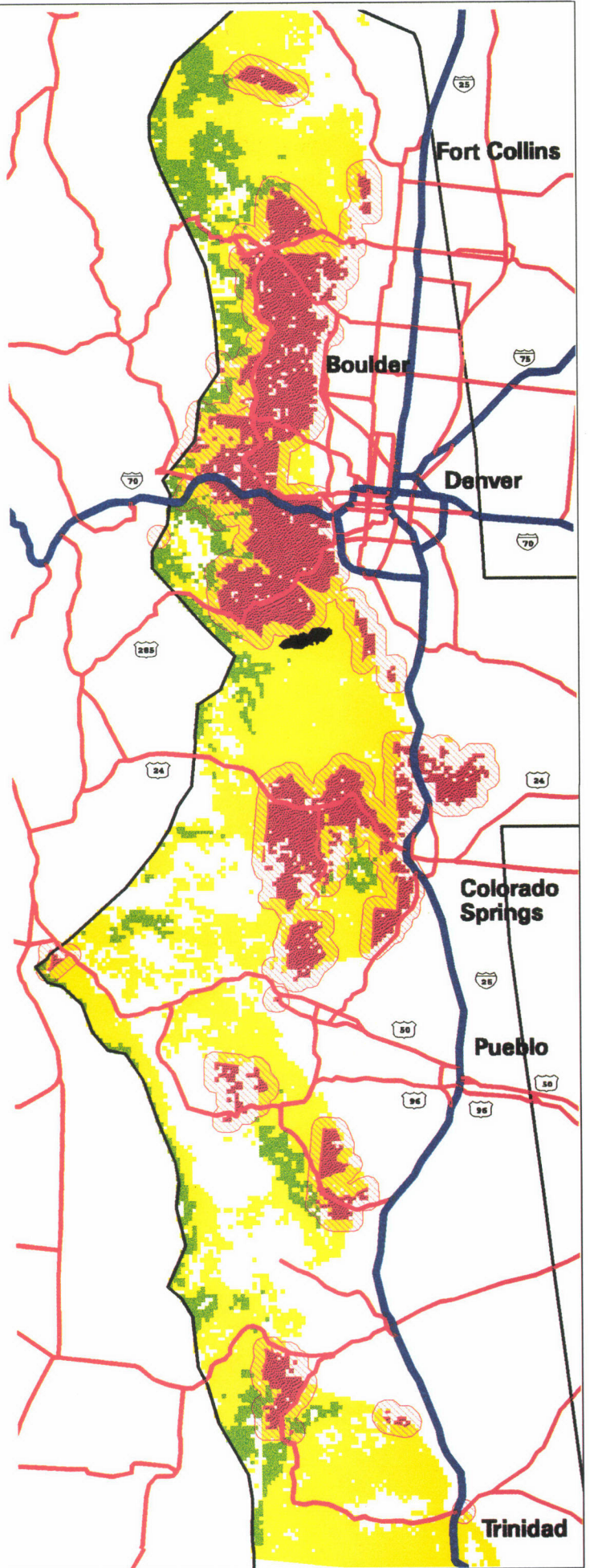


**Forest Insect  
and  
Disease Conditions  
in the  
Rocky Mountain  
Region  
1996**



United States  
Department of  
Agriculture



Renewable  
Resources  
Forest Health  
Management

Rocky  
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**FOREST INSECT AND DISEASE CONDITIONS**  
**IN THE**  
**ROCKY MOUNTAIN REGION**  
**1996**

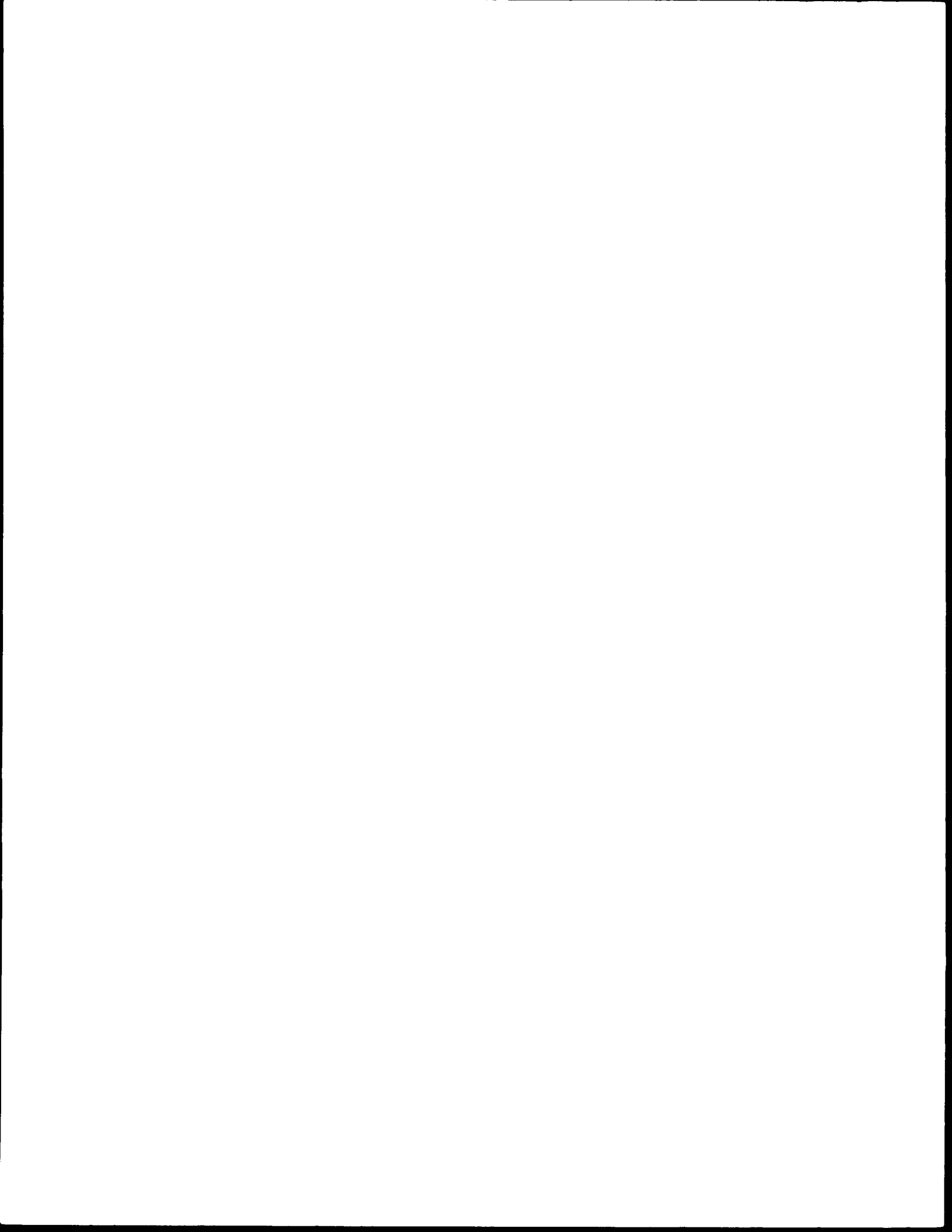
By

**The Forest Health Management Group**

Susan J. Johnson, Biologist, Editor

**July 1997**

USDA Forest Service  
Rocky Mountain Region  
Renewable Resources, Forest Health Management  
P.O. Box 25127  
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## ACKNOWLEDGMENTS

The Forest Health Management (FHM) Staff of the Renewable Resources Unit extends appreciation to all cooperators who contributed to this report.

Information on specific pest problems may be obtained from the Regional Office (303/275-5061), Lakewood Service Center (303/236-9541), Gunnison Service Center (970/641-0471), or Rapid City Service Center (605/394-1960), as well as from the following State Foresters:

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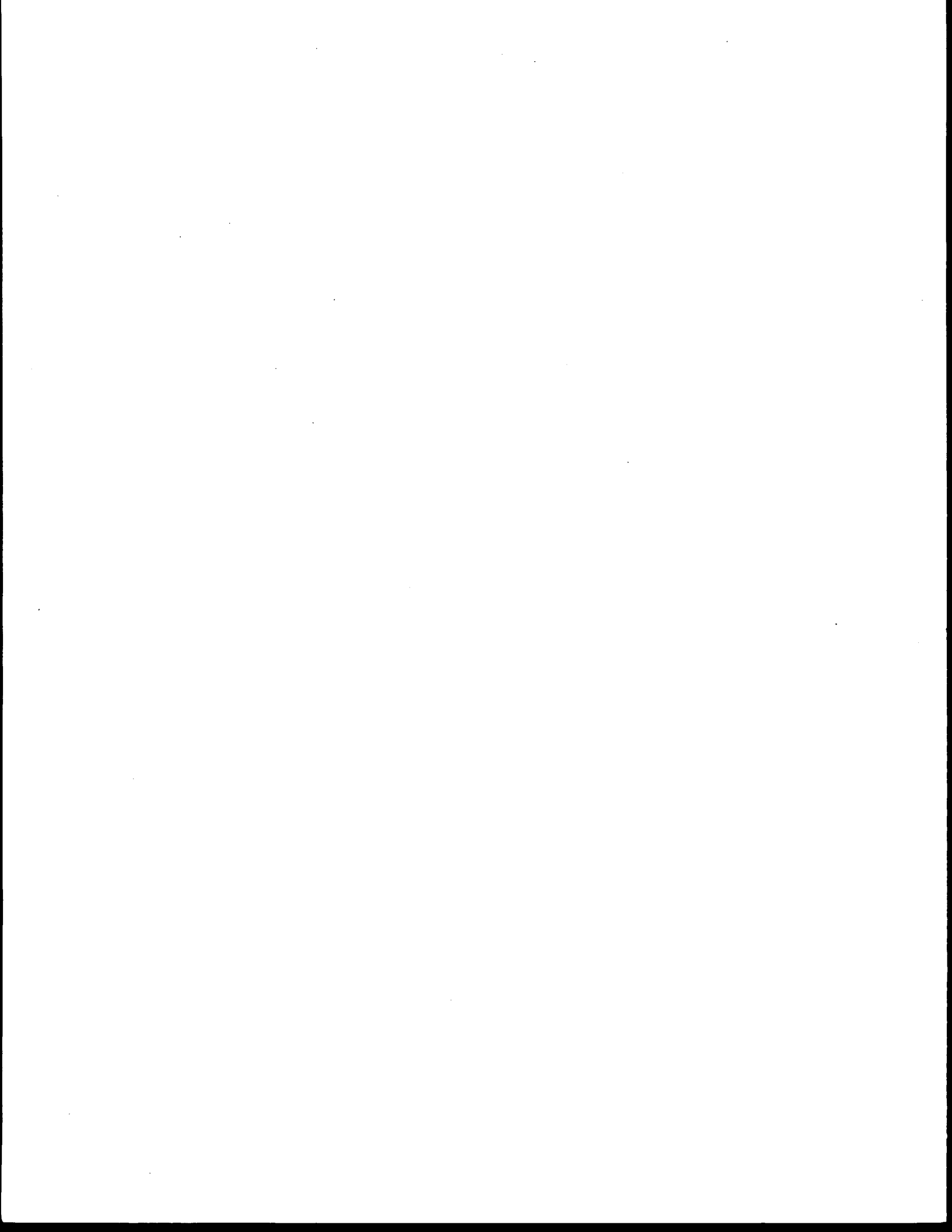
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### Cover:

GIS product of the Colorado Front Range Forest Health Assessment



## MAILING LIST UPDATE

### Annual Report 1996

Annually, we update our mailing list. If you have had an address change or would like to receive publications other than what you currently receive, please note the change and return this sheet to the P.O. Box Mailing Address listed below.

