L. Ash, unpublished data). In June, 1993, AshY symptoms were found on three planted green ash in Cass and Ransom counties in southeastern ND. Witches'-brooms consisting of a few shoots with shortened internodes, multiple branches from nodes and some simple leaves were present near the base of the trunk of two of the trees. Witches'-brooms consisting of multiple current-year shoots and mostly simple leaves were growing from the root collar of the third tree. AshY was confirmed by the 4',6-diamidino-2-phenylindole (DAPI) fluorescence test in roots from below each witches'-broom and with AshY-specific monoclonal antibody (T.A.Chen, Rutgers Univ.) in a leaf petiole from one of those witches'-brooms. One of the infected trees, in a rural Cass County windbreak, had severe top dieback, as did other trees without witches'-brooms in that windbreak. The other trees, in Lisbon, ND, appeared vigorous with no dieback. In late August, a green ash with a witches'-broom and severe dieback was found in a native stand in Billings County in far western ND. AshY was confirmed in this tree also. Thus, AshY was found at 3 sites across ND in urban landscape trees and rural windbreak and native trees. This is the first report of AshY in ND and in the Great Plains region of the U.S.A.

Because green ash is very important in native and planted forests of the Great Plains, the importance of AshY to green ash in this region should be evaluated. A cooperative regional survey to find where the disease occurs and what affect it is has on green ash in the Great Plains could provide the most appropriate information.

2. WESTERN GALL RUST ON PONDEROSA PINE (Walla)

Disease Resistance and Pathogen Characterization; with C.-G. Wang and Z.-M. Cheng, NDSU.

Inoculations of open- and control-pollinated ponderosa pine seedlings have been evaluated and results continue to be analyzed. In inoculations for his dissertation research, C.-G. Wang found significant differences in disease among host families (resistance) and among rust isolates (virulence/aggressiveness). It appears that both major and minor gene effects were present. He found unexpected changes in population genetics of the rust as compared to our earlier reports.

Disease Resistance; with Carol Schumann, USFS.

Inoculations of seedlings from control-pollinated ponderosa pines are being evaluated. Symptoms on seedlings inoculated in 1993 indicated substantial differences in resistance among seedling families and in virulence between inoculum sources. These seedlings are going through a dormant cycle and final readings will be taken in the spring of 1994.

Axenic Cultures.

The culture collection of Peridermium harknessii is being maintained and additional isolates have been added from sites where the rust has been found to vary from the norm in inoculations and in isozyme analysis. Currently, 58 isolates are in stock culture, representing four pine hosts from nine sites in four states. Isozyme analysis of two culture types of most isolates showed that the collection is genetically variable and that there is general agreement in isozyme phenotypes among the two culture types and spores from the original galls. New media testing is ongoing, with slow but continued improvement in growth rate and lengthening of the maximum time between culture transfers. Testing of various culture manipulations has resulted in some orange callus-like

isolates that are getting closer to having aeciospore characters. In compatibility work, initial pairings among several isolates of the same isozyme biotype found differences in how the individuals in each pair grew together. Inoculations of pines with axenic isolates continues to expand in methods and seedling numbers, but as yet with no gall formation.

3. OTHER PINE RUSTS (Walla)

White pine blister rust.

WPBR was found (w/ Draper, NDSU) on a limber pine in Mandan, ND, in 1992. All known soft pines were observed in the Mandan area in 1993; no additional infections were found. Soft pines in several sites in eastern ND were also observed in 1993. WPBR was found on a single planted eastern white pine on a farmstead landscape tree and on several planted eastern white pines in a wildlife management area in northeast ND. Additional observations will be made in 1994.

Eastern gall rust.

Axenic cultures of EGR (from MN) have been obtained from galls. As with WGR, two culture types were found, although the callus-like type has rarely been found and it is not orange. The white mycelial type of EGR and WGR appear similar. Axenic cultures of EGR, which may be very closely related to WGR, are being used in work with WGR.

Comandra blister rust.

Work continues to examine CBR as it occurs in ND. Attempts to grow the alternate host (Comandra) continue without success. CBR has been found on Comandra in a few locations in ND, but no Comandra has been found close to the infected pines (by Walla). Inoculations of pines with aeciospores or basidiospores resulted in no cankers. A fungus was isolated from CBR cankers on the same medium used to grow WGR. Although the development is very different than either WGR or EGR, one culture type (orange callus-like mycelium) has a very similar isozyme phenotype to CBR spores.

