USDA-Forest Service RESEARCH WORK UNIT DESCRIPTION Ref: FSM 4070	1. Number FS-SRS-4854	2. Station Southern Research Station
	3. Unit Location Asheville, NC	

4. Reseach Work Unit Title

SRS-4854: Eastern Forest Environmental Threat Assessment Center
(Asheville, Raleigh, and Research Triangle Park, NC)

5. Project Leader (Name and Address)

Danny C. Lee, USDA Forest Service, 200 W.T. Weaver Blvd., Asheville, NC 28804

6. Area of Research Applicability	7. Estimated Duration
Regional, national, and global threats to forest health	5 years

8. Mission

The mission of the Eastern Forest Environmental Threat Assessment Center is to generate knowledge and tools needed to anticipate and respond to environmental threats.

9. Justification and Problem Selection Summary

The mission of the Eastern Forest Environmental Threat Assessment Center ("Eastern Threat Center" or "Center") is to generate knowledge and tools needed to anticipate and respond to environmental threats. The most serious threats to forests and the benefits they provide inevitably involve complex factors interacting across multiple spatial and temporal scales. The Center's challenge is to maintain a comprehensive and integrated research program to tackle these complex issues, while delivering knowledge to forest landowners, managers, decision-makers, scientists, and other interested audiences in a timely, useful, and user-friendly manner. The Eastern Threat Center's mission and governance were established in its original 2004 charter.

The Center addresses problems related to the science of monitoring, assessment, and communication across four primary classes of environmental threats. These four classes include forest pests, weather and climate change, wildland fire, and changes in land use or land cover. Forest pests include both native and non-native invasive insects, pathogens, and plants. Weather and climate change include the more direct effects of extreme events such as hurricanes, ice storms, tornadoes, floods and droughts, and more broadly, the complex interactions of climate change and variability throughout ecosystems and landscapes. Wildland fire is a growing concern, presenting complex management tradeoffs related to people, ecosystems, communities, and landscapes. Land use/land cover change results from human-related development and urbanization, which creates intricate forest patterns within a mosaic of other landscape elements.

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SRS-4854 – Eastern Forest Environmental Threat Assessment Center
Asheville, Raleigh, and Research Triangle Park, NC
Project Leader: Danny C. Lee

9. JUSTIFICATION AND PROBLEM SELECTION

The mission of the Eastern Forest Environmental Threat Assessment Center ("Eastern Threat Center" or "Center") is to generate knowledge and tools needed to anticipate and respond to environmental threats, primarily to forests but also to other landscapes. The most serious threats to forests and to the benefits they provide inevitably involve complex factors interacting across multiple spatial and temporal scales. The Center's challenge is to maintain a comprehensive and integrated research program to tackle these complex issues, while delivering knowledge to forest landowners, managers, decision makers, scientists, and other interested audiences in a timely, useful, and user-friendly manner. The Eastern Threat Center's mission and governance were established in its original 2004 charter, which was signed by the deputy chiefs for the National Forest System, Research and Development, and State and Private Forestry.

The Eastern Threat Center is unique, fostering creativity and innovation and incubating new ideas and approaches. Its scientists engage in projects at the forefront of technology development, application, and transfer in forest threat detection and assessment. Researchers develop novel indicators of landscape change and provide land managers and policy makers with new insights and tools needed for strategic planning. Center scientists and partners collaborate to address long-standing and emerging issues for forest ecosystems, including water, biodiversity, carbon sequestration, and wildfire—all within the context of changing climate, increasing human populations, and dynamic socioeconomic constraints.

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Three characteristics distinguish much of the work performed by the Center: 1) the efforts are national or at least regional in scope, 2) the work is integrative, and 3) the emphasis is synthetic. The Center strives to address critical broad-scale management needs across all four threat areas, and its research focuses on resource managers' needs for monitoring their occurrence, interpreting their extent and implications, predicting their likely impact, and sharing results, technology, and resources with affected organizations and individuals. At times, Center scientists also perform foundational field, laboratory, statistical, and theoretical research that is essential to the larger efforts.