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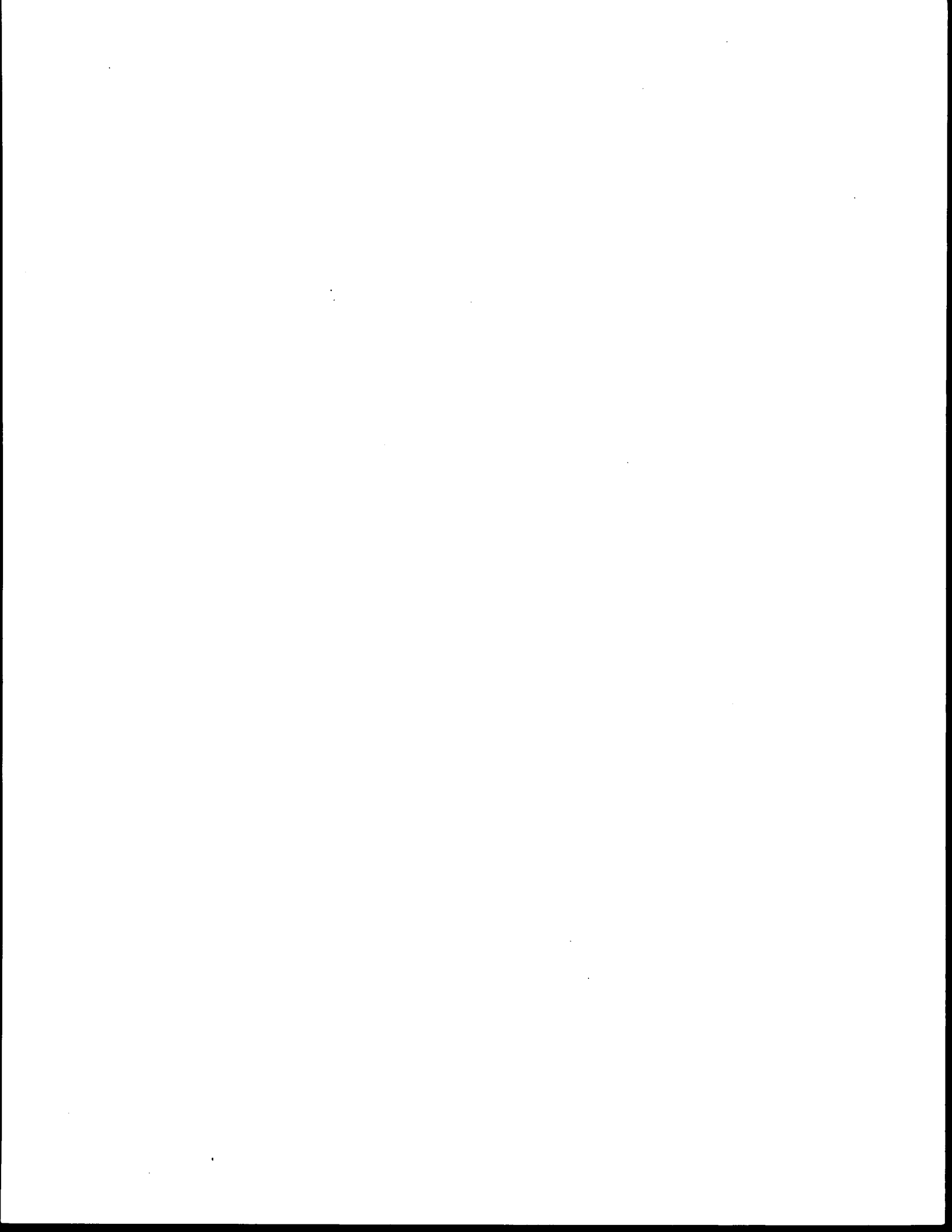
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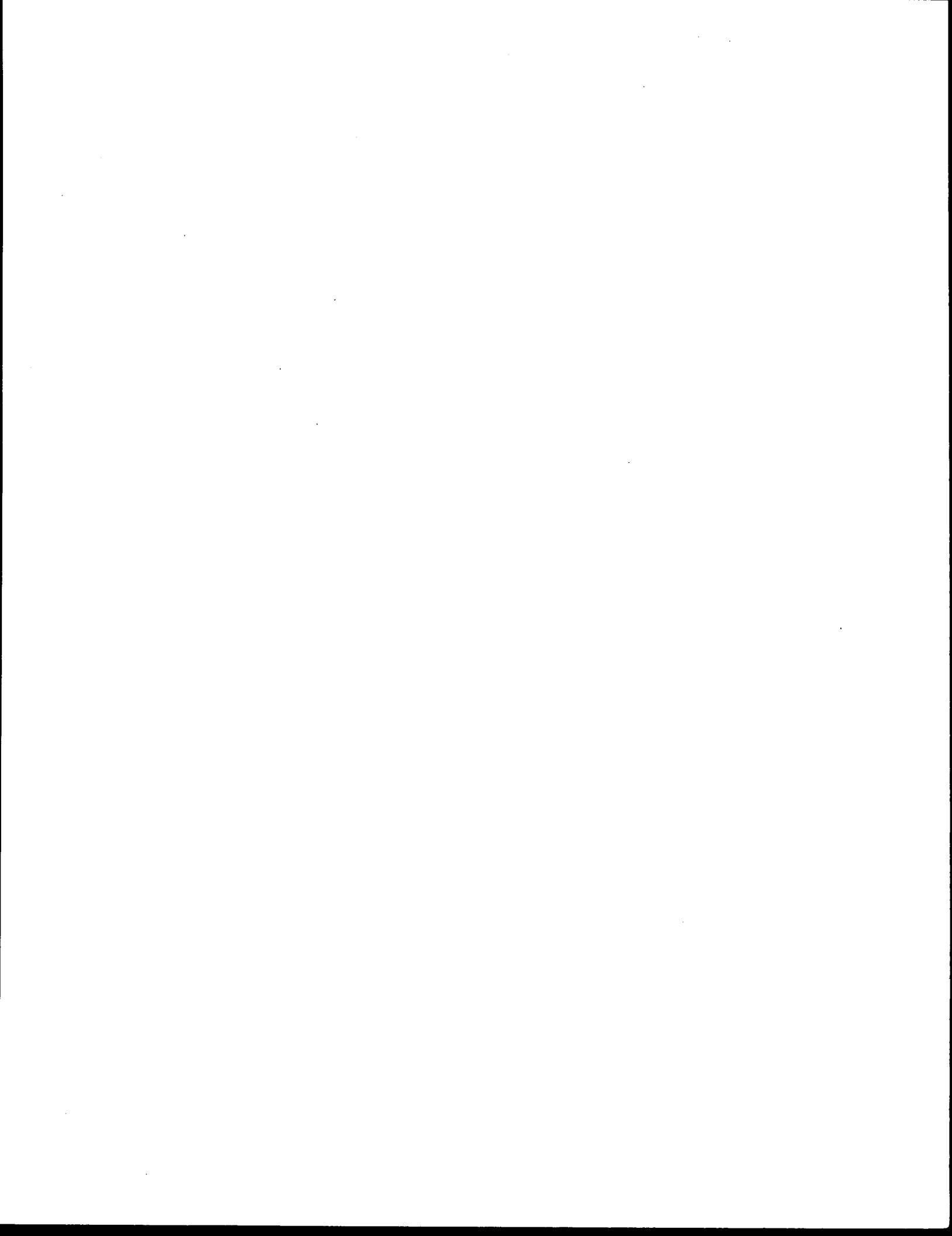
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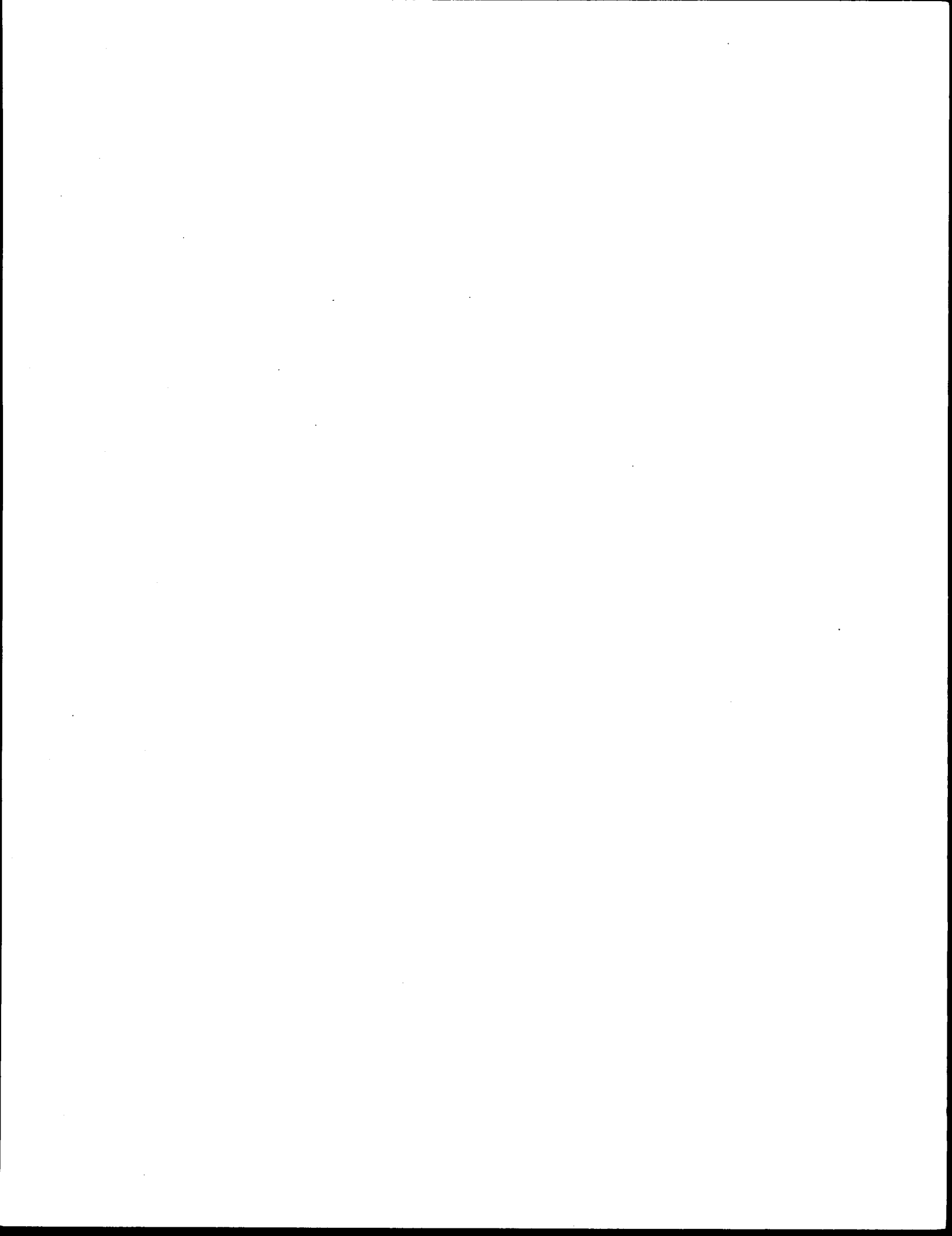


## INTRODUCTION

Forest Health Management (FHM) is responsible for the detection, evaluation, and suppression of insects and diseases on forested Federal lands. FHM also administers financial and technical assistance programs with the State Foresters of Colorado, Kansas, Nebraska, South Dakota, and Wyoming. In addition, the management of gypsy moth is a shared responsibility with the Animal and Plant Health Inspection Service (APHIS). APHIS also has the responsibility for range pest management programs on Federal lands. Close coordination and cooperation of the Federal and State agencies responsible for forest health management are necessary for effective program execution.

### Additional Acknowledgement:

In this year's edition a special acknowledgment goes to the people responsible for the Colorado Front Range Forest Health Assessment - In Region 2, a concern among fire ecologists, disturbance ecologists and agency line officers has been on the rise for many years. With the Buffalo Creek fire that occurred in 1996 on the Pike National Forest, concerns turned to designing an assessment to better predict and understand the Front Range landscape situation as it relates to catastrophic levels of disturbance. With cooperation and collaboration, Forest Service personnel from the Pike/San Isabel National Forest, the Arapaho/Roosevelt National Forest, the Regional Office, and State of Colorado, created and developed the featured Colorado Front Range Forest Health Assessment into a working final report with an associated GIS product. As a result of the Colorado Front Range Forest Health Assessment, federal, state, and local governments have begun vegetation management projects to address the situation described in this assessment. Many individuals are responsible for the quality and usefulness of the following product - thank you all for the valuable work.



# FOREST HEALTH MANAGEMENT ORGANIZATION-1996

## Rocky Mountain Region

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(detailed to CSDS)



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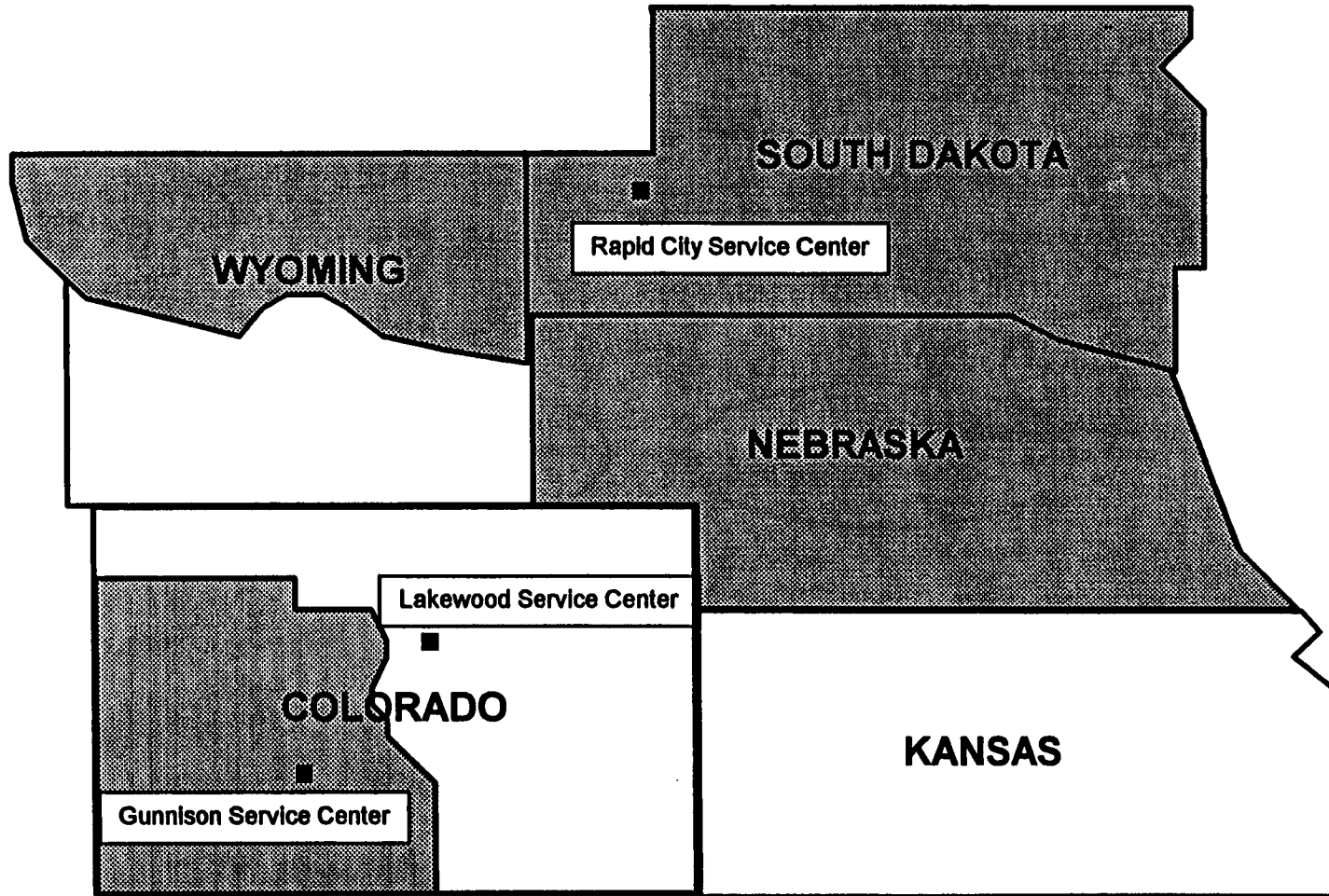
VACANT  
FH MONITORING COORDIN.  
REGIONAL OFFICE



SUSAN J. JOHNSON  
BIOLOGIST  
REGIONAL OFFICE



# ROCKY MOUNTAIN REGION Forest Health Management Zones



## FOREST HEALTH MANAGEMENT SERVICE CENTERS

Three Service Centers serve the Rocky Mountain Region. These were established to provide timely and effective pest management services to their customers. Questions concerning Center operations and requests for service can be directed to the Forest Health Management (FHM) Group Leader in the Regional Office or the respective Service Center Leaders.

The **Lakewood Service Center (LSC)**, 303/236-9451, 303/236-9542 FAX, in Building 20, on the Denver Federal Center provides assistance to Kansas, eastern and northwestern Colorado, and southern Wyoming. This includes the following National Forests and cooperators in adjacent areas:

**Pike and San Isabel (except Leadville, Salida, and San Carlos Ranger Districts)**  
**Arapaho and Roosevelt**  
**Routt**  
**Medicine Bow**  
**White River (Dillon Ranger District only)**

Dave Johnson, Supervisory Plant Pathologist, is the Service Center Leader. Willis (Bill) Schaupp is the LSC Entomologist, Erik Johnson serves Region 2 as the Aerial Survey Specialist and Bernard Benton, Computer Specialist, provides assistance with data entry and testing.

The **Gunnison Service Center (GSC)**, 970/641-0471, 970/641-1928 FAX, is located at 216 North Colorado, Gunnison, Colorado, 81230. It provides assistance to the following National Forests and cooperators west of the Continental Divide in Colorado:

**Rio Grande**  
**Pike and San Isabel (Leadville, Salida, and San Carlos Ranger Districts)**  
**San Juan**  
**Grand Mesa, Uncompahgre, and Gunnison**  
**White River (except the Dillon Ranger District)**

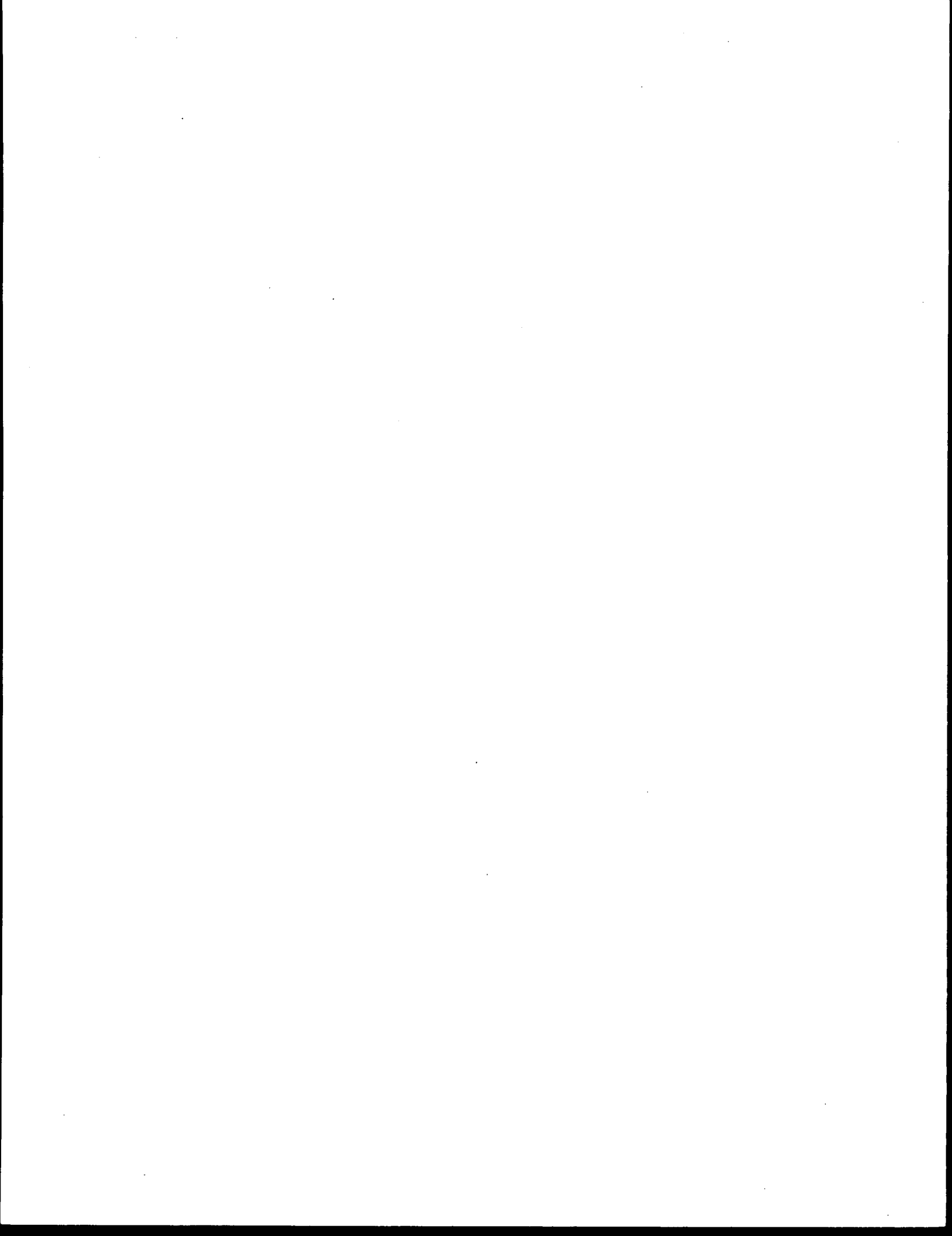
Roy Mask is the Supervisory Entomologist and Service Center Leader. Pete Angwin is the Plant Pathologist and Tom Eager is the Center's Entomologist.

