FS-4000-1 (8/76)

USDA-Forest Service	1. Number	2. Station
	* SRS-4505	* Southern Research Station
	3. Unit Location: Athens, GA 30602-2044	

4. Research Work Unit Title

* INSECTS AND DISEASES OF SOUTHERN FORESTS

5. Project Leader (Name and address)

* Kerry O. Britton, USDA Forest Service, 320 Green Street, Athens, GA 30602-2044

6. Area of Research Applicability	7. Estimated Duration
* National	* Five (5) years

8. Mission

* To provide the knowledge about insects and microorganisms needed to manage productive, healthy seed orchards, nurseries, plantations, and native forests.

9. Justification and Problem Section

Increasing national demand for timber products, coupled with decreased resource availability in other regions, has led to increased timber harvests in the South. Our goal is to provide information that will support the development of a mosaic of forest management practices, which maintains the lifestyle of the American people, and sustains the productivity and health of these forests for future generations. Perceived public preference and litigation suggest that most National Forest lands will be managed on extremely long rotations (e.g., 200 years). Insect and disease problems will increase as these stands age, and they will frustrate management objectives.

Withdrawal of National Forest lands from the available timber base has increased the amount of timber cut from private lands, which comprise 90% of the forest lands in the South. Most of this resource is in the hands of non-industrial landowners, with diverse management goals. As the demand (and price) for timber from these lands increased, harvest levels also increased. Recent analysis showed that conifer removals in the South

10. Approach to Problem Solution (Starts at conclusion of Item 9.

Signature	Title	Date
Recommended:		
/s/ Nancy G. Herbert	Assistant Director for Research	7/29/98
/s/ Stanley J. Barras	Assistant to Staff Director	7/29/98
	Staff Director	7/30/98
/s/ Peter J. Roussapolas	Station Director	8/21/98

exceeded net growth by 3%. The emphasis on National Forest lands is shifting toward natural regeneration, but replanting and intensive management is more common on both industrial and non-industrial private lands.

The frequency and economic impact of past problems increases with management intensity in these plantations. We will provide expertise to develop environmentally acceptable management strategies to support a stable forestry economy, reduce dependence on harvests from national forests, and decrease the probability of importing exotic pests, therefore leading to the long-term sustainability of our forest resources.

Seed Orchard Pests - Seed orchards are some of the most intensively managed pine plantations in the South. The economic and environmental importance of seed orchard pest management research is clearly and forcefully stated by Hodges et al. in the January 1997 issue of the Journal of Forestry (96:29-32). A. . .reduction of timber harvests on federal lands has increased demand for timber from private forests. If the demand for wood is not met domestically, the United States will need to rely increasingly on imports. . .increasing pressure to exploit world forests that are less well-managed and more environmentally sensitive than ours. Genetic gains from tree improvement programs will be crucial. However, these genetic gains can be realized only if pest protection in seed orchards is effective.@ Knowledge is needed to develop practical, integrated pest management strategies and tactics that are scientifically rational,
environmentally sound, and operationally safe.

Information is also needed on the epidemiology and control of diseases that affect the production of seeds in southern pine seed orchards. Diseases of seeds, cones, and mature trees, can greatly affect the quality and quantity of seeds produced in seed orchards. Seedborne fungi may be responsible for some seedling diseases that occur in nurseries and regeneration sites.

Nursery Pests - Lack of information on the management and control of pest problems in forest-tree nurseries has been underscored recently by the scheduled phase-out of methyl bromide by the year 2001 under the Clean Air Act. Since the 1950s, nursery managers in the South have relied on nursery bed fumigation with methyl bromide for the control of diseases, nematodes, weeds, and insect problems. Better information is currently needed on the biology of pests that affect the survival and growth of southern pine seedlings, and to facilitate the development of alternatives to methyl bromide fumigation and better integrated pest management practices.

Nantucket Pine Tip Moth - Management of many pine plantations has intensified because of demands for more fiber on fewer acres. Intensive site preparation, suppression of competing

vegetation, and fertilization, are increasingly common, especially on industrial forest lands. With the application of these techniques, pine tip moths have become a serious pest in young pine plantations. Although considerable knowledge is available on the biology of tip moths and some of their natural enemies, little is known about pathogenic microorganisms associated with them. Increasing the knowledge of the effects of pathogenic microorganisms on tip moths could reduce dependence on chemical pesticides.

