Forest Ecosystems and Society Development Plan – 2013

Phase I: IBPSS
(Integrating Biophysical and Social Sciences)

Summary: The Department of Forest Ecosystems and Society has strong and globally recognized disciplinary expertise in the biophysical and social sciences along with significant strengths in philosophy and policy. The faculty recognize and are rallying around one primary and distinctive goal for the near future: leading the difficult but necessary integration of the biophysical and social sciences into research and education programs that foster solutions to complex natural resource challenges. To achieve our integration goal, we need to revise and enlarge our curricular offerings, strengthen our disciplinary base, identify and incent our integrated research foci, develop a visiting scholars program, enlarge our international activities, and increase diversity among students and faculty.

Introduction

The Department of Forest Ecosystems and Society (FES) focuses on two entwined premises. First, FES recognizes that humans play an important role in structuring ecosystems, and that those ecosystems are, in turn, fundamental to human we ll-being. Second, FES recognizes that understanding and solving environmental challenges is inherently multidisciplinary, requiring expertise across the biophysical and social sciences. FES contains the wide range of scholars necessary to explore these issues, scholars who are not only experts in their various disciplines, but who are skilled at integrating the disparate areas of expertise required for solving environmental problems.

> *FES strives to develop and integrate scientific knowledge from the social and biophysical sciences to inform new approaches to sustain interdependent ecological and social systems of the world. FES also evaluates the scientific and philosophical foundations of natural resource management and policy and helps develop conceptual frameworks for natural resource policy reflective of our understanding of the world and the people within it.*

This ability to integrate is at the core of our graduate and undergraduate education programs, as well as our research and outreach. In particular, the synergy between biophysically-focused and human systems-focused faculty provides an opportunity to train the next generation of scientists, land managers, and educators to study the science behind and help resolve problems from a multi- and inter-disciplinary perspective. The FES Department is well positioned to meet this need and continue its leadership role in research, policy and education at local, national, and global scales.

FES's overriding goal in this plan is to integrate biophysical and social sciences in teaching, research, and outreach while maintaining disciplinary excellence. In accomplishing that goal, FES will contribute to COF's goals in research excellence, academic excellence, extension/outreach, and financial health. As FES works toward these Departmental and COF goals, we will take actions that will move us toward the goals of internationalizing FES and the COF, increasing funding for

FES activities, and becoming a center for policy-relevant work with an emphasis on important societal natural resources debates in the PNW and beyond.

This document describes our plan for research, education and outreach that goes beyond the simple inclusion of multiple disciplines—to the purposeful combining of disciplines to address regional and global land and ecosystem issues. This plan identifies our existing capacity and future needs, as well as a broader vision for our future. Here, we describe our current strengths, and then identify specific actions and mechanisms to improve our ability to achieve our mission.

Current Strengths

Mission Statement

Our department brings together biological and social scientists and philosophers to understand ecological systems, social systems, and the interactions between them. We work in terrestrial to aquatic systems, in wildland to urban settings, and from local to global scales. We evaluate the scientific and philosophical basis for management and policy decisions and provide enhanced frameworks for those decisions reflective of our latest findings. We conduct creative problem-solving and fundamental research; educate and engage the next generation of scholars, practitioners and users of the world's natural resources; and share our knowledge and discoveries with others.

Who we are now

The Department of Forest Ecosystems and Society (FES) was formed in 2007 from faculty from the Forest Resources and Forest Science departments as part of the restructuring of the College of Forestry. By bringing together faculty with social science and biophysical expertise plus adding critical positions, we are well positioned to address our mission.

FES is a leader at OSU in the research arena and we wish to maintain that status. Total new grants and contracts received in FY 2011-12 was $7.2 million, generating over $250,000 in overhead for the College annually. In FY011/12, the 28 professorial faculty produced over 170 research publications as well as several books; faculty in the department led over 118 workshops and outreach presentations. As of July 2013, we have over 112 graduate students, and are the administrative home to over 572 undergraduate students.

FES is much more than just T/TT faculty. As of June, 2012, we had 28 professorial faculty, 8 fixed term instructors, 44 faculty research assistants and associates, 18 professional faculty, 7 instructors, and 9 classified staff (FES office and College IT staff). In addition, FES has 14 adjunct and 88 courtesy/affiliate faculty that greatly contribute to our breadth and reach. Since its formation, FES has lost 7 T/TT faculty to retirement or other positions and hired 2 new faculty members. With our age structure, we will continue to have large number of retirements.

Education Programs

FES Education Vision: All degree programs administered now or in the future will revolve around one objective: prepare interdisciplinary thinkers, highly capable scientists, and natural resource leaders to address challenges in which human systems coexist and interact with

biophysical systems. We believe that education results from a wide range of experiences and from interactions with diverse individuals.