The **Rapid City Service Center (RSCS)**, 605/394-1960, 605/394-6627 FAX, is co-located with the Rocky Mountain Forest and Range Experiment Station at the Forestry Sciences Lab, South Dakota School of Mines and Technology, 501 E. St. Joe, Rapid City, South Dakota, 57701. The Service Center provides assistance to the following National Forests and cooperators east of the Continental Divide in northern Wyoming, and in South Dakota and Nebraska within Region 2:

**Black Hills**  
**Bighorn**  
**Shoshone**  
**Nebraska**

Judy Pasek is Supervisory Entomologist and Service Center Leader. Jeri Lyn Harris is the Plant Pathologist and Kurt Allen serves as the Center's Entomologist.

The Forest Health Management (FHM) staff in the Regional Office, 303/275-5061, 303/275-5075 FAX, located at 740 Simms Street, Golden, Colorado, 80401, provides assistance to the three Service Centers. Robert Averill is the Group Leader; Laura Disbrow is the Systems Analyst, currently detailed to CSDS; Susan Johnson, Biologist, handles special projects such as Cinara reports, is the Pesticide Specialist, and Acting Forest Health Monitoring Coordinator. The Forest Health Monitoring Coordinator position for the Rocky Mountain Region is vacant and is expected to be filled in the near future.





## FOREST HEALTH MANAGEMENT SPECIAL REGIONAL PROJECTS

### PROJECT TITLE:

Pest Trend Impact Plots In The West -  
Rocky Mountain Region

**INVESTIGATORS:** Pete Angwin, Jeri Lyn Harris, Dave Johnson, and Bernard Benton, FHM.

**COOPERATORS:** Bov Eav, Renee Platz, Julie Williams-Cipriani, Judy Adams, FHTET; Jim Friedly, BIA Southern Ute Agency; Elizabeth Stiller, Randy Rick, Jim Allen, and Steve Picsche, Black Hills NF; Sam Schroeder, White River NF; Gary Roper, Mike Morrison and Mike Westfahl, Routt NF; Paul Langowski and Steve Johnson, Roosevelt NF; Jon Morrissey, Grand Mesa / Uncompahgre / Gunnison NF's; Phil Kemp and Bob Vermillion, San Juan NF.

**YEARS:** Began 1990; end undetermined.

**PROJECT DESCRIPTION:** For the past 5 years, Region 2 has been actively involved with the westwide technology development project, "Pest Trend Impact Plots In The West." The objective of the project is to establish a series of permanent plots to provide data for the validation and calibration of various insect and disease computer simulation models. To date, most of the work has concentrated on the installation of plots to monitor the spread of *Armillaria*, *annosus*, and black stain root diseases.

In addition to the installation of the permanent plots, Region 2 FHM participated in the beta-testing of the Pest Trend Impact Plot System (PTIPS) data entry programs. In the spring of 1994, the PTIPS database was installed on the Data General System at the Rocky Mountain Regional Office. Recommendations from the PTIPS testing are currently being used to fine tune the database system.

### PROJECT TITLE:

Survey of biological species of *Armillaria* and *Heterobasidion* in Region 2

**INVESTIGATORS:** Pete Angwin, Jeri Lyn Harris and Dave Johnson. FHM.

**COOPERATORS:** Terry Shaw, Dan Omdal, and John Lundquist, Rocky Mountain Forest and Range Experiment Station; Geral McDonald, Intermountain Research Station; Alice Ratcliffe, Pacific Southwest Forest and Range Experiment Station; various Forest and Ranger District personnel.

**YEARS:** Began 1993; end undetermined.

**PROJECT DESCRIPTION:** The objective is to determine the biological species of *Armillaria* and *Heterobasidion* root disease 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 customers. Starting in 1993, diseased wood samples containing *Armillaria* and *Heterobasidion*, collected throughout the Region, were sent to the diagnostic lab at the FHM Lakewood Service Center. The pathogens were isolated and identified by pairing unknown isolates with known tester strains in culture. Although identification of the isolates is not yet complete, all isolates that have been paired to date have been *A. ostoyae*. The isolates have been catalogued and will be kept in cold storage as part of the Region's new fungal reference collection. A technical report, R2-58, detailing the survey results is available upon request.

## FOREST HEALTH MANAGEMENT SPECIAL REGIONAL PROJECTS

### PROJECT TITLE:

GIS - based Landscape Scale Root Disease Hazard Rating System

**INVESTIGATORS:** Jeri Lyn Harris, Judy Pasek, and Dave Johnson, FHM.

**COOPERATORS:** William Jacobi, Dept. of Plant Pathology and Weed Science, CSU; Robin Reich, Dept. of Forestry, CSU; Melanie Kallas, Graduate Student, Department of Forestry, CSU.

**YEARS:** Began 1995; end 1997.

**PROJECT DESCRIPTION:** Existing data on Armillaria root disease occurrence and new field data will be coupled with NRCS soil classification, stand inventory, site disturbance, habitat type, and meteorological data in a database. Utilizing spatial statistical analysis, an Armillaria root disease hazard rating system will be developed for the Black Hill National Forest.

### PROJECT TITLE:

Site and Stand Factors Associated with the Occurrence of Douglas-fir Beetle in Douglas-fir

**INVESTIGATORS:** Bill Schaupp, FHM; Jose Negron, Rocky Mountain Forest and Range Experiment Station; Ken Gibson, FHM-Region 1; Ralph Thier, Steve Munson, and others, FHM-Region 4.

**COOPERATORS:** Biometrics Group - Rocky Mountain Forest and Range Experiment Station.

**YEARS:** Began 1992; end 1996.

**PROJECT DESCRIPTION:** The objective is to evaluate characteristics of DFB infestations in Douglas-fir in order to develop an estimate of loss model. This model will be available to classify stands according to the relative level of expected mortality from future DFB epidemics. This project will provide a planning tool that can be used to prioritize proactive hazard mitigation efforts and predict future DFB epidemics.

Douglas-fir stands recently infested by DFB and uninfested stands were sampled and data collected on site, stand, and tree characteristics using standard USFS inventory procedures.

### PROJECT TITLE:

Forest Health Monitoring - Off-Plot Monitoring

**INVESTIGATORS:** Forest Health Management-Region 2; Intermountain Research Station - FIA; Colorado State Forest Service.

**YEARS:** Began 1991; on-going.

**PROJECT DESCRIPTION:** Forest Health Monitoring is a national program authorized by the Forest Ecosystems and Atmospheric Pollution Research Act of 1988, and the Food, Agriculture, Conservation, and Trade Act of 1990 (Farm Bill) amendments to the Cooperative Forestry Assistance Act of 1978 (P.L. 95-313). The Forest Health Program evolved in response to the public's concern for the "health and productivity of forests in the United States." In order to address the public's concern and the effects of various stressors on the forest ecosystem, a long-term monitoring program was developed. Currently, Colorado and Wyoming participate in the national program; additional Rocky Mountain states will join the program in the near future.

The Forest Health Monitoring program is organized into three components: Detection, Evaluation, and Intensive Site Ecosystem Monitoring. The Rocky Mountain Forest Health Management organization has the role of providing off-plot information as part of the detection monitoring component of the program. Off-plot monitoring has been implemented through the use of aerial photography of the installed plot system in Colorado and annual aerial surveys of the plot network in both Colorado and Wyoming. To date, a full array of Colorado aerial photography has been acquired and photo-interpreted within a 25-acre circle of plot center. A publication reporting the results of this effort is scheduled for release in the summer of 1997.

# COLORADO FRONT RANGE FOREST HEALTH ASSESSMENT

(Editors Note: The following report is a combination of scientific observation and common sense which cuminated into a set of maps visually depicting the Colorado Front Range Forest Health Assessment. The relevant maps are included at the end this section for the readers use and understanding.)

Interest in the Front Range forests of Colorado has grown as a consequence of more people taking up residence along this area of Colorado. The public, in general, and resource management professionals, in particular, are concerned about the current and future condition of the Front Range forests. General agreement about how the landscape should look and be managed has not been forthcoming. Often the vision for the forests is incompatible with the biological processes that regulate forests which illustrates the lack of understanding of those processes.

The Colorado Front Range Forest Health Assessment was designed to provide land managing agencies and the public with a broadscale understanding of the forest health issues of the Front Range. Additionally, the assessment identifies areas where potential conflicts between human use (i.e., housing and recreation opportunities) and disturbance process (i.e., fire, insects and disease) exist on the landscape. The desire for this assessment is to assist decision makers in identifying where on the Front Range landscape catastrophic levels of disturbance appear to be unacceptable to human values.

## INTRODUCTION AND BACKGROUND

The Forest Health Assessment was developed to answer two specific questions:

- Where are the forest ecosystems most at risk to severe, large-scale disturbances that are outside the historical range of variability?
- What important resources are at risk to severe, large-scale disturbances?

The Colorado Front Range Broadscale Assessment does:

- provide a "first approximation" of the relative size and extent of the situation.
- provide a strategic planning tool for land managers and local governments, who will be

able to identify the areas of highest risk to life and property.

- indicate to land managers and local governments where to "take a closer look" when evaluating landscape- and project-scale work for vegetative management of desired conditions, existing conditions, and/or potential treatment areas for greatest impact.

The Colorado Front Range Broadscale Assessment does not:

- prescribe the types and amounts of vegetation treatments.
- provide the data and analysis needed for more site-specific landscape- or project-scale planning.
- evaluate all disturbance risks to all important resources and uses. The assessment analyzed risks to vegetation using major forest cover types and associated disturbance regimes to capture the status of terrestrial ecosystems and housing density to represent the socioeconomic system within the Front Range forests.

Resources and uses such as riparian/wetland, municipal watersheds, wilderness, research natural areas, recreational opportunities, timber, and threatened and endangered species can be evaluated through the NEPA process and are inappropriate for analysis at this scale.

## Scale of Analysis

The scale is large and purposely chosen to reflect the broad implications of forest health along the Front Range. Analysis at this scale deals with processes and not with specific contents of the landscape other than major forest cover types.

## Disturbance Processes

Awareness and understanding of disturbance processes and the role disturbance plays in the ecosystem are essential to the understanding of ecosystem capabilities and the consequences of management choices.

Along the Front Range, disturbances caused by drought, disease, wildfire, insects, erosion, flood, and wind, constantly affect forest

## COLORADO FRONT RANGE FOREST HEALTH ASSESSMENT

ecosystems. Common as these elements are, humans often perceive them as being in conflict with human values, and collectively we work to minimize their effects in an effort to create a more stable ecosystem. With the practice of minimizing impacts at an economic and social level, disturbance processes within the forest ecosystem are occurring at catastrophic levels.

Most land managers and astute nature observers, based upon knowledge and experience, are able to say something about the periodicity of some disturbances. Drought, disease, insects, wildfire, and wind are recurring events along the Front Range and can be associated with certain forest and climatic conditions. To this extent, we can broadly identify disturbance regimes with some confidence. Identification of disturbance regimes assists in the understanding of their role in ecosystem dynamics and in understanding their socio-economic impacts.

### Forest Health

Forest health is a human concept of how a forest should function; therefore, defining it in terms relative to human desires and needs is most practical. In light of this, from a land managing agency perspective, forest health can be defined as a desired state of conditions where biotic and abiotic influences on the forest do not threaten management objectives now or in the future.

On the other end of the spectrum, conceptually, a healthy ecosystem is one in which vegetation composition, structure, and function allow for the maintenance of biological diversity, biologic integrity, and ecological processes over time.

Forest health is predicated on management objectives, whereas a healthy ecosystem is predicated on ecological processes. Forest health is content oriented; healthy ecosystems are process oriented. Both perspectives are valid and dependent upon the dynamics of forested ecosystems. Therefore, a relationship does exist between human valuing of forest health and the ecological processes that shape the landscape. This relationship is most often expressed in the contents of the ecosystem and how those contents are valued by humans. As ecosystems change overtime, with or without

human intervention, it is the human perspective that assigns value to the content and rate of change of these forested environments. Within this framework, forest health can be somewhat quantified, shaped, and directed by our choice of actions.

### Historic Range of Variability

Ecological succession is a continual process of slow change which guides the composition and structure of the forest ecosystems overtime. Ecosystems are dynamic and changes can be "slow" caused by ecological succession or "fast" caused by disturbance events. The affect of change on the ecosystem composition and structure depends on the spatial scale of the change and the severity of the change event.

Overtime, these changes fall within a range that reflects the genetic potential of species to wax and wane in accordance with the intensity and frequency of forest disturbance events. This range is referred to as the "range of natural variability" or "the historic range of variability (HRV)." These ranges reflect species composition, size classes of species, and stocking densities with disturbance events and ecological succession an intimate part of the forest picture. HRV can provide insights as to what the forest capabilities are and can subsequently function as a predictive model for future large scale disturbance events.

### Process for Analysis

Three elements were used to evaluate Front Range forest health: Hazard (forest conditions which are conducive to large scale disturbance events); Risk (the probability of ignition and spread of a disturbance event); and Value (the monetary and intrinsic worth that society ascribes to landscape/ecosystem components). The result of analyzing these elements was to identify areas on the landscape where the juxtaposition of human values and disturbance processes appeared to be high, moderate, and low. Of the set of GIS maps provided, the final map in the series, illustrates the areas along the Front Range which have a high, medium, or low potential for catastrophic disturbance events.

A Geographic Information System or GIS approach was used to analyze hazard, risk and value on the Front Range landscape. The

# COLORADO FRONT RANGE FOREST HEALTH ASSESSMENT

"layers" were disturbance regimes, current forest conditions, and human population densities. Disturbance regimes were interpreted using satellite imagery (AVHRR) of vegetation, a standard method to assess vegetative status. Current forest conditions were inferred from extensive and intensive forest inventory databases, then compared to existing HRV's prepared for major forest cover types. Human population densities and spatial distribution was inferred from 1990 census data to provide data on number of dwellings per acre.

To capture the element of risk, some inferences based upon human and climatic behavior had to be inferred. Basically, an ignition event can be caused by humans or by natural phenomena such as insect activity or lightning strikes. The closer human influence is to forested areas which are considered to have hazardous conditions and the higher the density of that human influence, the higher the probability for a human ignited disturbance event. For natural phenomena, the presence of a disturbance agent results in a higher probability of that disturbance agent becoming epidemic - resulting in a higher risk rating. In areas which experience high frequencies of lightning strikes (like the Front Range), a higher risk rating is assigned.

Potential for spread, the other component of risk, is the difference between what would result in a large scale disturbance event compared to a small scale disturbance event. The result is dependent upon the current stand conditions and present stand conditions as relative to HRV. In general, when the current stand conditions are outside of the historic range of variability, in terms of composition, tolerant tree species are at a high percentage, and density of individual trees exceed 80 square foot basal area per acre, then the forests are at high risk for a large scale event.