Fusiform Rust - Fusiform rust is the major disease of loblolly and slash pine in the southern United States. Fusiform rust affects both the quantity and quality of timber produced per unit area. Because of the relatively short rotation of pine in the South, increased rust resistance translates directly to increased economic value. As of 1995, approximately 16.7 million acres of slash and loblolly pine had 10 percent of the trees rust-infected. Incidence is increasing where slash and loblolly are planted outside their natural range. Georgia has the highest acreage of loblolly pine in the South (5,753,000 acres), and has the second largest percentage of high-hazard sites with respect to rust infection. Tree breeding efforts have reduced rust incidence dramatically in some pine families, but a variety of genetic sources are needed to ensure resistance stability. Even though the economic impact of the disease is significant, the pathogenic mechanisms underlying this disease remain poorly understood.

Diseases of Upland Hardwood Plantations - Plantation systems are being developed to meet increased demands for hardwood fiber for certain pulp products. Although hardwood removals comprised only 29% of regional net growth, much of the hardwood resource in the southern Appalachians has been withdrawn from production, and harvest from the bottomlands of the Piedmont and Coastal Plain is seasonally restricted by weather and riparian considerations. Two systems of upland hardwood plantations are being established.

In one system, plantations of sweet gum, sycamore, and cottonwood are widely established without irrigation. On upland sites, sweet gum is the most versatile species. However, dieback and transplant failures have occurred, some of which have been attributed to fungal facultative parasites in the genus *Botryosphaeria*. We will investigate the contribution of genetic selection and crop management practices in the nursery and at out planting. The goal is to reduce the probability of environmental stress-induced susceptability.

Sycamore is of particular interest because it grows rapidly and has desirable pulping qualities. A mid-rotation decline of sycamore plantations has been attributed in the past to *Botryosphaeria rhodina* and *Ceratocystis fimbriata.* A third pathogen, *Xylella fastidiosa*, has recently been isolated in many of the declining plantations. Genetic differences in susceptibility to decline have also been reported. Research is needed to determine the relative importance of these three pathogens in sycamore decline, and whether genetic resistance, site selection, or cultural practices can be manipulated to reduce disease severity.

Another system of upland hardwood production is the fiber farm, with a seven-year rotation. Drip irrigation lines are used to deliver fertilizer solutions to maximize growth. Very large fiber farms operate successfully on the dry side of the Cascade Mountains in the Pacific Northwest. Several southern

companies have recently established fiber farm plantations in the South. Pest problems abound, and considerable adaptation of the fiber farm system will be required to make this option viable in the southern United States. A consortium of Southern Research Station scientists plan collaborative studies to address environmental quality concerns, and questions about the sustainability of these systems, and how tree resource allocation patterns affect susceptibility to pests. SRS-4505 will participate as a full member in this consortium.

The scientists in SRS-4505 have the vital skills and collaborators needed to **develop integrated management strategies for pests of seed orchards, nurseries, and plantations (Problem 1)**. The probability of success in most of these areas is high.

Insect Ecology - As private lands in the South are increasingly being managed on shorter rotations and with greater intensity, public lands, in contrast, are being relied on more for maintenance of biological and genetic diversity. Critical issues associated with this evolving
role include conservation of rate, threatened, and endangered species, and restoration and maintenance of ecosystems.

Our forests have undergone considerable changes since Europeans first arrived in North America. They have been cleared, farmed, and then returned to forests, prevented from burning, invaded by exotic species, and often replanted with species not suited to the sites. Although these practices and changes have had profound visible effects on forest communities, we are only beginning to understand the more subtle changes that have taken place.

Insects are the most diverse group of organisms on earth. They play critical roles in the biology and ecology of forest ecosystems. These roles include pollinating flowering plants, serving as critical components of the forest food web, and decomposing woody debris and leaf litter. However, the ways in which our changing forests and forest management practices have affected insect communities and their abilities to carry out these roles are not understood. To effectively manage southern forest ecosystems, more **information is needed on the interactions of land use and forest management practices with arthropods and microbes of southern forests (Problem 2).** Such comprehensive work is labor-intensive, and complex studies such as these have only a moderate probability of success. However, the need for this information is urgent, and the payoff for success is high.

Exotic Pests - Invasive noxious weeds have infested well over 100 million acres, and continue to increase by 8% to 20% annually. Invasive exotic plants are now recognized as a direct threat to the productivity, biodiversity, and integrity of forest lands. Integrated pest management strategies must be developed to control these weeds. One reason that exotic weeds are so successful is that they invaded this country without the hindrance of natural enemies. In most cases, they are much less invasive in the country of origin, where regulating agents evolved to keep weed populations in check. Importation of biocontrol agents to regulate exotic weeds is often the best long-term solution to reducing their impact

on our native ecosystems. However, the hazard from such introductions must be minimized through intensive study of the life history and host range of potential biocontrol agents prior to their release. SRS-4505 proposes to establish such a program to search for weed biocontrol agents.