Because of its cross-disciplinary, tri-deputy administrative design and broad responsibilities, the Center is charged with actively bridging research and management. Center scientists use broad-scale approaches to inform local problems, scaling up location-specific findings to generate more broadly applicable principles. Guided by interactions with external groups such as the Technical User Group (TUG), the USDA Regional Climate Hubs, and other internal and external partners, Center researchers aspire to distill complex, interactive problems into solutions that are recognized as intuitive and useful to the managers who implement them.

One challenge with bridging research and management is that management information needs are often mis-matched with research efforts. To create a missing middle link, the Center typically utilizes "coarse-filter" approaches, which derive meaning and insight from both the coarsest and the finest scales that may be applicable to each. The Center operates across a spectrum of spatial and temporal scales, ranging from fleeting, ephemeral disturbance and recovery to more fundamental and dramatic ecosystem conversions. Increased accuracy (if not precision) often emerges from such middle-scale analysis.

The Eastern Threat Center works closely with its sister center, the Western Wildland Environmental Threat Assessment Center in Prineville, Oregon, to coordinate national approaches to common problems. The Eastern Threat Center differs from the Western Center in having a greater focus on private lands and on Eastern deciduous forests. The Centers have a shared history and mission, both arising from Forest Service and Congressional action following the Healthy Forest Restoration Act of 2003.

The work of the Eastern Threat Center is organized into three problem areas:

PROBLEM AREA 1: Improved methods are needed for efficiently detecting forest threats, identifying meaningful change, and interpreting landscape patterns and processes.

The ability to observe and track threats from pests, climate, extreme weather, wildland fire, and land-use or land-cover change is fundamental to effective forest management. Forest monitoring depends on the availability of data, but data alone are not sufficient. A variety of regularly collected data streams, including Forest Inventory and Analysis (FIA) data, weather station observations, and satellite imagery are gathered at multiple spatial and temporal scales. Other ancillary data sources such as demographic or socioeconomic data are routinely gathered by various agencies and institutions. These sources provide a wealth of potentially useful data. The greater challenge is integrating these complex data streams to derive meaningful metrics for detecting potential threats, assessing forest conditions, and tracking change. Innovative foundational research is often necessary to overcome this challenge. New monitoring methods, metrics, and strategies must be evaluated for their sensitivity and effectiveness for their intended purposes.

The primary monitoring efforts of the Center are twofold: 1) to provide up-to-date information regarding specific threats to areas and resources of concern, and 2) developing specialized tools and techniques to improve monitoring. The Center provides critical details about the current location, scope, and status of recognized threats, and these efforts often serve as a basis for important and recurring Forest Service reporting efforts. In other cases, the Center highlights previously unrecognized threats, thereby serving as an early warning system. Vegetation monitoring conducted by the Center typically spans large geographic extents and multiple years; at these scales, such monitoring provides the context

needed to separate changes of concern from normal forest dynamics. The broad scale of this work puts the Center in a unique position to provide synoptic evaluations that are impractical at finer scales.

The Center's wide purview often demands novel approaches and tools for inventory and monitoring, including the synthesis of initially disparate data streams. For example, the Center actively seeks new methods to combine and leverage remotely sensed data (including airborne and satellite surveys) with ground-based measurements in order to understand forest changes within a greater regional or national management context. Remote sensing observations provide regional perspectives that cross vegetation types and jurisdictions, but these data typically are of moderately coarse resolution. For instance, the five-year National Land Cover Dataset products distinguish forests from grasslands at 30-meter resolution, but they do not distinguish compositional changes within forests or grasslands. In contrast, field-based data such as FIA monitoring plots provide more power to examine local phenomena, but represent a comparatively sparse landscape sample and are collected less frequently than remotely sensed data. The respective strengths and weaknesses of these alternative data sources are largely complementary, so that their effective combination promises a more rigorous and holistic view.