### Results of the Front Range Forest Health Assessment

Based on observations and historic records, frequency of large scale disturbance events along the Front Range, the short interval disturbance regime was set at 40 years between events. This means that the Front Range forests experience insect/disease/fire events of a large scale on the landscape at a frequency

interval every 40 years or less. In this regime are landscapes that include the shrub, grass, pinyon-juniper, ponderosa pine, and mixed conifer types. The spruce/fir forest cover type was at the long interval regime of 100 years between disturbance events. The lodgepole pine and aspen appear to fit between these two regimes, thus, they are associated with the medium interval disturbance regime. However, it should be noted that lodgepole pine behaves more like a short interval regime at the lower elevations and behaves as a long interval regime at the higher elevations; but at this assessment scale it is only an informational point.

When current forest conditions for the Front Range were compared to the forest conditions reported for the HRV, it was evident that the Front Range is "outside" of the HRV. For the Front Range, this means significantly fewer acres of dominant seral species, like ponderosa pine and aspen, and trees per acre have significantly increased. Shade tolerant trees such as Douglas-fir, subalpine fir, and white fir, predominate on thousands of acres and in densities which are at high hazard and risk to large scale catastrophic disturbance events.

As previously stated, value was calculated using the structure density component of the 1990 census data. Value is a difficult element to assess; however, because people naturally want to protect their investments, like residential housing and recreational facilities, housing density is a factor in the assessment of value. The assignments for density are 1 structure per 100 acres is low density, 1 to 10 structures per 100 acres is medium density, and 10 structures and greater per 100 acres is in the high density category.

A Matrix of the Disturbance Regime and Housing Density integration follows:

		Disturbance Regime		
		Short	Medium	Long
Housing Density	High	H	H	M
	Medium	H	H	M
	Low	M	M	L

## **COLORADO FRONT RANGE FOREST HEALTH ASSESSMENT**

As a result of combining the disturbance regime (hazard), current forest conditions (risk), and housing density (value), areas with high, moderate, and low potential for catastrophic events were identified on the Forest Range landscape. Not too surprisingly, a large portion of the Front Range was identified as possessing a high potential for a catastrophic event.

### **Summary**

The Front Range Forest Health Assessment has facilitated land managers and the public with an opportunity to better determine where the highest priority for vegetation treatment exists. Partnerships between federal, state, and local governments are working together to begin the task of bringing the Front Range forests into a healthier and safer condition.

This hazard/risk/value assessment represents an important addition to the analysis toolbox available to land managers. It identifies areas where high potential for large, severe wildfires and/or insect outbreaks exists, but where such events are unacceptable. The unique combination of structural density and disturbance regimes in this assessment highlights some of the consequences to disturbance, like stand-replacing fires and insect epidemics, that because of stand conditions exceed the historic pattern and affects of disturbance dynamics within the ecosystem.














Finally, the Front Range Forest Health Assessment demonstrates the relative size

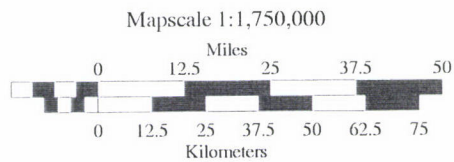
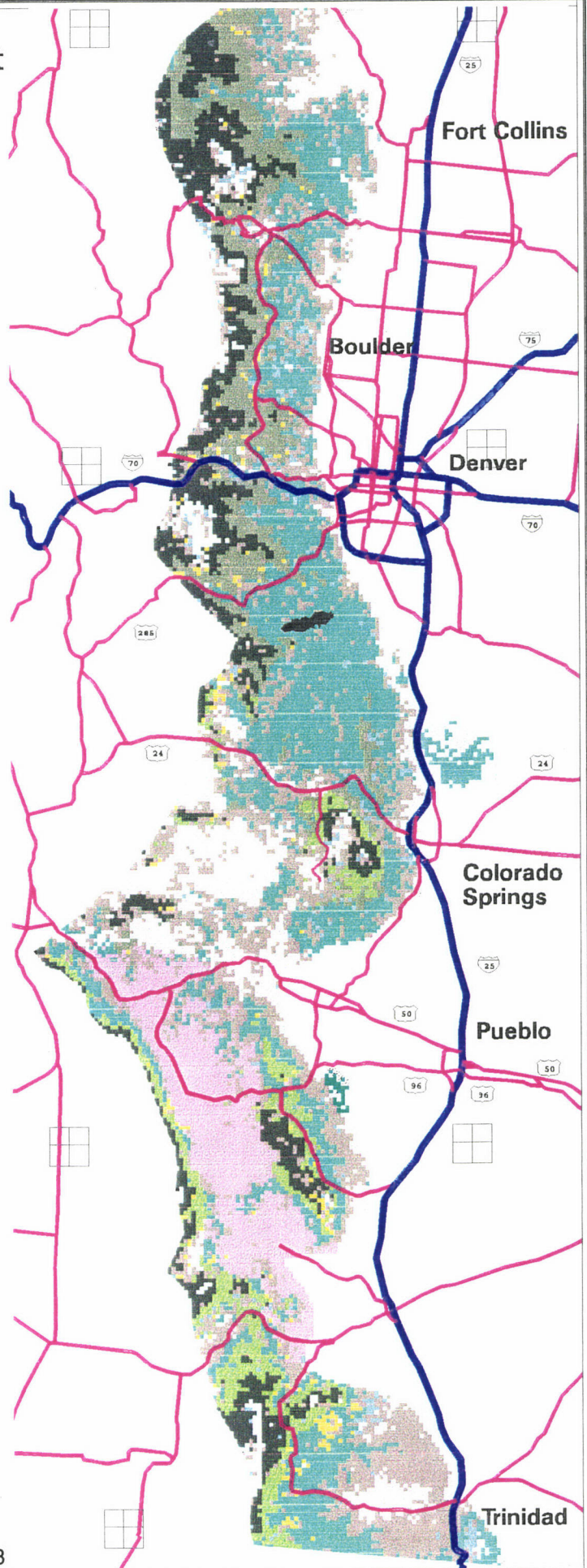
and magnitude of the challenge facing land managers and their corresponding attempts to develop sustainable and resilient forest ecosystems. The job of restoring sustainable ecosystems along the Front Range of Colorado is a massive and a collective responsibility. Ultimately the assessment is a broad look at the situation. Projects designed to address the catastrophic disturbance potential will have to be customized for site-specific features. To date, several agencies are developing strategies that meet the desire for forest health and healthy ecosystems.



# Colorado Front Range Assessment

## Forest Cover Types

-  Alpine Tundra | Rock : 113.05 sq miles
-  Shrubland -Grassland : 1597.87 sq miles
-  Grassland -Shrubland : 818.64 sq miles
-  Elm -Ash -Cottonwood : 14.88 sq miles
-  Douglas Fir : 476.08 sq miles
-  Ponderosa Pine : 2372.43 sq miles
-  Lodgepole Pine : 883.38 sq miles
-  Fir -Spruce : 1007.79 sq miles
-  Chaparral : 0.49 sq miles
-  Pinyon -Juniper : 2056.16 sq miles
-  Western Hardwood : 165.89 sq miles
-  Aspen Birch : 127.2 sq miles
-  Buffalo Creek Fire -18.75 sq miles







This GIS product was compiled from various sources and may be corrected, updated, modified, or replaced at any time.

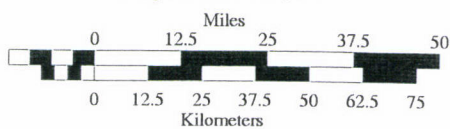
September 27, 1996



### Disturbance Regimes

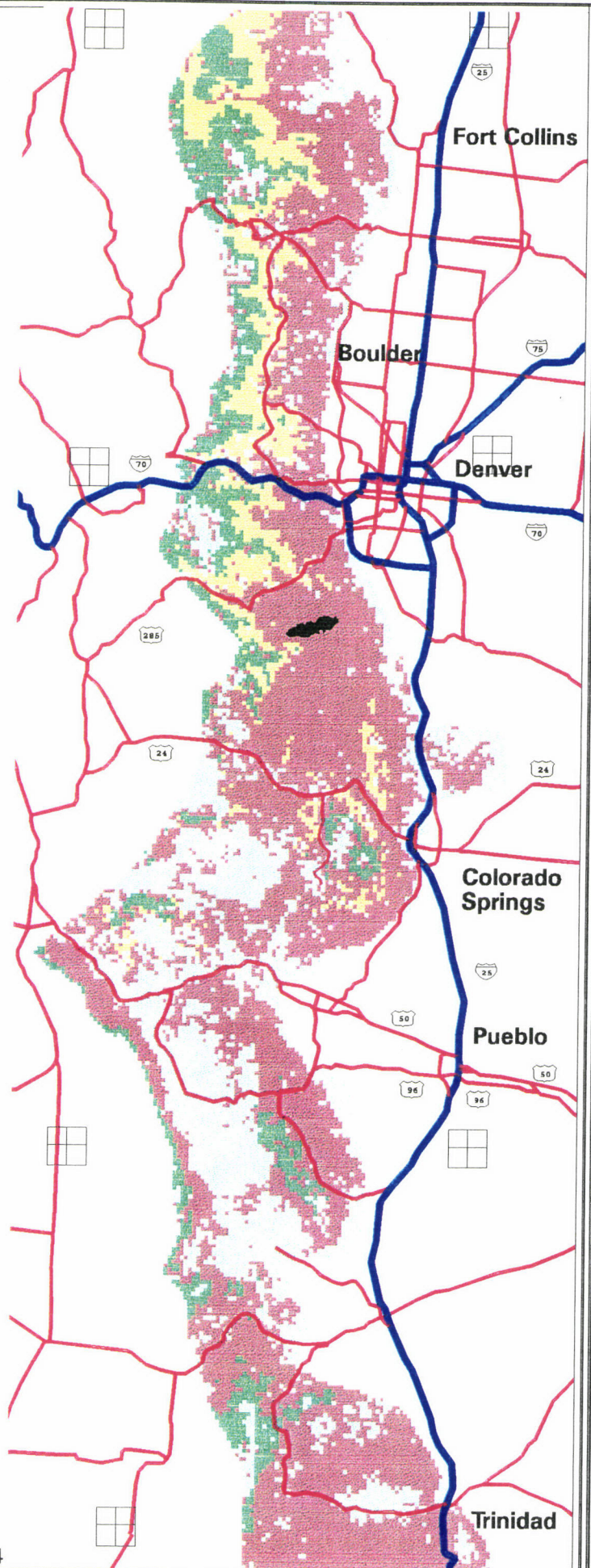
-  Short Interval < 40 yrs : 82.83 sq miles
-  Medium Interval 40 to 100 yrs : 10.37 sq miles
-  Long Interval 100+ yrs : 12.48 sq miles
-  Non-Forested Areas : 41.73 sq miles

Mapscale 1:1,750,000





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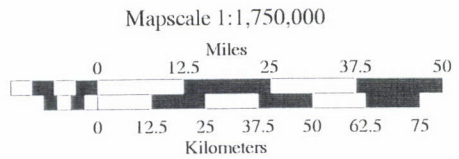
September 27, 1996





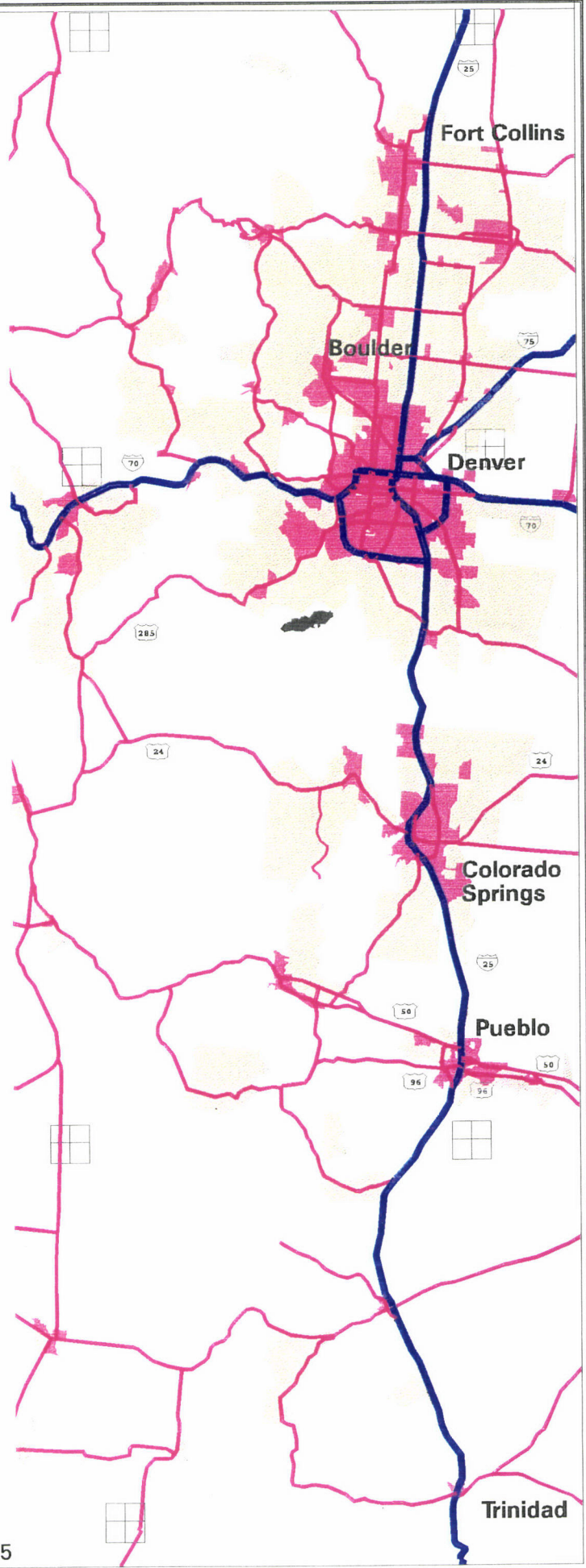
**Housing Density**

- 
 Medium (1 to 10 houses/100 acres)  
 7966.37 sq miles
- 
 High (>10 houses/100 acres)  
 1724.56 sq miles



This GIS product was compiled from various sources and may be corrected, updated, modified, or replaced at any time.

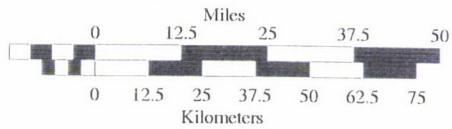
**September 27, 1996**



**Probability of Catastrophic Disturbance Events**

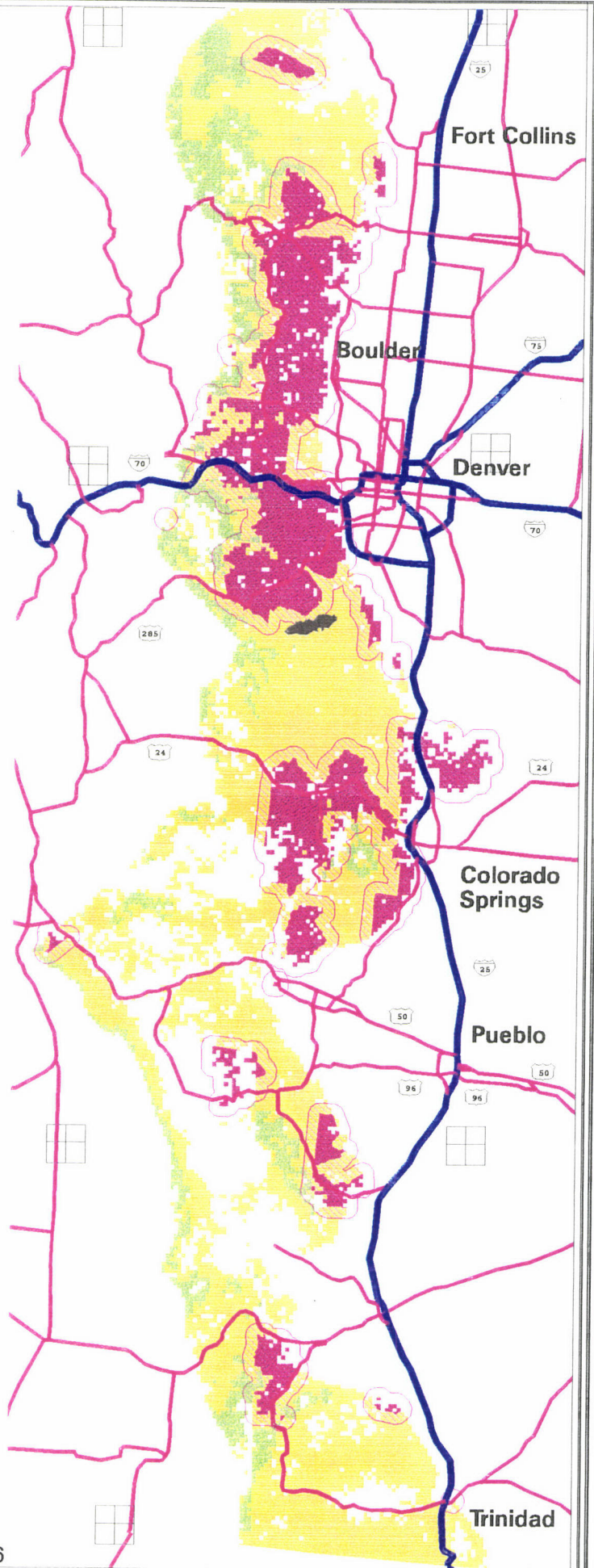
- High -1528.45 sq miles
- Medium -4412.94 sq miles
- Low -883.96 sq miles
- High Area Buffers -3735.09 sq miles

Mapscale 1:1,750,000



This GIS product was compiled from various sources and may be corrected, updated, modified, or replaced at any time.