Our educational philosophy is to provide**:**

- Interdisciplinary breadth and disciplinary depth
- Courses that actively integrate knowledge in social science, ecology, economics, forestry, public policy, climate change, and quantitative analysis
- Experiential education, including internships
- A choice of thesis and non-thesis graduate degree programs
- A choice of on-site and distance education

FES Degree Overview

A. **FES Ecosystems and Society Undergraduate Degree Program** (proposed start: 2015): Currently under development, the Cat I Proposal is scheduled for submission in late 2013. This undergraduate degree will prepare students for a range of careers, including policy, management, and ecosystem science. Many of these students will become leaders in local, state, and federal agencies; conservation NGO's; and business. The degree will be available both on campus and through E-campus. The key factor differentiating this from other undergraduate programs at OSU and across the country is disciplinary strength coupled with extensive integrated systems thinking and critical thinking. Several courses will use interdisciplinary approaches to foster understanding and application of multiple approaches and disciplines to address complex issues.

B. **OSU Natural Resources Undergraduate Degree Program:** The FES Department is the administrative home for OSU's Natural Resources (NR) Bachelor of Science degree program. This degree provides graduates with a working knowledge of a broad span of natural resources, their diversity and interdependence, and the critical relationships between humans and their environment. The program of study encompasses a broad spectrum of disciplines and coursework supported by the Colleges of Agricultural Science, Forestry, Liberal Arts, and Science. The program has a current enrollment of about 500 students.

C. **FES Recreation and Resource Management Undergraduate Degree Program:** COF has provided the OSU Recreation Resource Management (RRM) program for the past 30 years. This degree prepares students to meet the challenges of managing natural resources within the social dimensions of human use and behavior. There are 15 different options or minors associated with the degree ranging from recreation behavior, recreation planning and management, communication, wilderness management, resource economics, resource ecology and conservation, and resource analysis and policy. The program has a current enrollment of about 60 students.

D. **FES Tourism and Outdoor Leadership (TOL) Program** (Bend campus)**:** TOL is for students seeking careers connecting people to natural environments. There is a minor and four options: Adventure Leadership and Education, Eco and Adventure Tourism, International Ecotourism, and Recreation Management. The program provides the outdoor

leadership, business, communication, and other skills necessary for success in this field. The program includes a mandatory internship, with many students meeting this requirement in international locations. Graduates work for a range of outfitter / guide companies, outdoor education institutions, and local, state, and federal agencies.

E. **FES Forest Ecosystems and Society Graduate Degree Program:** The thesis-based M.S and Ph.D. degrees in FES produce high quality interdisciplinary and disciplinary leaders and scientists. There are currently 65 graduate students in the program. Programs of study integrate social and biophysical science disciplines and student thesis committees are required to include members from different disciplines. Disciplinary depth is achieved through course work within and beyond the College of Forestry. Interdisciplinary integration is achieved primarily through student research. Further investment to develop problem-based interdisciplinary courses is required. Additional investment is also required to replace disciplinary depth lost to retirements and advancements and to increase international experiences for students such as study-abroad programs, international internships, shared international is needed.

F. **Master of Natural Resources Graduate Degree:** Students in this online degree program will develop analytical and problem solving skills associated with complex natural resources issues. Moreover, students will learn from, and network with, world renowned OSU faculty in natural resources – including scientists from fisheries, wildlife, forestry, rangeland and water departments. This online degree program consists of 18 credits of core interdisciplinary courses, 18 credits of the student's choosing within natural resources (e.g. fisheries and wildlife, sustainable natural resources), and 9 credits of a capstone project.

G. **On-line Graduate Certificate in Sustainable Natural Resources :** This 18-credit online certificate is designed for all students, especially company, industry or agency employees who desire training in solving complex sustainability problems. Students complete an integrated course of study in a dynamic learning community, under the mentorship of professionals, to design workable solutions for complex natural resource issues of local, state, regional, national and international importance. Students are required to include a 1-unit course on integration, 6-9 credits of human dimensions coursework, and 6-9 credits of ecology and management coursework and 2 credits for a capstone project.

H. **On-line Graduate Certificate in Forests and Climate Change (FCC)** (proposed start: fall 2014): This 19-credits online Certificate is appropriate to all students, especially mid-career, company, industry or agency employees who want more training and experience in natural resources and climate change. The FCC is the only online program in the nation being offered in this area. The program is also packaged within the context of the MNR program, which offers a natural next step for students completing the FCC certificate.

I. **On-line Graduate Certificate in Urban Forestry (UF)** (proposed start: Fall 2014): This 18-19 credit online certificate is open to all students, but is specifically targeted to urban foresters and urban natural resource professionals practicing at the state, municipal, or non-profit levels, or in the private sector. It will be ideal for professionals who hold

undergraduate degrees in allied professions such as horticulture, landscape architecture, forestry, land use, or other natural resource disciples. The UF Certificate will be the first on-line graduate program in urban forestry available in the US. The program is also packaged within the context of the MNR program, which offers a natural next step for students completing the UF certificate.