4. MELAMPSORA LEAF RUST OF POPLARS (Mason, Stack)

Leaves of *Populus deltoides* (PD) and *P. tremuloides* (PT) with *Melampsora* leaf rust were collected from nine central and western states and two western Canadian provinces. The upper walls of teliospores were examined by light and scanning electron microscopy. Teliospores from 30 collections on PD had uniformly thin upper walls (0.98 $\pm$ 0.02 um). Although more variable, upper walls of teliospores from 25 collections on PT were significantly thicker (1.68 $\pm$ 0.38 um, $p<0.001$). Walls on five collections from PT were thin (0.98 um), similar to those from PD. Arthur distinguished two *Melampsora* species on these hosts: *M. albertensis*, having thicker walled teliospores, and *M. medusae*, having thinner ones. These observations suggest that, in this region, both species are present on PT while only *M. medusae* is present on PD.

5. MELAMPSORA OCCIDENTALIS ON BLACK COTTONWOOD IN THE CENTRAL U.S. (Moltzan, Stack, Mason [NDSU], Ostry [USFS, MN])

Melampsora occidentalis H. Jacks. is indigenous to western North America, where it causes leaf rust of black cottonwood (*Populus trichocarpa* Torr. & A. Gray), a tree native from the Rocky Mountains westward. In recent years, experimental forestry plantings of *P. trichocarpa* have been made in the Midwest. Leaf rust caused by *M. occidentalis* was found on *P. trichocarpa* growing in plantations in Iowa in 1989 and 1990 and in Wisconsin in 1989, 1990, and 1991. The uredial and telial stages of the rust in these collections were examined by light and scanning electron microscopy. The very large uredospores (38 X 17 um) and large teliospores with a thickened upper wall identify this pathogen as *M. occidentalis* and distinguish it from *M. medusae* Thuem., the common cause of Populus leaf rust in the central states. The occurrence of this rust at two locations and in successive years suggests that it has become established in the region. The alternate host is unknown, but several candidate coniferous species are widely distributed in the region. In addition to the above collections, *M. occidentalis* was identified on black cottonwood in Fargo, ND in 1993.

6. X-DISEASE OF CHOKECHERRY (Guo, Cheng, Walla)

Observations in 1993 found what have long been assumed to be X-disease symptoms on most native clumps and in most plantings of chokecherry throughout

ND. Apparently, this has happened before; verbal reports note that all the chokecherry plants in North Dakota died in the early 1950's from this disease. The disease appears to limit the use of chokecherry in the northern Great Plains; no controls are available. Resistance, if it exists, would be the best control. Mr. Yonghong Guo began a Ph.D. program in 1993 to work on this problem. A polyclonal antibody was developed to allow confirmation of whether plants are infected with XMLO. Using this polyclonal antibody, in combination with electron microscopy and with antibodies and a DNA probe from colleagues, XMLO was confirmed to be the cause of the disease. A provenance planting of chokecherry (Plant Materials Center, Bismarck, ND) was surveyed to look for resistant plants; about 30 of 1500 plants appeared to be resistant or tolerant. Samples from symptomatic plants were collected from throughout ND; XMLO was found to be present in all parts of ND, but not all symptomatic plants were found to have XMLO.

7. LIRULA NEEDLE BLIGHT ON SPRUCE (Walla, Stack)

A fungicide trial was established to find if a single late-season fungicide application will control Lirula, as was indicated by accident in an earlier trial. Individual shoots of infected trees will be sprayed at various times of the growing season to find when fungicide can be applied to adequately control the disease. This work is being with the help of the ND Forest Service, Walhalla.

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GREAT PLAINS TREE PEST WORKSHOP

KANSAS INSECT AND DISEASE REPORT

1994

GYPSY MOTH (Lymantria dispar)

A total of 1132 gypsy moth traps were placed at various locations across the state by federal and state agencies. Male moths were caught at two sites. One moth was trapped in a church parking lot in the Kansas City Area and one at a RV park in Dodge City.

Trapping will continue in 1994 and efforts will be increased at the two locations where moths were caught in 1993.

PINE PITCH MOTH (Dioryctria tumicolella)

Measures to eradicate the pine pitch moth is underway in 3 Kansas counties in northwest part of the state by the Kansas Department of Agriculture. Tree removal and insecticide applications may keep the insect under control.

PINE TIP MOTH (Rhyacionia spp.)

Pine tip moth control continues to be a problem for Christmas tree growers in Kansas. Overlapping life cycles of two or maybe three species makes the timing for insecticide application very difficult. Control is difficult even when using pheromone traps.

PINE SHOOT BEETLE (Tomicus piniperda)

State and federal quarantines are still in affect to prevent the pine shoot beetle from entering the state.

Les Pinkerton
State and Extension Forestry
Kansas State University

Walnut Trunk Webbing

In 1991 and 1992, people were reporting a massive webbing on the trunks and larger limbs of walnut trees. Reports had come from Leavenworth, Shawnee, Miami, Geary and Riley counties.