**September 27, 1996**



## SUMMARY OF INSECT AND DISEASE CONDITIONS

### STATUS OF INSECTS

#### DEFOLIATORS

##### Douglas-fir tussock moth Orgyia pseudotsugata

Hosts: Douglas-fir, Engelmann spruce

No defoliation was detected in 1996, indicating that the epidemic of 1993-1995 has completely collapsed. An early warning system using pheromone traps detected no areas of Douglas-fir tussock moth increase. It appears that Douglas-fir beetle populations increased in heavily defoliated stands and are now attacking trees in adjacent areas.

##### Western spruce budworm Choristoneura occidentalis

Hosts: Douglas-fir, Engelmann spruce, Subalpine fir, White fir

Widespread defoliation of Douglas-fir, true firs, and spruce continued throughout the forests of southern Colorado. In the Salida area of Colorado, an estimated 5,000 acres of infested private lands was reported. Current year defoliation in this area was in the moderate category. Other areas of activity reported for Colorado were in areas between South Fork and Wagon Wheel Gap and north of Lake City. No significant activity was reported in Wyoming in 1996.

##### Gypsy moth - European variety Lymantria dispar

Hosts: Hardwoods

Surveys continue region-wide on federal, state, and private lands. In Colorado, a total of 1,799 detection traps were deployed. An additional 153 delimitation traps were placed surrounding previous positive trap sites. A total of four moth catches were made in detection traps in 1996, one per site in the following areas: Denver, Lafayette, Northglenn, and Hotchkiss. The delimitation trapping caught no moths. Delimitation trapping will be done around all 1996 catches. Detection trapping was

expanded to include additional federal sites. In Wyoming, a total of 554 detection traps were deployed. An additional 80 delimitation traps were placed surrounding previous positive trap sites. Single moth catches were made in Cody, Jackson, and Sheridan. In 1996, delimitation trapping caught no moths in Wyoming. On Warren Air Force Base in Cheyenne, one trap caught eight gypsy moths and an adjacent trap caught three moths; an additional single catch was made nearby, for a total of 12 moths caught on the base. This is the most gypsy moths ever caught in one year in Wyoming. An extensive delimiting survey is planned in 1997 on Warren Air Force Base, as well as around the three other single catches. In South Dakota, four moths were caught from 697 detection traps. Moths were caught in Meade and Pennington Counties. In Nebraska, four moths were caught: two in Omaha, and one each in South Sioux City and Harlan Counties.

#### BARK BEETLES

##### Douglas-fir beetle Dendroctonus pseudotsugae

Hosts: Douglas-fir

An extensive outbreak in western Colorado and eastern Utah has been in progress for several years. In Colorado, from Rifle west to the Douglas Pass area to the Utah border, approximately 7,246 trees were killed in 1996. Because previously killed snags outnumber current faders, it is likely that this outbreak is declining. Scattered mortality included parts of the Wet Mountains, San Isabel National Forest and an area between Pagosa Springs and Bayfield, San Juan National Forest. These areas are expected to have continued beetle activity. Many trees that were burned by the Buffalo Creek fire, Pike NF, were found to be heavily infested. It is possible that this may spawn an outbreak in the South Platte River drainage. Nearby, additional mortality is occurring in areas heavily defoliated from 1993-1995 by the Douglas-fir tussock moth. Mortality along the Colorado Front Range continues to occur in small, widely scattered groups. Most mortality is on steep inaccessible slopes where western spruce budworm had defoliated trees over the past decade. On the Shoshone NF,



## SUMMARY OF INSECT AND DISEASE CONDITIONS

Wyoming, the epidemic appears to be subsiding on the Clarks Fork and Wapiti Ranger Districts. Approximately 1,000 trees were killed in 1996.

### **Pine engraver beetle**

Ips spp.

Hosts: Ponderosa pine

Ips sp. activity along the Front Range of Colorado continued, with high levels of activity reported in the Black Forest. Ips confusus activity was reported in pinyon pine on the western slope, particularly in areas west of Durango and south of Montrose, Colorado. Ips hunteri was reportedly responsible for urban Colorado blue spruce top and tree mortality in Denver, Greeley, and Colorado Springs. Small pockets of top kill and tree mortality continued to be present in ponderosa pine in the Black Hills. In Wyoming, very little Ips sp. activity was reported.

### **Mountain pine beetle**

Dendroctonus ponderosae

Hosts: Limber pine, Lodgepole pine, Ponderosa pine

In Colorado, mortality continues to increase in ponderosa and lodgepole pine. Aerial survey results from 86% of this area identified 12,891 dead trees on 10,879 acres. Areas of concern include, the Uncompahgre Plateau, Derby Mesa, Steamboat Lake State Park, the Vail Valley, the western foothills of the Arkansas Valley, the Frisco/Keystone area, Table Mountain and the Granby area, the Cache la Poudre/Redfeather Lakes area, Larkspur, and Buena Vista, where approximately 2,440 infested ponderosa pines and a few lodgepole pines, on 3,200 acres, were reported. The infestation near Buena Vista is expected to continue in 1997. The tri-county area of Summit-Grand-Eagle (Frisco/Keystone area) saw a 180% increase in mountain pine beetle activity in 1996 from 1995. A total 3,425 trees were infested in 1996. The populations are expected to increase. Along the Front Range of Colorado, a general increase of mountain pine beetle activity was reported in ponderosa pine. Activity of the mountain pine beetle on the Black Hills was very low. Approximately 1,500

ponderosa pine trees were killed on 2,900 acres of the Black Hills in South Dakota and Wyoming. Mountain pine beetle activity associated with pine tussock moth defoliation on ponderosa pine declined for the third consecutive year near Edgerton, Wyoming. An area around Deer Mountain, south of Laramie, is still of concern. Statewide, mountain pine beetle activity increased slightly throughout Wyoming.

### **Spruce beetle**

Dendroctonus rufipennis

Hosts: Engelmann spruce

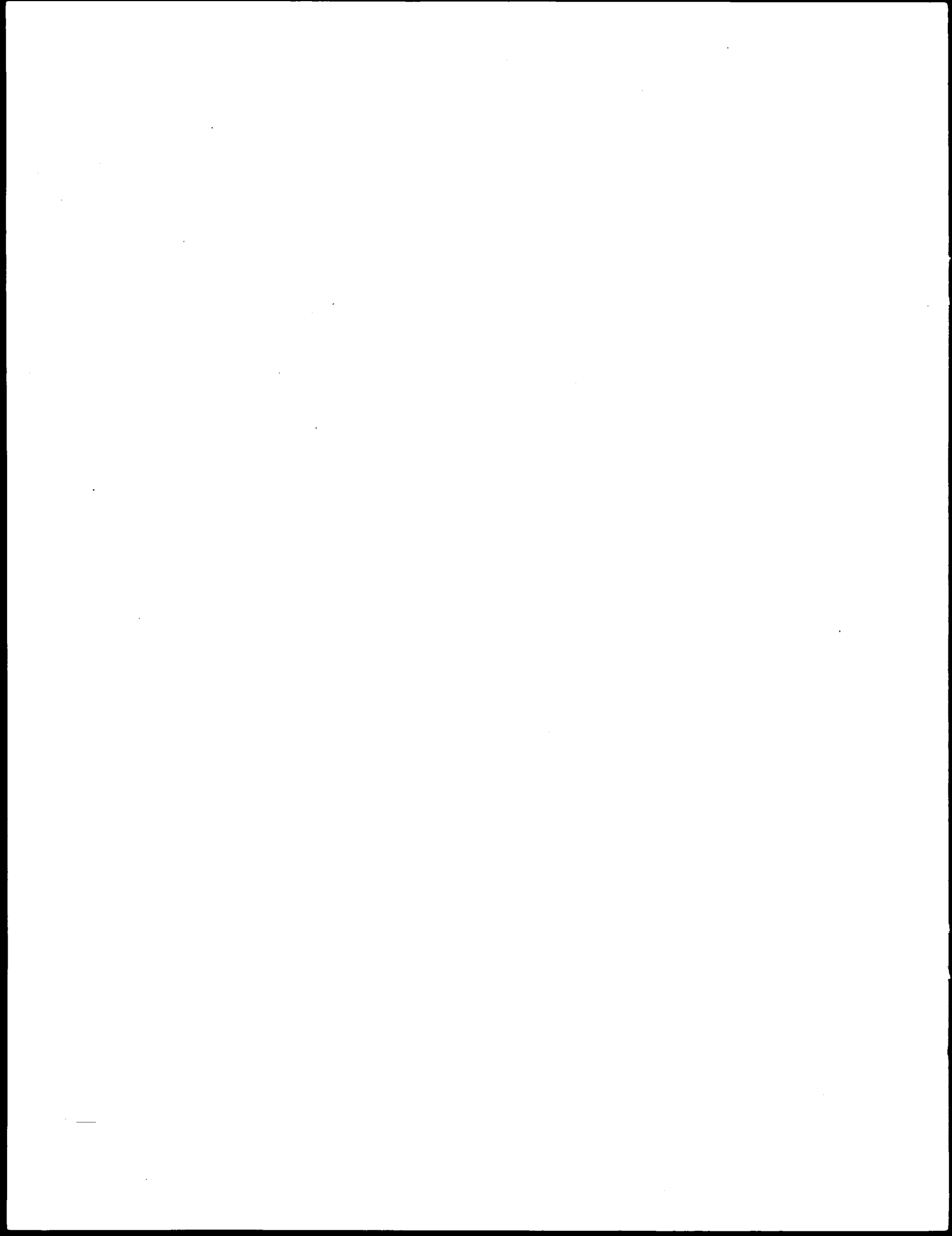
Spruce beetle activity in the state of Colorado was minimal and occurred only in very isolated areas, i.e., Forbes Trinchera Ranch south of Fort Garland, Colorado. Slight population increases were associated with spring blowdown in western Wyoming. Activity occurred in scattered patches, containing only a few dozen trees.

### **Western balsam bark beetle**

Dryocoetes confusus

Hosts: Subalpine fir

Mortality was common throughout the spruce/fir cover type from the Wyoming - Colorado border south throughout the Rocky Mountains. Additional factors, especially Armillaria root disease and possibly other biotic and abiotic components, are acting together to produce this mortality. The area from Centennial, Wyoming, to Grand Junction and Leadville, Colorado, has especially concentrated areas of mortality. Aerial survey of 86% of Colorado documented 327,993 dead subalpine fir on 147,244 acres. Efforts are underway to determine the causes, effects, and mitigation measures possible to deal with this mortality complex. Mortality was common on both the Shoshone and Bighorn National Forests in Wyoming. Over 12,500 trees on 7,000 acres were affected on a combination of National Forest, other federal, state, and private lands in and adjacent to Shoshone National Forest. Mortality was common throughout the spruce/fir cover type in Wyoming.



# SUMMARY OF INSECT AND DISEASE CONDITIONS

## STATUS OF DISEASES

### STEM AND BRANCH DISEASES

#### Dwarf Mistletoe

##### Arceuthobium americanum

Hosts: Lodgepole pine

Dwarf mistletoes cause the greatest disease losses in Region 2. Losses equal at least 10 million cu. ft. annually. In Colorado, 50% of the lodgepole pine type is infested. Forest Health Management funded presuppression surveys and silvicultural control on six National Forests. Continuing emphasis is being placed on surveys at landscape scale and on suppression projects in developed recreation sites.

#### Dwarf Mistletoe

##### Arceuthobium douglasii

Hosts: Douglas-fir

Occurs mostly in the southern two-thirds of Colorado. Forest Health Management funded a control project on the Salida Ranger District, San Isabel National Forest. Areas of management concern are; Columbine Ranger District, San Juan National Forest; Mountain Lion Lookout area, Saguache Ranger District, Rio Grande National Forest; and Long Creek on the Uncompahgre Plateau, Uncompahgre National Forest.

#### Dwarf Mistletoe

##### Arceuthobium vaginatum subsp.cryptopodium

Hosts: Ponderosa pine

Losses amount to 885,000 cu.ft. annually. Suppression projects emphasized tree removal and pruning of infested trees in developed recreation sites. Forest Health Management funded silvicultural control projects on the Southern Ute Reservation and the Salida Ranger District, San Isabel National Forest. Private landowners in the Black Forest and along the Front Range of Colorado are reporting concerns as a consequence of newly established residences in infested areas.

## ROOT DISEASES

### Armillaria root disease

#### Armillaria spp.

Hosts: Conifers and Hardwoods

Armillaria root disease is easily the most common and damaging of the root diseases in Region 2. *Armillaria ostoyae* has been identified as the only biological species present on 10 different tree hosts in Colorado, South Dakota, and Wyoming. The disease is commonly associated with the decline of subalpine fir caused by several bark beetles (*Scolytus/Dryocoetes*) throughout Colorado and Wyoming. Subalpine fir damage caused by this complex is particularly high at Aspen Mountain, Crested Butte, and Powderhorn Ski Areas; on the White River National Forest, in areas including, Basalt Mountain, Burnt Mountain, and Kobey Park; on the Uncompahgre Plateau at Ouray Springs; on white fir in the San Juan National Forest.

### Black Stain root disease

#### Leptographium wagenerii

Hosts: Pinyon pine, Ponderosa pine

Black stain root disease continues as a problem on pinyon pine in the southwestern corner of Colorado. Recent mortality was detected on private land near Colona, Colorado. The disease is of concern in recreation areas near McPhee Reservoir and at Mesa Verde National Park.