Butternut canker is a hardwood disease caused by *Sirococcus clavigignenti-juglandaccearum*, which is thought to be an introduced pest. This fungus causes multiple cankers on trees, which eventually girdle and kill the tree. The disease has contributed to as much as an 80% decrease in butternut in some states. Butternut canker ranges from eastern Canada west to Minnesota, and as far south as Arkansas, Alabama, Georgia, Louisiana, and Mississippi. In addition to concern over lost biodiversity as species are eliminated, the loss of butternut trees (*Juglans cinerea*) also adds to a cumulative concern about the loss of mast-producing species in the southern Appalachians. In recent years, we have lost several other important mast trees, such as chestnut. Dogwood populations have been decimated in some areas by anthracnose. In addition, oaks are threatened by oak decline, oak wilt, and gypsy moth. The impact of this cumulative loss of mast species on wildlife populations is unknown. **Information is needed to develop control measures for non-native, invasive species (Problem 3).** The probability of success in controlling exotic pests is relatively low, but proportional to the resources dedicated to the research. Such programs are expected to result in publications discussing promising results, but not pest eradication strategies within 5 years.

10. Approach to Problem Solution

Problem 1 B Develop integrated management strategies for pests of seed orchards, nurseries, and plantations.

Practical, integrated pest management strategies that are scientifically rational, environmentally sound, and operationally safe, require detailed knowledge of the life history of the pest, the nature of its interaction with its host, and the influence of cultural conditions and practices, and genetics, on both host and pest.

Element 1 **B** Managing insects and fungal pathogens in southern pine seed orchards and plantations.

The development of monitoring techniques and the use of more efficient serial pesticide applications have greatly reduced pesticide loads in seed orchards and intensively-managed plantations. However, managers still must rely upon frequent applications of insecticides for insect control. In order to enhance current and future control strategies, knowledge beyond the natural histories of pest insects is needed to better understand insect biology, life cycles, natural enemies, and migration patterns. Research is needed to evaluate new, environmentally-friendly insecticides, biorationals, and potentially useful microbials, and develop improved control options that reduce application rates and frequencies. Reliable techniques for monitoring pest populations are needed to optimize the timing and frequency of control tactics. Pheromones and host chemicals need to be identified and tested for use in mating disruption, trap-out, and inhibition tactics for mitigating pest damage. Research is also needed to understand the effects of insecticides and cultural treatments on natural enemies of orchard and plantation pests in order to minimize negative effects and maximize natural biological control. This

project is being conducted in collaboration with Region 8 NFS and S&PF, the NC State Tree Improvement Cooperative, the Western Gulf Tree Improvement Cooperative, and forest industry.

Accomplishments expected within the next five years:

1. Evaluate and report the efficacy of new biorational and environmentally-friendly materials for control of coneworms, seed bugs, and seedworms in southern pine seed orchards.

2. Identify and field-test minor components of *Dioryctria* spp. pheromones for use as attractants in baited traps and for mating disruption.

3. Test the efficacy of mating disruption of *Dioryctria* spp. moths using synthetic pheromones released in seed orchards.

4. Identify cone and seed insects attacking minor commercial conifer species, including fraser fir, red spruce, Carolina helmock, eastern hemlock, and Atlantic white cedar.

5. Identify insect pests of hardwood seed (green ash, sycamore, and sweetgum) used in intensively-managed plantations in the South.

6. Determine what naturally-occurring pathogenic microorganisms are associated with *Dioryctria* spp. coneworms in the South.

7. Determine what impact native insect pathogens have on coneworms.

8. Determine the potential for augmentation of existing coneworm pathogens or introduction of new pathogens into southern coneworm populations.

Pathogens of southern pine tip moths and other North American *Rhyacionia* spp. are being studied for possible use as biological control agents. Pathogens are often critical, but overlooked components of the population-regulating mechanisms of insects. In addition, they have great potential as alternatives to insecticides in many cases. Thus, populations of *Rhyacionia* spp. are being surveyed for infection by fungi, bacteria, viruses, and microsporidia to determine what pathogens are present, how prevalent they are, and the possibilities of using them in a biological control program. This project is conducted in collaboration with the University of Georgia Pine Tip Moth Consortium.