The Center's monitoring efforts may target the condition of forests directly or the stressors that can affect landscape change. Importantly, the occurrence of even moderate levels of tree damage and mortality do not necessarily indicate problematic or abnormal conditions, as forest species and ecosystems are commonly adapted to and may even depend on specific stressors for their persistence. For instance, many ecosystems are adapted to short-term climatic stress such as temperature or moisture extremes. Recognizing the distinction between normal and abnormal conditions calls for nuanced inventory and monitoring approaches that are attuned to historical baseline conditions. One example of the need for nuanced monitoring is wildland fire in fire-adapted ecosystems. In order to understand the status of fire-adapted forests, researchers need to track the absence of wildfire as much as the direct effects of fire. In contrast, nuanced monitoring of native insects or diseases is considerably more difficult. Biotic agents are often numerous, populations can erupt naturally and unpredictably, historical data are limited, and effects are more difficult to ascertain. The Center aims to comprehensively understand native stressors so that they can be more intelligently monitored as indicators of significant change.

In addition to monitoring direct indicators of forest change and native stressors, the Center also tries to anticipate the effects of non-native invasive species. By understanding invasive species' distributions and spread, Center scientists and partners can monitor the factors that govern their movement and predict how and where invaders might spread, as well as estimate their likely impacts before they arrive. This includes efforts like monitoring the movement of firewood and nursery products that convey alien species of concern quickly over large distances. By characterizing primary pathways for the movement of non-native invasive species, and developing approaches to monitor these pathways, it becomes easier to focus on the critical task of determining which species are likely to be major threats (or threatened), or evaluating the potential extent of their impacts.

Monitoring can be exploratory, designed to determine status or to summarize conditions, or it can be confirmatory, designed to verify or test results of prior management actions. In either case, monitoring is more likely to be utilized and maintained long-term if it is efficient and cost-effective. Mechanisms should be in place to evaluate and, if necessary, modify detection and monitoring efforts based on feedback from resource managers, policy-makers, and stakeholders.

<u>Problem 1a</u>. Detecting forest threats, monitoring their extent and severity, and tracking forest

conditions through time require new methods and tools for processing, measuring, and interpreting observational data, as well as new techniques to combine multiple data sources in novel ways.

Problem 1b. Scientists and managers tasked with characterizing forest ecosystems require timely summaries of the status of current and emerging situations within and surrounding those ecosystems. A lengthy record of monitoring over a wide geographic area and across all types of land use/land cover is needed to help provide important context for interpretation and management insights.

PROBLEM AREA 2: Innovative approaches to assessment and prediction are needed to improve understanding of the realities and implications of ecosystem change.

To achieve long-term societal goals of sustaining forests, more is needed than the knowledge gained from detection and monitoring. Although they are necessary first steps, detection and monitoring alone insufficient for assessment and prediction. Synthetic frameworks that analyze, interpret, and present information in ways that relate to the pressing needs of policy makers, planners and managers are also needed. The end users of knowledge may struggle to ascribe meaning and value to science results that lack broader spatial or temporal contexts. While a tremendous volume of potentially relevant science and monitoring information is available for addressing forest problems, much of it is not being used as effectively as it might be. Moreover, certain critical information is readily acquirable, but not yet available. The Center conducts foundational research targeted on these critical phenomena when such knowledge is likely to improve the quality of future assessments and predictions. The Center also conducts synthetic assessments to help forest practitioners better interpret the significance and relevance of published science.

Assessments provide a set of approaches to digest and structure applied knowledge, though these vary greatly in their formality, mathematical rigor and purpose. Some are largely narrative descriptions of the status and problems experienced by forests, while others attempt to rigorously quantify risks and tradeoffs to multiple values of concern. The most advanced assessments provide policy or management options for problem solution and communicate the uncertainties and assumptions from imperfect models or datasets. Guided by a clear vision or framework for knowledge acquisition and application, these assessments rigorously connect foundational science, monitoring and implementation. They also help identify and prioritize information most relevant to the decisions surrounding a particular set of issues. Within such a framework, scientific models can synthesize or organize related information in ways that make it more accessible and interpretable.