On May 12, 1993, Les Pinkerton (State Extension Forester), Bob Bowling (KSU Department of Entomology Diagnostician), Ft. Riley grounds personnel and I visited several sites at Ft. Riley where the webbing had been heavy in 1991 and 1992. While there were quite a few small moths to be seen, the numbers were down from what had been observed in previous weeks. Never-the-less, several specimens were collected for the purpose of having them identified. However, their mere presence did not mark them as the progenitors of the webmakers.

George Lippert (KSU Southeast Area Extension Entomologist), Herschel George (Miami County Cooperative Extension Agricultural Agent) and I visited several sites in Miami county. Around the bases of webbed trees, the litter/dirt had a "disturbed look". A hundred or so larvae were collected from the aforementioned soil. The larvae were of the family Tortricidae. Larvae were maintained in a dirt-filled container. Within 10 days, larvae had pupated. Eventually 7 moths emerged.

Moths were sent off to William (Bill) E. Miller, Department of Entomology at the University of Minnesota. He identified the moths as Gretchena concitatricana (Heinrich). Because the moths came from pupa of the collected larvae, G. concitatricana was thus identified as the species responsible for the webbing.

Bill indicated that he had identified the same from Kansas in 1969. Gary Naughton (State Extension Forester) had submitted those former specimens. Naughton stated that he had essentially seen the moths every year since but never observed any webbing from that time through 1990. It is not known why webbing is now a common occurrence as opposed to the many past years. The tortricid expert knew of no other tortricids that produced webbing other than some tentmaking species in which (instances) the tents are functional.

1994: Because little is known regarding this insect, attempts will be made to document information relative to it's life history. By capturing and confining large numbers of moths, we would hope to obtain (thus identify and record) eggs. Eggs will be maintained indoors, and hopefully their hatching times thus recorded. Larvae will be reared both indoors and outdoors for the purpose of making life history observations. Trunk banding activities may help define where moths deposit eggs. Additional trunk banding may help define numbers of descending larvae responsible for creating thick webbing. Although more of an "aesthetic pest" than a "destructive pest" (trees re-leaf after larvae leave, webbing breaks up and people soon forget that anything peculiar had happened), there is the opportunity to learn more about this interesting situation and insect. Trunk banding may become an effective nonchemical method to disrupt the life cycle of the insect.

WE WOULD APPRECIATE ANY IMPUT FROM OTHERS WHO HAVE SEEN/OBSERVED THE SAME WITHIN THEIR RESPECTIVE DISTRICTS/STATES. PLEASE CONTACT:

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Diagnostic Lab. Excessive rain throughout the summer resulted in high water damage to a number of tree and shrub species. Forsythia and common lilac were killed throughout the eastern 1/3 of the state. This injury was generally associated with water-saturated soils, although root rotting pathogens may have contributed to the decline. Other tree species, especially conifers, were severely damaged by standing water.

Most foliage diseases (anthracnose, scab, Entomosporium leaf spot, Mycosphaerella leaf spot on London Plane and ash, others) were severe this summer. Elm black spot caused shoot blighting and leaf spotting on Chinese and Siberian elms. Cedar-quince rust on Washington and cockspur hawthorns caused fruit and twig galls and branch dieback. The incidence of this disease has increased over the past 10 years and may limit future plantings of hawthorns in Kansas.

Dothistroma needle blight and brown spot caused extensive damage to Austrian, Ponderosa, and Scots pines in windbreak and Christmas tree plantings. Mycosphaerella pini was tentatively identified from Pinus edulis in western Kansas. A similar finding was reported by W. Jacobi and W. Brown in eastern Colorado.

Oak rust. Uredinia of a rust fungus were observed on leaves of Quercus macrocarpa during a routine inspection of a nursery in Hays, KS in August by B. Buehler and J. Appel (Kansas State Board of Agriculture). Aecial galls were not detected on Scots pine in the nursery or in the adjacent area. The rust was subsequently observed on Q. macrocarpa, Q. alba, Q. bicolor, and Q. muehlenbergii in Manhattan. Urediniospores were moderately echinulate and measured 13-18 X 19-30 u. Telia were not found on any of the oak species. D. Appel (Texas A&M) also has reported rust on Q. virginiana in Texas (personal communication). Because of the widespread distribution of the rust in Kansas and Texas, it is unlikely that aeciospores were the primary source of the oak infections in Kansas. The current hypothesis is that urediniospores were carried into Kansas from infected oaks in Texas by the relatively unusual weather patterns in July. The rust has been tentatively identified as Uredo quercus Brond. ex Duby (syn. with Cronartium quercuum (Berk.) Miyabe ex Shirai ?) by R. S. Peterson, St. Johns College, Santa Fe. Oak rust was previously reported in Kansas in 1898.