Accomplishments expected within the next five years:

1. Determine what naturally-occurring insect pathogenic microorganisms are associated with *Rhyacionia* spp. in the South.

2. Determine what impact tip moth pathogens have on their native hosts.

3. Determine the potential for augmentation of existing tip moth pathogens or introduction of new pathogens into southern tip moth populations.

4. Identify hybrid pine families that are susceptible and resistant to the Nantucket pine tip moth and determine if there is a relationship between host volatiles and insect attacks.

5. Determine the factors affecting catches of Nantucket pine tip moths in traps baited with synthetic pheromones.

Little is known about the biology of seedborne fungi, or the importance of seed and cone pathogens in the development of nursery diseases. Information on the biology and ecology of pathogenic fungi that occur in seed orchards will be collected and used in the development of disease control strategies. The influence of seed orchard cultural practices and cone collection practices will be examined to determine their effect on the development of seedborne disease problems. Remedial seed treatments, including the use of fungicides and other chemicals, as well as biological control agents, will be evaluated.

Accomplishments expected within the next five years:

1. Determine the efficacy of seed treatments for decontaminating pine seeds.

2. Determine if there is a linkage between seed contamination by *Fusarium subglutinans* f. sp. *pini* and the incidence of pitch canker in nurseries.

3. Evaluate factors affecting the incidence of contamination and infection of southern pine seeds by *Fusarium* spp.

Element 2 **B** Developing alternatives to methyl bromide for managing pests in southern forest tree nurseries.

Nursery diseases have been largely controlled by routine fumigation with methyl bromide. This ozone-depleting chemical is being phased out, and nursery problems are expected to increase dramatically. An integrated pest management approach is being developed, which will include chemical, biological, physical, and cultural control strategies. This project involves active collaboration with NCFES, Region 8 - NFS and S&PF, Georgia Forestry Commission, NC Div. of Forestry, Auburn Nursery Cooperative, and the University of Georgia.

Accomplishments expected within the next five years:

1. Determine which pests will be a problem in southern forest tree nurseries after the use of methyl bromide is discontinued.

2. Evaluate solarization as an alternative to methyl bromide for controlling pests in pine

nurseries.

3. Evaluate biocontrol options for managing weeds and soilborne pathogens in nurseries.

4. Evaluate the impact of cultural practices on soilborne pathogen and nematode populations, and disease development.

5. Evaluate methods of application and determine efficacies of more environment-friendly soil fumigants and other chemical alternatives to methyl bromide for managing pests in pine nurseries.

6. Develop strategies for managing nutsedge species in southern nurseries.

Element 3 **B** Understanding the host/pathogen interaction in fusiform rust.

In the last ten years, the advances of molecular biology in combination with our past research effort at the organismal level have combined to give us new ways of looking at plant pathogen/ host interactions. These techniques are now being applied to the study of fusiform rust pathogen avirulence and host resistance genes. Knowledge of genetics is crucial to the development of deployment strategies for genes for rust resistance in high hazard areas. This is of particular concern since industry has shifted toward pine plantations with less genetic diversity.

Current research here and elsewhere supports the hypothesis that the fusiform rust disease conforms to the complementary genetic system of pathogenesis. At present, we are working with Region 8 - FHP, SRS-4153, NC State University, and the University of Georgia. The first goal is to challenge selected superior material, with single urediniospore-derived rust cultures having known combinations of avirulence genes, and then identify unique differential gene pairs. As differential host genetic sources are identified, the current screening methods will be adapted, to permit testing pines with a panel of differential rust cultures, with known virulence against different resistance genes. Knowledge about race-specific reactions will allow us to monitor the rust pathogenicity genes in the population for changes in gene frequency. A single rust resistant seed source deployed over a large area may shift frequency of virulence genes of the rust pathogen. We need information on the effects of both temporal and spatial selection pressure to develop effective deployment strategies. This RWU will provide one scientist to assist in this regionwide, multi-agency research effort.

Accomplishments expected within the next five years:

1. Examine cellular interactions of the fusiform rust fungus with host and non-host surfaces. Determine factors that lead to germination or non-germination on host and non-host surfaces.

2. Characterize the spore/cell interactions, examining the morphological and physiological basis for compatible and incompatible interactions in host tissues. Determine why some

areas of inoculated seedling tissue are more susceptible to pathogen invasion than other tissues.

3. Examine the effects of past deployment strategies on rust incidence. Further develop predictions of rust incidence under various deployment scenarios.