Quantitative risk assessment is a mainstay of the Center's efforts and provides a powerful approach to addressing uncertainty in forest management. This process involves the formal consideration of values so that they are unambiguously expressed as measures, followed by a formal evaluation of the factors that, in a causal sense, put those measures at risk. This framework then allows an exploration of consequences and how they are likely to vary across scenarios or management alternatives. The quantitative aspect is founded on the statistical concepts of probability and likelihood, and includes flexible and readily updatable tools, such as Bayesian information networks. Part of the flexibility of these networks stems from their ability to integrate the effects of multiple independent drivers to address multiple outcomes as part of a comprehensive comparative risk assessment process.

Assessments and predictions become exceedingly important and challenging when they target problems that impact multiple aspects of highly complex systems. Unfortunately, many ecosystems are inherently

dynamic across spatial and temporal scales or levels of organization all-the-while they are experiencing novel changes in invasive species, land use/land cover, extremes in weather or climate, or other uncharacteristic disturbances. As demand for a range of ecosystem services grows, assessments often involve characterizing potentially controversial tradeoffs. Such trade-off can be most acute when the future is most uncertain.

Problem 2a. Foundational knowledge of the key patterns and processes that influence ecosystem change is sometimes lacking. Fine-scale research, such as fieldwork and data analyses, can improve or validate ecosystem models.

Problem 2b. Ecosystem values and services can be affected by uncharacteristic or novel changes in weather and climate, land use or land cover change, wildfire and invasive species. As implications and impacts of these stressors are rarely certain, applied theory and innovative approaches to modeling can anticipate problems before or as they evolve. This problem includes the need for syntheses of bodies of existing knowledge to make knowledge more accessible.

Problem 2c. The quality of management decisions that involve high uncertainty can be improved through quantitative risk assessment. As decisions often impact multiple values at once, a key need for applied assessments is to address proposed solutions in terms of their likely and conditional tradeoffs.

Problem 2d. Predicting future change in ecosystems and services can lead to earlier intervention, improved management, mitigation, or adaptation, but accurate predictive tools and forecasts are often lacking. Improved prediction can make forest management decisions more proactive than reactive.

PROBLEM AREA 3: Active information exchange is essential to ensuring that science is used in management, and equally important in fostering relevant and useful science.

As the amount and availability of scientific information skyrockets, new challenges and opportunities arise for understanding forest threats and landscape change. The Center recognizes the need to share information, tools, and resources that partners, customers, and other users can readily use and apply to sustain natural resources, especially in the face of new, evolving, and interacting threats to forests. Responding to emerging forest threats and sustaining natural resources across a changing landscape require active information exchange between and among customers, including resource managers and planners, policy-and decision-makers, management and extension specialists, researchers, and stakeholders. This critically important exchange of information is complicated by complex networks of individuals with widely varying roles, responsibilities, interests, and understanding of natural resource values and threats to sustainability. The Center is uniquely positioned to interconnect these networks, to create advanced tools and products that streamline information exchange, and to establish methods to develop tools and products that meet diverse, multi-dimensional customer needs.

Fundamental to successful information exchange is identifying the scientific information most relevant to policy- and decision-makers, understanding the role of management and extension specialists to facilitate this critical information exchange, and recognizing society values linked to natural resources. The Center works with customers to understand their priorities and needs, and to ensure that tools and products are designed and implemented in useful and meaningful ways. This understanding is gained through both direct and indirect methods—directly through consultations with representative

customers, and indirectly through review of existing customer products. Both methods inform scalable solutions that include not only relevant information, but also mechanisms, techniques, and capacities to deploy successful products that meet customer priorities and needs.