Juniper diseases. Demonstration plantings of Juniperus spp. (Manhattan and Wichita) were rated for severity of Kabatina tip blight (Kabatina juniperi), cedar-apple rust (Gymnosporangium juniperi-virginiana), Cercospora needle blight (Cercospora sequoiae var. juniperi) and Botryosphaeria canker (Botryosphaeria stevensii). Although cultivars of the different species were replicated at both locations, they were not randomized. Therefore, ratings were based on overall ratings and were not subjected to statistical analysis. In general, cultivars of J. chinensis were relatively resistant to all of the major diseases, while J. scopulorum cultivars were extensively damaged. Most cultivars of J. virginiana were susceptible to rust.

Sphaeropsis tip blight of pines. Foliar applications of Tenn-Cop 5E, Cleary's 3336, Nova, Bravo 720, and Banner were applied to mature, diseased Pinus ponderosa trees in late April and early May. Ratings on the incidence of blighting of current season's shoots were made in early August. Shoot blighting was severe as a result of constant rains in the spring and early summer of 1993. None of the fungicides significantly ($P = 0.05$) reduced the incidence of shoot blighting compared to non-sprayed trees. However, there was a general trend towards reduced shoot infection (20-40%) in fungicide-treated trees. Applications of thiophanate-methyl (Cleary's) resulted in the lowest shoot infection, whereas the Tenn-Cop 5E had the highest infection of the fungicide treatments. This experiment corroborates arborist's complaints concerning the lack of tip blight control with two foliar applications in rainy springs.

Injections with propiconazole (Alamo) and tebuconazole (Lynx) for control of Sphaeropsis tip blight are planned for this fall and next spring. Fungicides will be injected by standard harness-type injection equipment and by microinjection applicators (Arbor X, Tree Technology Systems).

Table 1. Relative disease ratings of *Juniperus* cultivars to cedar-apple rust, Kabatina tip blight, Cercospora needle blight, and Botryosphaeria canker

J. virginiana	Rust	Kabatina	Cercospora	Bot canker	Comments
Admiral	light	light	none	none	No severe disease problems.
Emerald Sentinel	moderate	light	none	none	Some rust, otherwise fair.
Hilli Dundee	moderate - severe	light - moderate	none	none	Rust may be problem.
Henryii	severe	light	none	none	Rust may be problem.
Manhattan Blue	severe	light	none	none	Serious rust.
Hillspire	none	light	none	none	No severe disease problems.
Blue Fountain (shrub?)	none	none	none	none	No severe disease problems.
Oxford	moderate	moderate	none	none	Rust and Kabatina may be problem.
J. chinensis	Rust (cedar-apple)	Kabatina	Cercospora	Bot canker	Comments
Blue Point	none	light - moderate	none	none	All *chinensis* cultivars are relatively free of diseases listed.
Robusta Green	none	none	none	none	
Mountbatten	none	none	none	none	
Perfecta	none	none	none	none	
Columnaris hetzii	none	none	none	none	
Ames	none	none	none	none	
Spartan	light	light	none	none	
Maneyii	none	none	none	none	
Winter green	none	none	none	none	
Keteleeri	none	none	none	none	
J. scopulorum	Rust	Kabatina	Cercospora	Bot canker	Comments
Gray Gleam	moderate	moderate	none	none	Fair.
Welchii	light	moderate	moderate	severe	Bot canker severe; don't plant.
Platinum	light	moderate	none	none	Fair.
Sky Rocket	light	severe	severe	severe	This cultivar is a dud.
Sparkling Skyrocket	none	severe	severe	severe	This cultivar is a sparkling dud.
Sutherland	severe	none	none	none	Severe rust.
McFarland	moderate	moderate	severe	light	Serious Cercospora blight.
Moffettii	moderate	moderate	moderate	none	Poor.
Blue Haven	moderate	moderate	moderate	severe	Don't plant in Kansas.
Wichita Blue	none	moderate	moderate	severe	Don't plant in Kansas. A real dog.
Dewdrop	moderate	moderate	moderate	none	Foliage diseases may be a problem.
Pathfinder	light	light - moderate	light	none	Kabatina may be a problem.
Cologreen	moderate	light	moderate	none	Rust, Cercospora are problems.
Moonglow	none	moderate	moderate	severe	Bot canker; don't use.
Medora	none	moderate	light	severe	Bot canker; don't use.
Silver Globe	moderate	light	none	none	Fair.