Element 4 **B** Developing pest management strategies for upland hardwood plantations.

The first approach to sycamore decline must be to determine the relative frequency of the pathogens in declining plantations. This may vary with site, host genetics, and cultural conditions. Inoculations with the prime suspect pathogens will be performed to assess their relative aggressiveness under controlled conditions, and possible interactions that may exacerbate decline. Genetic variation in host susceptibility to these pathogens will be assessed.

Sweetgum dieback after planting is a common problem. Preliminary isolations from dying seedlings have yielded *Botryosphaeria dothidea*. Fungi in the genus *Botryosphaeria* are considered facultative parasites with a broad host range. Inoculum is probably uniformly present, and genetic variation among isolates is considerable. The first approach to defense against such pathogens is to increase the vigor of the host. Manipulations of nursery or cultural practices should be tested to reduce losses at transplanting. These projects will be conducted in collaboration with SRS-4155, the NC State Hardwood Coop, and forest industry.

Accomplishments expected within the next five years:

1. Survey declining sycamore plantations and determine the relative importance of the various disease agents through controlled inoculation studies.

2. Develop a method for rapid resistance screening to the most important pests of sycamore.

3. Determine, as far as possible, what basic underlying mechanisms contribute to host susceptibility or resistance to sycamore decline.

4. Determine the cause of sweetgum cankers, and prove pathogenicity.

5. Determine when infection of sweetgum occurs, and whether nursery or planting practices can be manipulated to reduce losses.

Environmental consideration: The studies in this problem area are expected to have little or no potential for soil movement, water quality degradation, or impact on sensitive resource values, and are, therefore, covered under FSH 1909.15, Chapter 30, **A**Categorical Exclusion from Documentation in an EIS or EA.@ For research involving pesticides, environmental concerns will be evaluated within individual study

plans, or by Environmental Assessments or Environmental Impact Statements prepared with and approved by cooperating District or Forest staffs.

Problem 2 B <u>Information is needed on the interactions of land use and forest management practices with arthropods and microbes of southern forests</u>.

Intensive forest management focuses on maximizing wood fiber production and minimizing losses through tree mortality and subsequent decomposition. However, whole communities of insects rely on dead trees for survival, and detritus is a major part of the forest food web. Large scale (23 acres) plots have been established by other RWUs as part of a long-term study on the Upper Coastal Plain of South Carolina; on some of these all of the woody debris is being removed annually to determine the functional role of woody debris in southern forests, and we will monitor its effect on insect populations.

Fire is increasingly being suggested as a way of restoring and maintaining longleaf pine ecosystems. Study plots that have been burned regularly for over 30 years will be sampled to determine what the long-term effects of prescribed burning are on the arthropod community.

Pollinators play a critical role in the life history of many flowering plants. In the case of endangered species, it is unclear whether or not the pollinator community is still intact or functional. Recent advances in video equipment and computers make video monitoring of pollinator activity a viable option for studying pollinator behavior. By understanding the pollination ecology of rare plants, we will be able to help managers restore the whole community that endangered plants require.

These projects have been undertaken in collaboration with SRS-4104, 4105, 4201, the University of Georgia, DOE, the Nature Conservancy, and Region 8-NFS.

Accomplishments expected within the next five years:

1. Examine the role of coarse woody debris (wood greater than 4 inches in diameter) in southern pine forests. In particular, determine how it contributes to overall forest diversity and arthropod abundance.

2. Determine what role insects play in coarse woody debris decomposition.

3. Evaluate the effects of frequent, long-term dormant season burning on arthropod abundance, diversity and community composition in longleaf pine stands.

4. Study the effects of prescribed burning and coarse woody debris removal on the arthropod prey of the red-cockaded woodpecker.

5. Develop and implement a video technique for the study of pollinators of rare or endangered plants to determine if the pollinator communities and pollination ecology of

isolated plant populations differ from those that are found in more intact plant communities.

Environmental consideration: The studies in this problem area are expected to have little or no potential for soil movement, water quality degradation, or impact on sensitive resource values, and are, therefore, covered under FSH 1909.15, Chapter 30, ACategorical Exclusion from Documentation in an EIS or EA.@ For research involving pesticides, environmental concerns will be evaluated within individual study plans, or by Environmental Assessments or Environmental Impact Statements prepared with and approved by cooperating District or Forest staffs.

Problem 3 B Information is needed to develop control measures for non-native, invasive species.