Problem 3a. Opportunities to create and strengthen effective and efficient information exchange are enhanced by understanding and gauging stakeholder needs, and by using best practices for outreach, extension, and communication. The Center strives to increase effectiveness when developing and exchanging knowledge, and basic foundational research helps to enhance perspective and understanding of customer needs and desires.

Problem 3b. Collaborative development and transfer of effective analytical tools and technology that support science-based decision-making are necessary to sustain long-term forest health and productivity. Early and active engagement with end-users maximizes the likelihood that decision-support tools and information will be adopted and effectively used.

Problem 3c. A wide spectrum of products, tools, and services are needed to engage diverse, multi-faceted audiences; to increase their understanding of forest threats; and to encourage long-term collaboration. The desired goal is an interactive, bidirectional exchange. Everyone at the Center has an important role to play in achieving such engagement, and that role occurs throughout the entire scientific process.

10. APPROACH TO PROBLEM SOLUTION

PROBLEM AREA 1: Improved methods are needed for efficiently detecting forest threats, identifying meaningful change, and interpreting landscape patterns and processes.

Planned research and accomplishments

Problem 1a (foundational research)

- Systematic landscape and national monitoring of the occurrence of biotic and abiotic stressors, including the introduction or initiation of new stressors and long-term trends in their occurrence
- Systematic landscape and national monitoring of indicators of forest conditions
- Development of value-added monitoring indicators that cross spatial resolutions
- Development of broadly applicable indicators for monitoring long-term response to disturbance, such as multi-year trends in decline or the rate of recovery

Problem 1b (regular reports)

- Periodical forest health reports that summarize the condition of forests and key stressors using a variety of datasets such as forest inventories or remotely sensed datasets

Anticipated outcomes

- Local, regional and national audiences will gain understanding of the pattern and impacts of biotic and abiotic stressors acting both individually and collectively.
- Forest monitors and planners will gain more effective and efficient monitoring capability from value-added forest threat and response indicators.

- Forest monitors will be better able to systematically detect, track and interpret threats through more effective use of extensive data sets, including the ability to recognize change that may otherwise have been overlooked.
- Landscape and regional planners will benefit from monitoring that provides systematic insights at coarse scales across jurisdictions.
- Broad audiences will stay current on the annual state of the forest.

PROBLEM AREA 2: Innovative approaches to assessment and prediction are needed to improve understanding of the realities and implications of ecosystem change.

Planned research and accomplishments

Problem 2a (foundational research)

- Discovery of basic knowledge about how ecosystems work with implications for how ecosystems are managed
- Development or refinement of new theories that may eventually be incorporated into applied science products
- Validation of existing models using empirical information obtained through field or remotely sensed observations

Problem 2b (stressor-effects research)

- Focused analyses on the effects of wildfire, drought, insects and diseases, development, land cover/land use change, invasive species, weather and climate change on specific values or ecosystem services such as water, forest species diversity, forest cover and configuration, carbon sequestration, and resilience
- Syntheses of existing knowledge of forest stressors and their effects for broader appreciation of the "state-of-the science"

Problem 2c (quantitative risk assessment)

- Analysis of the risks associated with different decisions for prioritizing management efforts, such as treatments or restoration options
- Elucidation of the tradeoffs associated with management options
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Problem 2d (predictive modeling)

- Formal predictions of how specific management options are likely to have desired effects based on Bayesian modeling
- Projections of the effects of gradual change in stressors or disturbance regimes using historical trends and/or process models

Anticipated outcomes

- Scientists and managers will improve their understanding of ecosystem pattern and processes with basic science that targets broad-scale ecosystem modeling needs.
- Agencies and other entities charged with conducting forest assessments will benefit from having access to science-based exemplars, improved datasets, relevant models, and insights.
- Forest decision makers faced with difficult tradeoffs can make more inclusive, transparent and rigorous decisions using emerging approaches to quantitative risk assessments.

- With more accurate predictive models in hand, decision makers will become more proactive than reactive when managing issues that affect long-term forest resilience.

<u>PROBLEM AREA 3</u>: Active information exchange is essential to ensuring that science is used in management, and equally important in fostering relevant and useful science.