## VASCULAR DISEASES

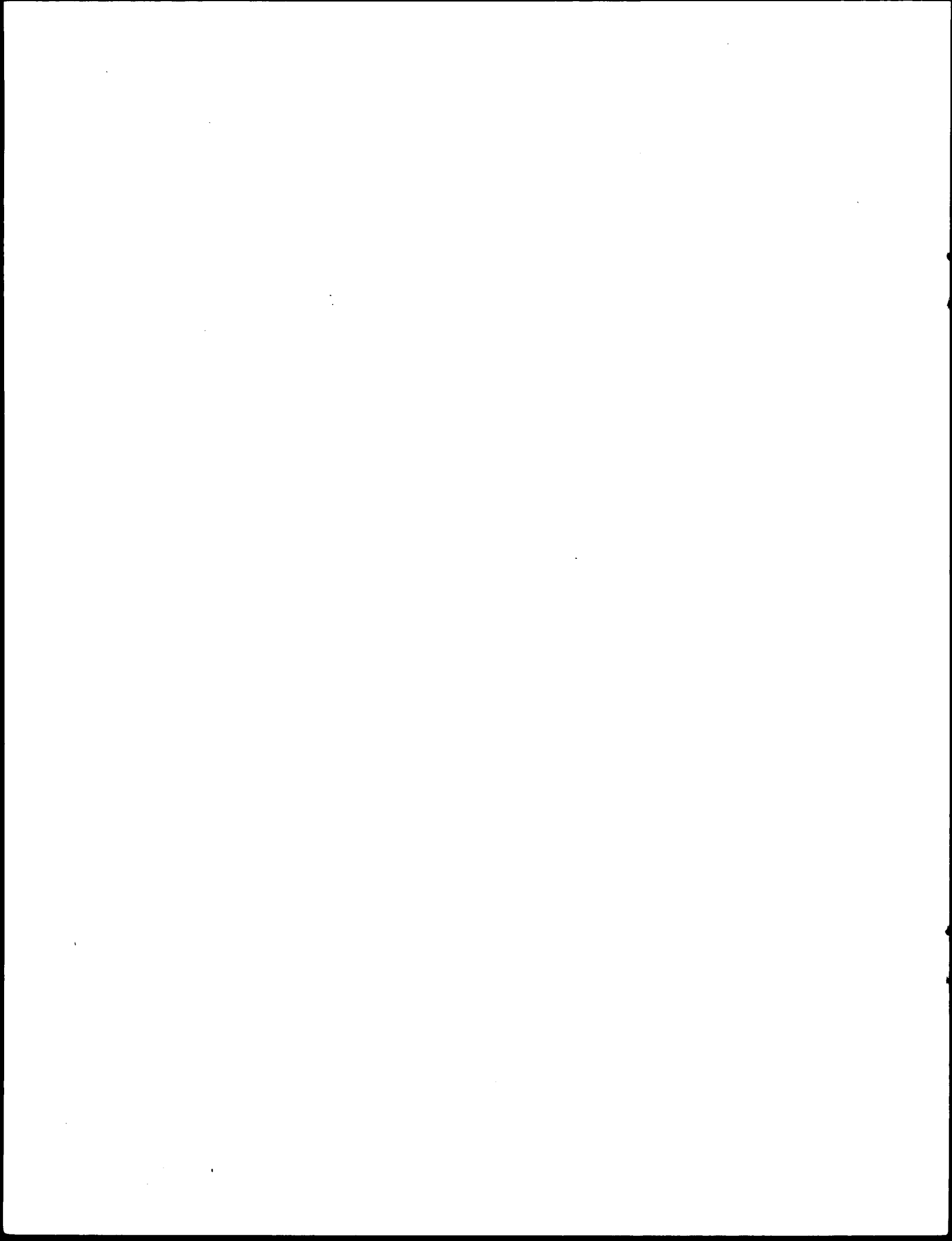
### Dutch Elm Disease

#### Ceratocystis ulmi

Hosts: Elm species

All states report moderate levels of Dutch elm disease activity for 1996. Sanitation remains the predominate method for all states to manage the spread of the disease.

**FISCAL YEAR 1996**  
**ROCKY MOUNTAIN INSECT AND DISEASE**  
**STATUS REPORT**





Rocky Mountain Region - Status of Insects in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

INSECT	HOST	LOCATION	REMARKS
<b>Bronze birch borer</b> <i>Agilus anxius</i>	Paper birch	Nebraska, South Dakota, Wyoming	In Nebraska, the borer is common in urban areas in the eastern part of the state. In South Dakota, insect activity in 1996 was low. In Wyoming, insect activity is responsible for occasional top kill and mortality of cutleaf weeping birch.
<b>Cankerworms</b> <i>Alsophila pometaria</i> <i>Paleacrita vernata</i>	Bur oak, Elm, Green ash, Hackberry, Honeylocust	Kansas, South Dakota, Wyoming	In South Dakota, insect activity in the central part of the state declined in 1996 from the moderate to heavy activity in urban and floodplain locations for 1995. Kansas reported low activity in 1996.
<b>Chafer</b> <i>Diplotaxis obscura</i>	Ponderosa pine	Colorado	No significant activity reported in 1996.
<b>Common European pine beetle</b> <i>Tomicus piniperda</i>	Scotch pine, White pine	Kansas	This beetle has not been reported in Kansas. A federal and state quarantine is still in effect to prevent establishment of the insect which could adversely affect the Christmas tree industry.
<b>Dioryctria pine moths</b> <i>Dioryctria</i> sp.	Austrian pine, Pinyon pine, Ponderosa pine, Scotch pine	Colorado, Nebraska, South Dakota	No change reported in infestation levels in Nebraska and South Dakota in 1996. Both states report problematic situations in windbreaks, tree plantations, and landscape plantings.
<b>Douglas-fir beetle</b> <i>Dendroctonus pseudotsugae</i>	Douglas-fir	Colorado, Wyoming	An extensive outbreak in western Colorado and eastern Utah has been in progress for several years. In Colorado, from Rifle west to the Douglas Pass area to the Utah border, approximately 7,246 trees were killed in 1996. Because previously killed snags outnumber current faders, it is likely that this outbreak is declining. Scattered mortality included parts of the Wet Mountains, San Isabel National Forest and an area between Pagosa Springs and Bayfield, San Juan National Forest. These areas are expected to have continued beetle activity. Many trees that were burned by the Buffalo Creek fire were found to be heavily infested; it is possible that this may spawn an outbreak in the South Platte River

Rocky Mountain Region - Status of Insects in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

INSECT	HOST	LOCATION	REMARKS
Douglas-fir beetle continued...			drainage. Nearby, additional mortality is occurring in areas heavily defoliated from 1993-1995 by the Douglas-fir tussock moth. Mortality along the Colorado Front Range continues to occur in small, widely scattered groups. Most mortality is on steep inaccessible slopes where western spruce budworm had defoliated trees over the past decade. On the Shoshone NF, Wyoming, the epidemic appears to be subsiding on the Clarks Fork and Wapiti Ranger Districts. Approximately 1,000 trees were killed in 1996.
Douglas-fir tussock moth <i>Orgyia pseudotsugata</i>	Douglas-fir, Blue spruce	Colorado	No defoliation was detected in 1996, indicating that the epidemic of 1993-1995 has completely collapsed. An early warning system using pheromone traps detected no areas of Douglas-fir tussock moth increase. It appears that Douglas-fir beetle populations increased in heavily defoliated stands and are now attacking trees in adjacent areas. Very low levels of insect activity were reported on blue spruce in the Denver and Colorado Springs metropolitan areas.
Elm leaf beetle <i>Xanthogaleruca luteola</i>	American elm, Siberian elm	Colorado, Kansas, Nebraska, South Dakota	All states report activity in 1996 at low to moderate levels. In Colorado, Siberian elm in Colorado Springs and Castle Rock sustained heavy defoliation.
European pine sawfly <i>Neodiprion sertifer</i>	Scotch pine	Kansas, Nebraska, South Dakota	All states report low to moderate insect activity in 1996. The insect is common in all states.
Fall webworm <i>Hyphantria cunea</i>	Cottonwood	Colorado, Kansas, South Dakota, Wyoming	Kansas reported very heavy damage in the eastern part of the state with many non-traditional host types affected. In other states, no significant activity reported in 1996.
Greenstriped mapleworm <i>Dryocampa rubicunda</i>	Silver maple	Kansas	Moderate defoliation was reported again in the eastern part of the state in urban and recreation areas.

Rocky Mountain Region - Status of Insects in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

INSECT	HOST	LOCATION	REMARKS
<b>Gypsy moth</b> <i>Lymantria dispar</i>	Hardwoods	Colorado, Kansas, Nebraska, South Dakota, Wyoming	Surveys continue region-wide on state, private, and federal lands. In Colorado, a total of 1,799 detection traps were deployed. An additional 153 delimitation traps were placed surrounding the previous positive trap sites. A total of four moth catches were made in detection traps in 1996, one per site in the following areas: Denver, Lafayette, Northglenn, and Hotchkiss. The delimitation trapping caught no moths. Delimitation trapping will be done around all 1996 catches. Detection trapping was expanded to include additional federal sites. In Wyoming, a total of 554 detection traps were deployed. An additional 80 delimitation traps were placed surrounding the previous positive trap sites. Single moth catches were made in Cody, Jackson, and Sheridan. In 1996, delimitation trapping caught no moths in Wyoming. On Warren Air Force Base in Cheyenne, one trap caught eight gypsy moths and an adjacent trap caught three moths; an additional single catch was made nearby, for a total of 12 moths caught on the base. This is the most gypsy moths ever caught in one year in Wyoming. An extensive delimiting survey is planned in 1997 on Warren Air Force Base, as well as around the three other single catches. In South Dakota, four moths were caught from 697 detection traps. Moths were caught in Meade and Pennington Counties. In Nebraska, four moths were caught: two in Omaha and one each in South Sioux City and Harlan Co. No gypsy moths were caught in Kansas in 1996.
<b>Honeysuckle aphid</b> <i>Hyadaphis tataricae</i>	Honeysuckle	Kansas, South Dakota	Very common insect in windbreaks in both states.
<b>Juniper sawfly</b> <i>Monoctenus fulvus</i>	Eastern redcedar, Rocky Mountain juniper	Kansas	After several years of low activity, heavy infestations were reported in NW and NE Kansas. Conditions warranted aerial application of insecticide in the NW area of the state.
<b>Mountain pine beetle</b> <i>Dendroctonus ponderosae</i>	Limber pine, Lodgepole pine, Ponderosa pine	Colorado, South Dakota, Wyoming	In Colorado, mortality continues to increase in ponderosa and lodgepole pine. Results from the 1996 aerial survey show that of the 86% area flown in Colorado, 12,891 dead trees on 10,879 acres were identified. Areas of concern include, the

INSECT	HOST	LOCATION	REMARKS
Mountain pine beetle continued...			<p>Uncompahgre Plateau, Derby Mesa, Steamboat Lake State Park, the Vail Valley, the western foothills of the Arkansas Valley, the Frisco/Keystone area, Table Mountain and the Granby area, the Cache la Poudre/Redfeather Lakes area, Larkspur, and Buena Vista, where approximately 2,440 infested ponderosa pines and a few lodgepole pines, on 3,200 acres, were reported. The infestation near Buena Vista is expected to continue in 1997. The tri-county area of Summit-Grand-Eagle (Frisco/Keystone area) saw a 180% increase in mountain pine beetle activity in 1996 from 1995. A total 3,425 trees were infested in 1996. The populations are expected to increase. Along the Front Range of Colorado, a general increase of mountain pine beetle activity was reported in ponderosa pine. Activity of the mountain pine beetle on the Black Hills was very low. Approximately 1,500 ponderosa pine trees were killed on 2,900 acres of the Black Hills in South Dakota and Wyoming. Mountain pine beetle activity associated with pine tussock moth defoliation on ponderosa pine declined for the third consecutive year near Edgerton, Wyoming. An area around Deer Mountain, south of Laramie, is still of concern. Statewide, mountain pine beetle activity increased slightly throughout Wyoming.</p>
<p>Pine butterfly <i>Neophasia menapia</i></p>	Ponderosa pine	South Dakota	<p>Pine butterfly populations increased to high levels in the south eastern corner of the Black Hills, particularly around Custer. Noticeable levels of defoliation were common along with a large number of adults in late August.</p>
<p>Pine engraver beetle <i>Ips</i> spp</p>	Lodgepole pine, Ponderosa pine	Colorado, South Dakota, Wyoming	<p><i>Ips</i> sp. activity along the Front Range of Colorado continued, with high levels of activity reported in the Black Forest. <i>Ips confusus</i> activity was reported in pinyon pine on the western slope, particularly in areas west of Durango and south of Montrose, Colorado. <i>Ips hunteri</i> was reportedly responsible for urban Colorado blue spruce top and tree mortality in Denver, Greeley, and Colorado Springs. Small pockets of top kill and tree mortality continued to be present in ponderosa</p>

Rocky Mountain Region - Status of Insects in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

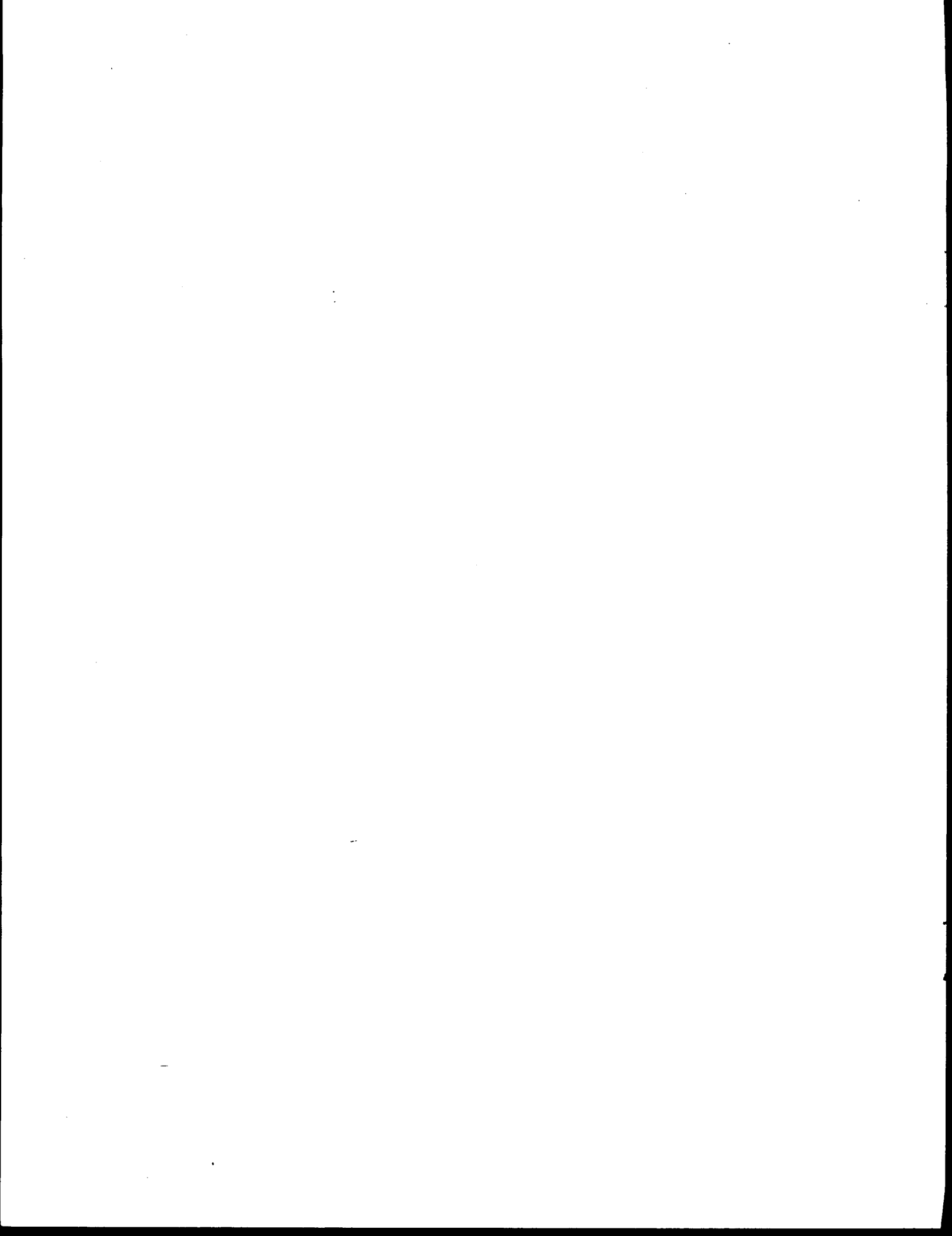
INSECT	HOST	LOCATION	REMARKS	
Pine engraver beetle continued...			pine in the Black Hills. In Wyoming, very little Ips sp. activity was reported.	
<b>Pine sawflies</b> <i>Neodiprion autumnalis</i> <i>Neodiprion fulviceps</i>	Ponderosa pine	Colorado, South Dakota, Wyoming	In Colorado, scattered infestations were found in the Black Forest. Approximately 80 acres of moderate to heavy defoliation occurred on the US Air Force Academy in 1996. This area was treated with insecticide. Defoliation occurred on Fort Carson as well. In South Dakota and Wyoming, populations were again high around the edges of the Black Hills of SD and WY. Heavy defoliation was noted on single trees and small groups of trees. Defoliation is expected to continue in 1997. The State of Wyoming reported 600 acres of heavy defoliation north of Aladdin. A winter egg count survey is planned to determine population status.	
27	<b>Pine tip moths</b> <i>Rhyacionia bushnelli</i> <i>Rhyacionia frustrana</i> <i>Rhyacionia neomexicana</i>	Austrian pine, Ponderosa pine, Scotch pine, Virginia pine	Colorado, Nebraska, Kansas, South Dakota, Wyoming	Kansas, Nebraska, and South Dakota report varying levels of activity statewide; plantations and windbreaks are common locations for damage.
<b>Pine tussock moth</b> <i>Dasychira grisefacta</i>	Ponderosa pine	Colorado, Nebraska, South Dakota, Wyoming	No defoliation was reported in 1996.	
<b>Red turpentine beetle</b> <i>Dendroctonus valens</i>	Jack pine, Ponderosa pine	Nebraska, South Dakota, Wyoming	Beetle attacks are present on scattered stressed or injured trees, but rarely cause tree mortality. Present in small numbers in the burned area of Buffalo Creek, Colorado.	
<b>Spruce needleminer</b> <i>Endothenia albolineana</i>	Blue spruce	South Dakota	In the eastern part of the state, a significant increase of insect activity was reported in 1996.	