Kudzu *(Pueraria lobata*) was first introduced into the United States in 1876. It was widely planted as an ornamental, and for erosion control. The invasive nature of this pest was not recognized until the 1950s. Today, kudzu covers about 7 million acres in the southern United States, yet in its native China, kudzu is not a pest. Preliminary explorations in China by ARS, USDA Forest Service-INT, South African, and Australian teams, have found five species of insect and one pathogen attacking kudzu there. SRS-4505 proposes to expand collaboration with S&PF-FHP, and develop collaborative relationships with ARS, with the Chinese, with State Forestry Commissions, and with diverse interested land managers, to assess the potential of kudzu pests as biocontrol agents in the United States.

Accomplishments expected within the next five years:

1. Evaluate the potential to use parasitized soybean loopers to defoliate and suppress kudzu as part of an operational IPM control program.

2. Identify and describe the life history of pests of kudzu as they occur in China and determine those that are potentially useful for a biological control program in the United States.

3. Determine whether these pests of kudzu attack economically important crop plants of the United States.

4. Ascertain whether these pests of kudzu attack any of the rare and endangered leguminous plants of the eastern United States.

5. Develop the infrastructural capability to address other exotic weed problems.

A consortium of interested researchers and forest managers from the University of Tennessee, Clemson University, USFS-NCFES, and Region 8 S&PF, are plotting the Global Positioning System (GPS) coordinates of remaining butternut trees found on federal, state, and private lands. These data are being used for yearly nut and scion wood collections to develop a breeding program. A resistance screening technique is being developed. The establishment of a breeding program is necessary to provide the pedigrees required to guide the selection of molecular markers for disease resistance. Fundamental knowledge of the population genetics and pathology of this disease can help restore butternut in the forest. Preliminary studies have discovered many isolates of *S. clavigignenti-juglandacearum* contain double-stranded RNA. Whether this confers hypovirulence, as is true for the chestnut blight fungus, is unknown.

Accomplishments expected within the next five years:

1. Develop an extensive collection of regional isolates of *S. clavigignenti-juglandacearum* and examine them for dsRNA. The pathogenicity of isolates containing dsRNA will be evaluated for possible hypovirulence.

Environmental consideration: The studies in this problem area are expected to have little or no potential for soil movement, water quality degradation, or impact on sensitive resource values, and are, therefore, covered under FSH 1909.15, Chapter 30, ACategorical Exclusion from Documentation in an EIS or EA.@ Where environmental concerns exist regarding particular studies, these will be evaluated within individual study plans, or by Environmental Assessments or Environmental Impact Statements prepared with and approved by cooperating District or Forest staffs. Importation of exotic insects and diseases as biocontrol agents will be governed by APHIS regulations and specific permits will be obtained as necessary.

MISSION PROBLEM: Complete and close studies on dogwood anthracnose.

Dogwood anthracnose is a fungal disease caused by *Discula destructiva* Redlin. This fungus is believed to be an exotic pest. Although a control strategy for protecting dogwoods in landscape situations has been developed, little is known of the effect of forest management practices on disease severity in woodland situations.

Accomplishments expected within the next five years:

1. Ongoing studies of the effects of timber harvest practices on disease severity will continue to be monitored for dogwood regeneration and anthracnose development.

2. Other studies on the effects of dogwood nutrition on disease severity, and the contribution of dogwood to forest nutrient cycles, will be concluded within two years.

Environmental consideration: The studies in this problem area are expected to have little or no potential for soil movement, water quality degradation, or impact on sensitive resource values, and are, therefore, covered under FSH 1909.15, Chapter 30, ACategorical Exclusion from Documentation in an EIS or EA.@ For research involving pesticides, environmental concerns will be evaluated within individual study plans, or by Environmental Assessments or Environmental Impact Statements prepared with and approved by cooperating District or Forest staffs.

STAFFING

This research program will require an average of 8 scientists per year, at an average annual cost of $2 million. The present unit budget is $1.7 million. Kudzu work is dependent upon additional funding. Distribution of SY=s through the 5-year term is as follows:

Problem Area	Scientist Years For Each Year of RWU				
	1	2	3	4	5
1	4.5	5.5	5.7	5.7	5.7
2	1.0	1.0	1.0	1.0	1.0
3	0.3	1.3	1.3	1.3	1.3
Mission Problem	0.2	0.2	-0-	-0-	-0-

The scientific staff is currently 7 permanent scientists, one of whom is the Project Leader. The kudzu work will be initiated if funding permits.

Currently, there are 7 permanent full-time technicians, 2 clerical positions, and 4 temporary FTEs.