<u>Planned Research and Accomplishments</u>

Problem 3a (foundational research)

- Understanding the relative effectiveness of the Center's various approaches to information exchange
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Problem 3b (engagement with proven and new technologies)

- Refinement of applied web-based forest and disturbance monitoring tools that enable highly engaged forest managers to monitor, assess or predict threats to the health of individual forests or landscapes
- Targeted efforts to engage forest managers through online communications or with technical consultations
- Broad engagement of individuals, agencies and organizations through webinars that highlight new products or information
- Engagement of narrowly targeted individuals, agencies and organizations through hands-on workshops that highlight new products or approaches

Problem 3c (tailor information to diverse audiences)

- Development of informational materials and products for nontraditional clients and stakeholders in ways that enable them to understand natural resource values and threats

<u>Anticipated Outcomes</u>

- Greater institutional insights into the effectiveness of different engagement strategies
- More refined models for information exchange between scientists and managers will help ensure that science is highly relevant and actually used to make better decisions
- Forest managers will be more likely to use relevant science when it is tailored to their specific needs and presented in accessible formats
- A broad distribution of forest information will ensure that underserved groups and the public overall are more aware of the importance of forests and growing threats to their viability

11. ENVIRONMENTAL CONSIDERATIONS

The RWU-4854 program of research includes activities that are not expected to have a significant adverse effect on the quality of the human environment. The environmental effects of specific actions will be considered during the development of study plans, at which time the existence of extraordinary circumstances related to the proposed action and any categorical exclusions will be documented as a part of the study plan as described in FSH 1909.15, Chapter 30. For research involving the use of toxicants, environmental considerations will be further evaluated through Environmental Assessments or Environmental Impact Statements prepared with, and reviewed by the cooperating District or Forest staffs. For research having the potential to affect a plant or animal species that is federally listed as

endangered or threatened or proposed for such listing, RWU-4854 will consult with District or Forest biologists and the U.S. Fish and Wildlife Service as per Section 7 of the Endangered Species Act of 1973, as amended.

Key Cooperators: The Center collaborates with research scientists, professional resource managers and academic colleagues from public and private organizations across the country to address the effects of forest threats on healthy forests. Partners and collaborators work with Center staff on the full range of activities, ranging from foundational research, to forest monitoring, to assessment, to technology development and delivery. Specific examples relevant to technology delivery include developing tours and field trips, and publishing brochures and other written and web-based materials. The following list includes organizations and institutions that have participated in projects both large and small with the Center.

Southern Research Station:
SRS-4804 Forest Economics and Policy
SRS-4855 Center for Integrated Forest Science
SRS-4156 Center for Forest Disturbance Science
SRS-4801 Forest Inventory and Analysis
SRS-4552 Insects, Diseases, and Invasive Plants
SRS-4353 Coweeta Hydrologic Laboratory

Within the USDA Forest Service:
Western Wildland Environmental Threat Assessment Center
Forest Health Protection
Forest Health Monitoring
Forest Health Technology Enterprise Team
Forest Inventory and Analysis
Southern Region, National Forest System
International Institute of Tropical Forestry
Northern Research Station
Northeastern Area, State and Private Forestry
Rocky Mountain Research Station
Pacific Northwest Research Station
Pacific Southwest Research Station
Pacific Southwest Region, National Forest System
Remote Sensing Applications Center
National Forests in North Carolina
International Programs

USDA (other than Forest Service):
Agricultural Research Service
Animal and Plant Health Inspection Service
National Agroforestry Center
Natural Resources Conservation Service

Other Federal Agencies (other than USDA)
USDI Bureau of Land Management

USDI National Park Service
National Aeronautics and Space Administration (NASA) Stennis Space Center
National Oceanographic and Atmospheric Administration
United States Agency for International Development
US DOE Oak Ridge National Laboratory
US Environmental Protection Agency
USDI Fish & Wildlife Service, Landscape Conservation Cooperatives (LCCs)
USDI Geological Survey
USGS EROS Data Center
USGS Southeast Climate Science Center
USDI Bureau of Indian Affairs (and Tribes)
USDI Office of Wildland Fire