Rocky Mountain Region - Status of Insects in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

INSECT	HOST	LOCATION	REMARKS
<b>Smaller European elm bark beetle</b> <i>Scolytus multistriatus</i>	Elm	Colorado	No significant increase reported in 1996.
<b>Spruce beetle</b> <i>Dendroctonus rufipennis</i> Trinchera	Engelmann spruce	Colorado, Wyoming	Spruce beetle activity in the state of Colorado was minimal and occurred only in very isolated areas, i.e., Forbes Ranch south of Fort Garland, Colorado. The exception is windthrown spruce in a sale area just southwest of Creede, Colorado. Slight population increases were associated with spring blowdown in western Wyoming. Activity occurred in scattered patches, containing only a few dozen trees.
<b>Tent caterpillars</b> <i>Malacosoma americanum</i> <i>Malacosoma californicum</i> <i>Malacosoma disstria</i>	American plum, Aspen, Chokecherry, Hardwoods	Colorado, Kansas, South Dakota, Wyoming	In Colorado, most activity was at static levels; however, on the Uncompahgre National Forest, populations appeared to be increasing on aspen. In South Dakota and Wyoming, populations were high in pockets of host trees in the Black Hills and on the Shoshone NF, Wyoming. Chokecherry was the more common host, with complete defoliation in some places.
<b>Twig beetles</b> <i>Pityophthorus</i> spp. <i>Pityogenes</i> spp.	Pinyon pine, Ponderosa pine	Colorado	In 1996, moderate levels were reported on the US Air Force Academy, Colorado, on ponderosa pine.
<b>Walnut caterpillar</b> <i>Datana integerrima</i>	Black walnut, Bur oak, Hickory, Pecan	Kansas, Nebraska	In Kansas, damage reports increased and second generation damage was reported. One black walnut plantation on the Winnebago Indian Reservation, Nebraska, was completely defoliated this year. Expectations are that defoliation will continue next year.
<b>Western balsam bark beetle</b> <i>Dryocoetes confusus</i>	Subalpine fir	Colorado, Wyoming	Mortality was common throughout the spruce/fir cover type from the Wyoming - Colorado border south throughout the Rocky Mountains. Additional factors, especially Armillaria root disease and possibly other biotic and abiotic components, are acting together to produce this mortality. The area from Centennial, Wyoming, to Grand Junction and Leadville,

Rocky Mountain Region - Status of Insects in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

INSECT	HOST	LOCATION	REMARKS
Western balsam bark beetle continued...			Colorado, has especially concentrated areas of mortality. Aerial survey of 86% of Colorado documented 327,993 dead subalpine fir on 147,244 acres. Efforts are underway to determine the causes, effects, and mitigation measures possible to deal with this mortality complex. Mortality was common on both the Shoshone and Bighorn National Forests in Wyoming. Over 12,500 trees on 7,000 acres were affected on NF, other federal, state, and private lands in the vicinity of the Shoshone National Forest. Mortality was common throughout the spruce/fir cover type in Wyoming.
Western pine beetle <i>Dendroctonus brevicomis</i>	Ponderosa pine	Colorado	No significant activity reported in 1996.
Western spruce budworm <i>Choristoneura occidentalis</i>	Blue spruce, Douglas-fir, Engelmann spruce, True firs	Colorado, Wyoming	Widespread defoliation of Douglas-fir, true firs, and spruce continued throughout the forests of southern Colorado. In the Salida area of Colorado, an estimated 5,000 acres of infested private lands were reported by the State of Colorado. Current year defoliation in this area was in the moderate category. Other areas of activity reported for Colorado were in areas between South Fork and Wagon Wheel Gap and north of Lake City. In June of 1996, 636 acres of private land with Douglas-fir were treated in Hinsdale and Gunnison counties. No significant activity was reported in Wyoming in 1996.





Rocky Mountain Region - Status of Disease In Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS	
<b>STEM AND BRANCH DISEASES</b>				
<b>Black knot</b> <i>Apiosporina morbosum</i>	Chokecherry	Colorado, South Dakota	Chokecherry in riparian zones throughout Colorado and western South Dakota is commonly affected by this disease. Black knot is common at the Amphitheater Campground on the Ouray Ranger District, Uncompahgre NF.	
<b>Comandra blister rust</b> <i>Cronartium comandrae</i>	Lodgepole pine, Ponderosa pine	Colorado, South Dakota, Wyoming	This disease continues as one of the most common diseases of lodgepole pine in northern Colorado, western South Dakota, and Wyoming, but is of concern in only a few areas.	
<b>Elytroderma needle cast</b> <i>Elytroderma deformans</i>	Ponderosa pine	South Dakota	No significant activity reported in 1996.	
31	<b>Fir broom rust</b> <i>Melampsorella caryophyllacearum</i>	Subalpine fir	Colorado, Wyoming	This disease is common throughout the spruce/fir cover type in Colorado and south-central Wyoming, where it causes only minor damage. On the White River National Forest, it was identified as a management concern at Aspen Mountain Ski Area and in the Four-mile/Divide Creek Area. Brooms are scattered on older subalpine fir in the Bighorn NF, Wyoming.
<b>Fire blight</b> <i>Erwinia amylovora</i>	Apple species, Cotoneaster, Crabapple	Colorado, South Dakota, Wyoming	In South Dakota, widespread damage continues. In Colorado, a dry spring kept activity levels low.	
<b>Pine tip blight</b> <i>Sphaeropsis elisii</i>	Austrian pine, Ponderosa pine	Kansas	Reports of damage was down from 1995, however, will continue to be serious problem in the eastern part of the state.	
<b>Spruce broom rust</b> <i>Chrysomyxa arctostaphyll</i>	Blue spruce, Engelmann spruce, White spruce	Colorado, South Dakota	Common throughout the spruce/fir type in Colorado, where it generally causes only minor damage. The disease is common in Engelmann spruce at the Aspen Mountain Ski Area and was identified as a management concern in the Four-mile/Divide Creek Area, White River National Forest.	

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
Western gall rust <i>Endocronartium harknessii</i>	Lodgepole pine, Ponderosa pine	Colorado, Nebraska, South Dakota, Wyoming	No significant increase in activity reported for Colorado, South Dakota, or Wyoming, in 1996. Continues as a moderate to severe problem in central and western Nebraska.
White pine blister rust <i>Cronartium ribicola</i>	Limber pine, White pine	Colorado, South Dakota, Wyoming	In Colorado, one western white pine was found in 1996 with a rust canker on the stem. The tree was shipped from Idaho to a Colorado nursery. Nurseries in Colorado are bringing in various white pines for landscaping. These trees pose a threat to native limber and bristlecone pine populations since the disease has not been detected in native Colorado pine stands. In Wyoming, all areas with five-needle pines are known to be infected with white pine blister rust. Some branch and tree mortality in limber pine is occurring on Casper mountain and northwest of Cody, in the Sunlight area, on the Shoshone National Forest.
32 CANKER DISEASES			
Black target canker <i>Ceratocystis fimbriata</i>	Aspen	Colorado	Black target canker is common in many aspen stands throughout Colorado. It was identified as one of many factors affecting management in the Clear Creek Timber Sale area, Norwood Ranger District, Uncompahgre National Forest, locations on the Grand Mesa National Forest, and the Four-mile/Divide Creek area, White River National Forest.
Cytospora canker <i>Cytospora</i> spp. <i>Leucocytospora</i> spp.	Aspen, Cottonwood, Poplar, Spruce, Willow	Colorado, Kansas, Nebraska, South Dakota, Wyoming	This disease is common on aspen throughout Colorado where it is a management concern in recreation, riparian, and regeneration areas. Cytospora canker was noted at locations on the Grand Mesa National Forest, in the Four-mile/Divide Creek Timber Sale area, White River National Forest, and is a management concern in the Clear Creek Timber Sale area, Uncompahgre National Forest. In Nebraska and Wyoming, the disease can be found statewide.

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS	
<b>Cryptosphaeria canker</b> <i>Cryptosphaeria populina</i>	Aspen	Colorado, South Dakota	This canker is common in many aspen stands throughout Colorado. The disease was noted as one of many factors affecting management in the Clear Creek Timber Sale Area, Uncompahgre National Forest.	
<b>Russian olive canker</b> <i>Phomopsis arnoldiae</i> <i>Tubercularia</i> sp. <i>Lasiodiplodia</i> sp.	Russian olive	Kansas, Nebraska, South Dakota, Wyoming	This disease continues to be a very serious problem in the eastern half of Kansas.	
<b>Siberian elm canker</b> <i>Botryodiplodia hypoderma</i> <i>Tubercularia ulmea</i>	Siberian elm	Colorado, Nebraska, South Dakota, Wyoming	Continues to be a problem in Nebraska.	
33	<b>Sooty bark canker</b> <i>Encoelia pruinosa</i>	Aspen	Colorado	Sooty bark canker is a common disease in aspen stands in Colorado. It was noted as one of the main factors affecting management in the Clear Creek Timber Sale area, Uncompahgre National Forest. It is a management concern in many locations on the Grand Mesa National Forest and the Four-mile/Divide Creek area, White River National Forest.
<b>Thyronectria canker</b> <i>Thyronectria austro-americana</i>	Honeylocust	Colorado, Kansas, Nebraska	In Kansas, honeylocust has been eliminated in older windbreaks. In western Kansas, windbreaks continue to be infected. In Nebraska, the canker is a problem statewide.	
<b>DWARF MISTLETOES</b>				
<i>Arceuthobium americanum</i>	Lodgepole pine	Colorado, Wyoming	Dwarf mistletoes cause the greatest disease losses in Region 2. Losses equal at least 10 million cu. ft. annually. In Colorado, 50% of the lodgepole pine type is infested. Forest Health Management funded presuppression surveys and silvicultural control on six National Forests. Continuing emphasis is being placed on surveys at landscape scale and on suppression projects in developed recreation sites.	

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
<b>DWARF MISTLETOES</b>			
<i>Arceuthobium cyanocarpum</i>	Limber pine	Colorado, Wyoming	Limber pine dwarf mistletoe continued as a minor problem.
<i>Arceuthobium divaricatum</i>	Pinyon pine	Colorado	Pinyon pine dwarf mistletoe continued as a minor problem in western Colorado in 1995. However, perceived impacts of the disease are becoming more evident as people move into the pinyon/juniper woodlands of southern Colorado.
<i>Arceuthobium douglasii</i>	Douglas-fir	Colorado	Occurs mostly in the southern two-thirds of Colorado. Forest Health Management funded a control project on the Salida Ranger District, San Isabel National Forest. Areas of management concern are: Columbine Ranger District, San Juan National Forest; Mountain Lion Lookout area, Saguache Ranger District, Rio Grande National Forest; and Long Creek on the Uncompahgre Plateau, Uncompahgre National Forest.
<i>Arceuthobium vaginatum</i> subsp. <i>cryptopodium</i>	Ponderosa pine	Colorado	Losses amount to 885,000 cu.ft.annually. Suppression projects emphasized tree removal and pruning of infested trees in developed recreation sites. Forest Health Management funded silvicultural control projects on the Southern Ute Reservation and the Salida Ranger District, San Isabel National Forest. Private landowners in the Black Forest and along the Front Range of Colorado are reporting concerns as a consequence of newly established residences in infested areas.
<b>DECAY DISEASES</b>			
Aspen trunk rot <i>Phellinus tremulae</i>	Aspen	Colorado, South Dakota	Aspen trunk rot is common throughout the aspen cover type in Colorado. In 1996, white trunk rot was identified as a management concern in several stands in the Four-mile/Divide Creek area, White River National Forest National

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS	
Aspen trunk rot...			Forest and in some locations of the Grand Mesa National Forest.	
<b>Red ray rot</b> <i>Dichomitus squalens</i>	Ponderosa pine	South Dakota	Heartwood decay is widespread in mature ponderosa pine on the Black Hills of South Dakota.	
<b>White mottled rot</b> <i>Ganoderma applanatum</i>	Aspen	Colorado	The disease is common in aspen throughout Colorado, and is a source of potential hazard in campgrounds and recreation areas. Scattered occurrences of the disease were observed in the Four-mile/Divide Creek area, White River National Forest.	
<b>ROOT DISEASES</b>				
35	<b>Annosus root disease</b> <i>Heterobasidion annosum</i>	Jack pine, Ponderosa pine, White fir	Colorado, Nebraska	Annosus root disease has scattered distribution in white fir in the mixed conifer cover type throughout southern Colorado. In campgrounds, the disease creates hazardous conditions by increasing the probability of tree failure. In 1996, the disease was discovered in Vallecito Campground, Columbine Ranger District, San Juan National Forest. With FHM funding, a sanitation removal project was implemented at the Amphitheater Campground, Ouray Ranger District, Uncompahgre National Forest.
	<b>Armillaria root disease</b> <i>Armillaria</i> spp.	Engelmann spruce, Hardwoods, Lodgepole pine, Ponderosa pine, Subalpine fir, White fir	Colorado, South Dakota, Wyoming	Armillaria root disease is easily the most common and damaging of the root diseases in Region 2. <i>Armillaria ostoyae</i> has been identified as the only biological species present on 10 different tree hosts in Colorado, South Dakota, and Wyoming. The disease is commonly associated with the decline of subalpine fir caused by several bark beetles ( <i>Scolytus/Dryocoetes</i> ) throughout Colorado and Wyoming. Subalpine fir damage caused by this complex is particularly high at Aspen Mountain, Crested Butte and Powderhorn Ski Areas; on the White River National Forest, in areas including, Basalt Mountain, Burnt Mountain, and Kobey Park; on the Uncompahgre Plateau at Ouray Springs; on white fir in the San Juan National Forest.

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
<b>Black stain root disease</b> <i>Leptographium wagemeri</i>	Pinyon pine, Ponderosa pine	Colorado	Continues as a problem on pinyon pine in the southwestern corner of Colorado. Recent mortality was detected on private land near Colona, Colorado. The disease is also of major concern in recreation areas near McPhee Reservoir and at Mesa Verde National Park.
<b>FOLIAGE DISEASES</b>			
<b>Anthracnose</b> <i>Gnomonia leptostyla</i>	Walnut	Kansas	No significant activity reported in 1996.
<i>Apiognomonina veneta</i> = <i>Gnomonia platani</i> <i>Discula</i> sp.	Ash, Maple, Sycamore	Colorado, Kansas, Wyoming	In Kansas, contrary to 1995, very little activity was reported in 1996.
<i>Gnomoniella fraxini</i>	Green ash	South Dakota	No significant activity reported in 1996.
<b>Ash leaf rust</b> <i>Puccinia sparganioides</i>	Green ash	Colorado, Kansas, Nebraska, South Dakota	In eastern South Dakota, activity was limited to only a few communities in 1996.
<b>Aspen leaf blights</b> <i>Ciborina whetzellii</i> <i>Marssonina populii</i>	Aspen	Colorado, South Dakota	No significant activity reported in 1996.
<b>Brown spot needle blight</b> <i>Scirrhia acicola</i> <i>Mycosphaerella dearnessii</i>	Scotch pine	Kansas, Nebraska	Kansas again reported high levels of brown spot needle blight in 1996. Christmas tree growers reported removal and destruction of trees due to the severity of the disease. In Nebraska, brown spot was an occasional problem for a few Christmas tree plantations.