State Agencies:
California Department of Parks and Recreation
Illinois State Museum
North Carolina Department of Agriculture, Forest Service (NCFS)
North Carolina Department of Environment and Natural Resources (NC DENR)
South Florida Water Management District
Texas Forest Service
Michigan Department of Natural Resources
State Climate Office of North Carolina

Universities:
Alcorn State University
Auburn University
Brown University
Clemson University
Dartmouth University
Humboldt State University
North Carolina State University
Michigan State University
Mississippi State University
North Carolina A&T University
Taiwan National University
Texas A&M University
University of Alabama, Huntsville
University of California-Berkeley
University of Florida
University of Georgia
University of Hong Kong
University of Kentucky
University of Maine
University of Maryland
University of Missouri
University of New Hampshire
University of North Carolina Asheville
University of Toledo

University of Wisconsin-Madison
Virginia Polytechnic Institute and State University
Virginia State University
Yale University

Other institutions or organizations:
Chinese Academy of Sciences
EcoAdapt
E&S Environmental U.S.-China Carbon Consortium
European Commission, Joint Research Centre
National Atmospheric Deposition Program
Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre
Research Triangle Institute (RTI)
Southern Group of State Foresters
National Association of State Foresters
Southeast Climate Consortium
Southeast Watershed Forum
Southern Regional Extension Forestry (SREF) at University of Georgia
United South and Eastern Tribes
Mescalero Apache Indian Reservation
Weyerhaeuser Corporation
The Nature Conservancy

12/13. STAFF AND COSTS

The RWUD describes an ambitious five-year plan of work. The Center is currently staffed with 21 permanent employees comprising a center director, seven RGEG1 scientists, a communications specialist, and twelve professional and administrative support personnel. The staff is augmented by various cooperators, contractors, term employees, and students that are located on-site, with the total number of supplemental staff varying annually from 5 to 15 individuals depending on funding and cooperative arrangements. The total incoming funding in 2014 for the Center from all sources was approximately $5 million. This total includes a mix of appropriated Forest Service research funding (FRRE), core funding provided by the National Forest System and State and Private Forestry, and supplemental funding from a variety of other sources including competitive grants. Current projections are that this funding is unlikely to increase above 2014 levels in the foreseeable future and could possibly decrease substantially.

The proposed permanent staffing level would increase the number of RGEG scientists to 9 or possibly 10 and maintain a professional and support staff similar to 2014 levels. The increase in RGEG scientists could include an additional research ecologist or forest geneticist specializing in conservation and a landscape ecologist with expertise in planning or risk assessment. The current approved organizational chart for the Center (Attachment 1) includes three vacant scientist positions (vacancies arose due to retirement). There also is interest in increasing the technology transfer or extension capabilities within the Center. Possibilities for doing so include redirecting the work of some of the existing staff, or hiring additional expertise.

1 RGEG refers to panelled scientists covered by the Research Grade Evaluation Guide.

Discretionary funding decisions within the Center tend to be made along the lines of specific projects rather than allocating funds among the three problem areas. Appendix 1 provides a crosswalk of specific projects to problem areas and identifies key partners that are involved in these primary efforts. As shown in the matrix in appendix 1, each project includes significant elements of each of the three problem areas. The level of emphasis among the problem areas depends on the maturity of the project and whether it is an ongoing effort such as the ForWarn forest monitoring project, or a more specific project with specified timelines and budget such as PINEMAP. Individual scientists and staff members are assigned to the different projects and expected to contribute in all three problem areas. Similarly, a blend of funds from the different Forest Service deputy areas (or other sources) are used in each project depending upon the nature of the effort. For example, research funds are used primarily for foundational research and methods development. Other funding is better suited for monitoring efforts or information exchange.