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
<b>Cedar apple rust</b> <i>Gymnosporangium juniperi-virginiana</i>	Apple species, Eastern red cedar, Rocky Mtn juniper, Utah juniper	Colorado, Kansas, Nebraska, South Dakota, Wyoming	Moderate levels of this disease were noted at McPhee Reservoir, San Juan National Forest, and on the Southern Ute Reservation.
<i>Gymnosporangium nelsonii</i>	Rocky Mountain juniper, Serviceberry	Colorado	Active disease galls were noted on juniper on the Southern Ute Reservation and private lands near Colona, Colorado, in 1996.
<b>Cercospora blight of juniper</b> <i>Cercospora sequoiae</i>	Eastern red cedar, Rocky Mountain juniper	Kansas, Nebraska, South Dakota	<i>Cercospora</i> continued to be a problem in the eastern parts of KS and NE in 1996. In eastern South Dakota, the disease is becoming a problem in windbreaks.
<b>Conifer-aspen rust</b> <i>Melampsora medusae</i>	Aspen, Douglas-fir, Lodgepole pine, Ponderosa pine	Colorado, Nebraska, South Dakota	Like the aspen foliage diseases, conifer-aspen rust causes great aesthetic concern but little permanent damage to the host trees. Disease levels were low in 1996 in Colorado.
<b>Diplodia blight</b> <i>Sphaeropsis sapinea</i> <i>Diplodia pinea</i>	Ponderosa pine, Lodgepole pine	Nebraska, South Dakota, Wyoming	This fungus, first found on 2-0 lodgepole pine seedlings at the USFS Nursery, Halsey, NE, in 1994, was reportedly active and causing damage, in 1996. Nebraska and South Dakota report moderate to serious problems in older pines.
<b>Dothistroma needle blight</b> <i>Dothistroma pini</i> <i>Mycosphaerella pini</i>	Austrian pine, Ponderosa pine	Kansas, Nebraska	Severe levels occurred again in the eastern parts of both states in 1996. Nebraska reported very serious and widespread damage occurring throughout the eastern part of the state in 1996.
<b>Melampsora leaf rusts</b> <i>Melampsora</i> spp.	Aspen, Cottonwood, Willow	Colorado, Kansas	No significant activity reported in 1996.

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
<b>Needle casts</b> <i>Lophodermella concolor</i> <i>Lophodermella montivaga</i>	Lodgepole pine	Colorado, Wyoming	No significant activity was noted in 1996.
<i>Lophodermella cerina</i>	Ponderosa pine	Colorado	Widespread needle cast was noted in the Target Tree Campground, San Juan National Forest.
<b>VASCULAR WILTS AND DECLINES</b>			
<b>Ash yellows (decline)</b> caused by phytoplasmas	Green ash, White ash	Colorado, Kansas, Nebraska, South Dakota, Wyoming	A preliminary survey of green ash yellows was begun in 1996. There are indications that the disease is present in most sampled populations, including windbreaks, urban areas, and native stands. Confirmation of the results will provide intensity and distribution of the disease. In Nebraska, the survey detected ash yellows in 15 counties statewide and in two-thirds of randomly sampled trees.
<b>Dutch elm disease</b> <i>Ceratocystis ulmi</i> <i>Ophiostoma ulmi</i>	Elm species	Colorado, Kansas, Nebraska, South Dakota	All states report moderate levels of activity in 1996.
<b>Oak wilt</b> <i>Ceratocystis fagacaerum</i>	Oak species	Kansas, Nebraska	No significant activity was noted in 1996.
<b>Pinewood nematode</b> <i>Bursaphelenchus xylophilus</i>	Austrian pine, Scotch pine, White pine	Kansas, Nebraska, South Dakota	Pinewood nematode remains a serious problem in the eastern part of Kansas; however, movement to the west appears to have slowed and no new counties were reported in 1996.



Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
<b>ABIOTIC</b>			
<b>Chemical damage</b>	<b>Hard and softwood species</b>	<b>Colorado, Kansas, Nebraska, South Dakota, Wyoming</b>	<b>Herbicide damage to windbreaks in Kansas continues to be a serious problem because of chemical drift via aerial spray applications for weed control in planted fields.</b>
<b>Drought and other agents</b>	<b>Black walnut, Blue spruce, Buffaloberry, Dogwood, Green ash, Pear, Ponderosa pine, Poplar, Russian olive, Siberian elm, Silver maple</b>	<b>Colorado, Nebraska, Kansas, South Dakota, Wyoming</b>	<b>No significant activity reported in 1996.</b>
<b>Flooding/Heavy Rains/Saturated Soils</b>	<b>Hard and softwood species</b>	<b>Colorado, Kansas, Nebraska, South Dakota, Wyoming</b>	<b>Due to continually saturated soils, South Dakota reported many declining windbreaks.</b>
<b>Winter / Hail damage</b>	<b>Hard and softwood species</b>	<b>Colorado, Kansas, Nebraska, South Dakota, Wyoming</b>	<b>Hail damage to living snow fences will likely result in seedling mortality near Byers, Colorado, in 1996. Windbreak plantings in southeastern Colorado reportedly suffered winter drying and conifer mortality.</b>
<b>Pinyon pine decline</b>	<b>Pinyon pine</b>	<b>Colorado</b>	<b>Decline continues to varying degrees of severity in the Salida and Mancos areas in Colorado. A complex of stressors is leading to the decline and mortality.</b>

Rocky Mountain Region - Status of Disease in Colorado, Kansas, Nebraska, South Dakota, and central and eastern Wyoming

DISEASE	HOST	LOCATION	REMARKS
Sprout dieback	Aspen	Colorado	Regeneration failure and dieback have been documented on the Grand Mesa, Uncompahgre, Gunnison, San Juan, and Routt National Forests; however, no significant activity was reported in 1996.
Needle dieback	Douglas-fir, Engelmann spruce, Subalpine fir	Colorado	Widespread needle dieback of unknown cause was noted in various locations on the Gunnison, White River, and Rio Grande National Forests in 1996.
Subalpine fir decline	Subalpine fir	Colorado, Wyoming	Subalpine fir in an older condition continues to exhibit decline regionwide. Subalpine fir decline is a complex of organisms working as a disturbance factor in the forested ecosystem.

## PESTICIDE USE IN REGION 2 IN FISCAL YEAR 1996

<i>Type of Pesticide</i>	<i>Chemical Used<sup>1/</sup></i>	<i>Primary Mgmt. Activity</i>	<i>Units Treated in Acres</i>
<b>Fumigant</b>	Dazomet	Nursery bed sterilization Mgmt.	15 acres
	Methyl bromide	Nursery bed sterilization Mgmt.	2 acres
<b>Fungicide</b>	Chlorothalonil	Fungi Mgmt.	28 acres
	Dodine	Fungi Mgmt.	6 acres
	Thiophanate methyl	Fungi Mgmt. Vegetation Mgmt.	46 acres
	Thram	Fungi Mgmt.	165 # seeds
<b>Herbicide</b>	Bromacil/Diuron	Noxious Weed Mgmt.	248 acres
	Chlorosulfuron	Noxious Weed Mgmt.	9 acres
	Clopyralid	Noxious Weed Mgmt.	116 acres
	2,4-D/Clopyralid	Noxious Weed Mgmt. Vegetation Mgmt.	1,189 acres
	2,4-D	Wildlife Habitat Improvement Noxious Weed Mgmt.	3,253 acres
	2,4-D Amine	Noxious Weed Mgmt.	1,304 acres
	2,4-D Ester	Noxious Weed Mgmt.	604 acres
	DCPA	Vegetation Mgmt.	12 acres
	Dicamba	Noxious Weed Mgmt.	683 acres
	Glyphosate	Vegetation Mgmt. Noxious Weed Mgmt.	1,431 acres
	Imazapyr	Recreation improvement	2 acres
	Metsulfuron methyl	Noxious Weed Mgmt.	841 acres
Oxyflurofen	Noxious Weed Mgmt.	31 acres	

## PESTICIDE USE IN REGION 2 IN FISCAL YEAR 1996

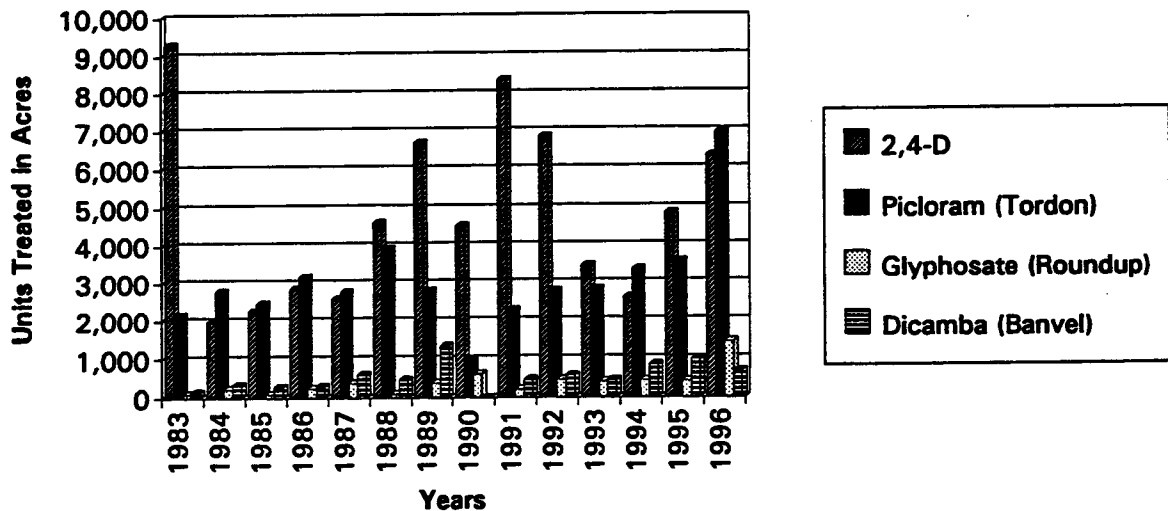
<i>Type of Pesticide</i>	<i>Chemical Used <sup>1/</sup></i>	<i>Primary Mgmt. Activity</i>	<i>Units Treated in Acres</i>
<b>Herbicide</b>	<b>Picloram</b>	<b>Vegetation Mgmt. Noxious Weed Mgmt.</b>	<b>6,970 acres</b>
<b>Insecticide</b>	<b>Dimethoate</b>	<b>Insect Mgmt.</b>	<b>18 acres</b>
<b>Rodenticide</b>	<b>Zinc phosphide</b>	<b>Prairie dog control Animal damage control</b>	<b>1,240 acres</b>
<b>Biological control</b>	<b>Defoliating insects</b>	<b>Noxious Weed Mgmt.</b>	<b>21,000 insects</b>

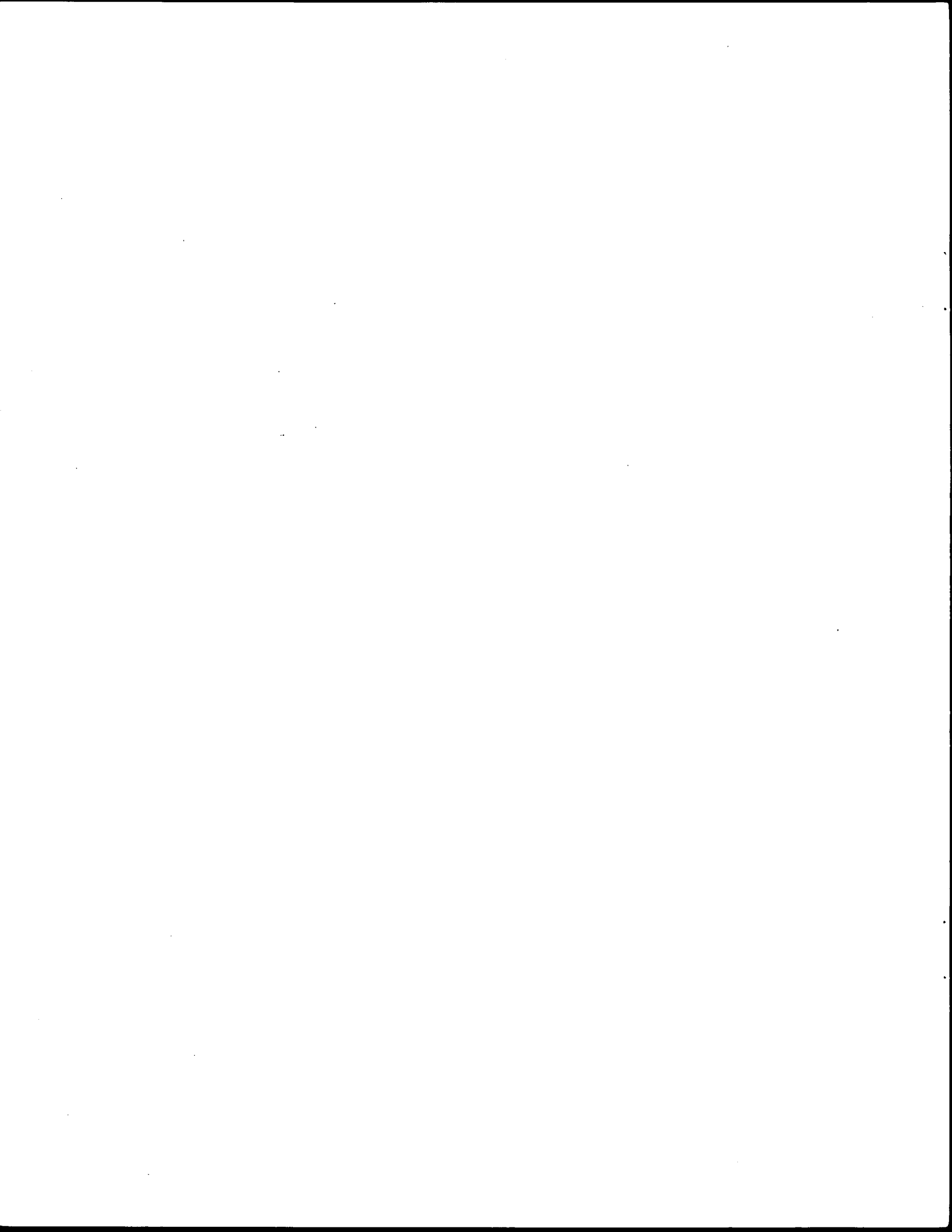
**1/** Includes use by the USDA Forest Service, other federal agencies, permittees, licensees, and grantees.

## HERBICIDE USE IN REGION 2

While our knowledge of biological control is developing, the use of herbicides continues as an essential part of Forest Health Management. Herbicides are valuable tools in management of noxious weeds and undesirable vegetation in range management, forest tree nursery management, and more recently, to manage the expansion of noxious and exotic plants. The following graph shows herbicide use trends for 1983 - 1996. The major target species in the graph are the sagebrushes, thistles, leafy spurge, and various broadleaf weeds for range improvement and roadside management projects.

**Herbicide Use in Region 2 - 1996**





## RECENT PUBLICATIONS

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

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

Forest Health Management Group. 1997. Forest Insect and Disease Conditions in the Rocky Mountain Region 1996. USDA Forest Service. Renewable Resources, Rocky Mountain Region. 46 p.

Johnson, D.W. 1996. Picea engelmannii Parry ex Engelm. In: eds., Schutt, Schuck, Aas, Lang, Enzyklopedie der Holzgewachse (Encyclopedia of Woody Plants). Ecomed Verlag, Landsberg, Germany. (In press).

Johnson, D.W. 1996. Picea pungens Engelm. In: eds., Schutt, Schuck, Aas, Lang, Enzyklopedie der Holzgewachse (Encyclopedia of Woody Plants). Ecomed Verlag, Landsberg, Germany. 8 p..

Johnson, D.W., W.C. Schaupp, Jr., M. Hood and E. Smith. 1997. Cold Springs Analysis Area, Douglas Ranger District, Medicine Bow National Forest - Forest Health Assessment. USDA Forest Service. Renewable Resources, Rocky Mountain Region Biological Evaluation. (Draft)

Johnson, E., S.J. Johnson and D. W. Johnson. 1997. Interpretation of aerial photography of Colorado's forest health monitoring plots 1992-1995. USDA Forest Service, Renewable Resources, Rocky Mountain Region Technical Report. (In press).

Wu, Y., D.W. Johnson and P. Angwin. 1996. Identification of *Armillaria* species in the Rocky Mountain Region. USDA Forest Service. Renewable Resources, Rocky Mountain Region Technical Report. R2-58. 28 p.

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