Research Overview

FES is a department that maintains a tradition as a world leader in disciplinary ecological and social science research. The parent departments to FES – Forest Science and Forest Resources – have a remarkable history of key discoveries that have transformed basic and applied research in forests and resulted in the policy change from local to global scales. FES consistently challenges, and helps revise, scientific assumptions and existing forest management paradigms, inspiring and informing vital, visionary public policy. Policy shifts grounded in the top science produced by FES helps create healthier and more resilient forest ecosystems in our rapidly changing world. The systems approach, core to most work, is setting the framework for new policy. Examples of disciplinary projects are given in Appendix 4.

This high level of scientific and policy impact is not by chance. It occurred due to an explicit focus on attracting and supporting high-quality faculty to the department, which in turn, attracted other high-quality scientists and students.

FES is more than a disciplinary research leader. FES strives to integrate social and biophysical sciences to address important environmental problems. This requires faculty that have the appropriate blend of disciplinary depth and cross-disciplinary breadth. It is critical that faculty are strongly grounded disciplinarily and well respected nationally and internationally in their respective fields, and also are willing and able to work with collaborators across disciplines. Many FES faculty members currently participate in interdisciplinary projects. FES is the home department for the HJ Andrews LTER program, an international leader first in biophysical sciences and more recently in the integration of biophysical and social sciences. A few other examples of complex work that bring biophysical and social sciences together include:

- Knowledge about ecological impact on water quality, economic demands for water, and social concerns are being integrated to produce projections and policy recommendations for water quality and land use in the Willamette Valley. This is a large-scale interdisciplinary project funded by the National Science Foundation Coupled Human and Natural Systems directorate.
- Economists, ecologists, and computer scientists are developing a spatially-explicit bioeconomic decision model of invasive species dispersal and establishment in a river network to determine the optimal type, location and timing of management activities.
- NSF coupled human-natural systems grant brings together fire scientists, economists, agent-based modelers, forest ecologists, social scientists, and GIS personnel to build a systems model and use collaborative learning to improve our

understanding of how humans adapt to living near fire-prone ecosystems in central Oregon.

- Analyzing spatially explicit models of rural people's resource extraction from, and the resulting patterns of forest degradation in, forests in low-income (often tropical) countries reveals how extraction responds to socioeconomic characteristics such as market access, biological characteristics such as biomass densities, and management policies such as livelihood projects and enforcement.
- With support from the Forest Health Initiative and the US Forest Service, social and biological scientists in FES are working together to understand public perceptions of the acceptability of various biotechnologies for restoring endangered forest tree species, and helping forests to adapt to climate change.

The next steps for FES research are to develop a set of integrated research foci, incent faculty to participate, and ensure that staffing is adequate to the needs.

Outreach Overview

All FES faculty engage in outreach usually tied to individual research programs. Many funding agencies now require it. FES Extension faculty are all county-based, delivering programs to small woodland owner and other audiences. FES seeks to use our integration of biophysical and social sciences to broaden the extent of our outreach activities to traditional and new stakeholders. Outreach activities will bring our innovative approach to problem solving to new stakeholders and issues, and provide insights and guidance about stakeholder needs to inform our teaching programs.

FUTURE DIRECTION OF FES

Over the short 5 years of its existence, there has been considerable progress in developing a new dynamic around the integration of the biophysical and social sciences to meet societal needs. In addition, over the past year, considerable enthusiasm has revolved around the development of the new undergraduate program, increasing awareness of coupled human and ecological systems research, and the focus of Dean Maness' vision for the College.

Tactical approaches to meeting needs of the education, research and outreach programs are listed in Appendices 1, 2 and 3, respectively. Financial resources will be needed to support and incent faculty and others to develop and engage in these new activities. These activities include curricular development, integrated research foci, and outreach programs. More details are provided in the appendices.

At the same time, the Department is at a critical juncture that reduces its potential to fully contribute to future opportunities. Significant turnover in departmental leadership in the past 5 years has challenged departmental cohesion around a strategic direction. Attrition in key personnel and current demographics have diminished the Department's capacity to bring new thoughts and ideas into Departmental efforts, and is putting pressure on meeting basic educational, research and outreach needs.

Strategic investments are requested to help FES better represent both the social and biological dynamic important in solving future resource problems, provide opportunities to attract faculty and students that represent diverse background and ideas, expand more fully into focused international

opportunities, and attract new supporters and stakeholders that align with the Departmental and the College.

Major Investments for a Future FES

Several key and significant steps are necessary to move the FES Department forward and enhance its ability to meet its mission and role in the future COF. These include the search for a new FES Department Head and the development of the new FES Undergraduate Degree. Most critical, however, is the need to bring in new faculty—faculty that have as part of the position descriptions the direction to build upon the integrated mission of the Department.

Opportunities exist to fill future positions that directly benefit the FES mission and provide value-added curricular, research and outreach offerings that will benefit numerous College and University programs. Future staffing will require careful analysis and represent a hiring strategy that meets both short and long term needs. Immediate term needs center around the filling of key positions brought on by retirements and the inability to teach essential undergraduate and graduate courses to support College-level curriculum and research possibilities. The new undergraduate program unfolds and we more fully engage our broadened stakeholder base, careful analysis will identify a number of new faculty lines that will be critical to supporting the future mission and direction of the Department.

Within the next 6 months, FES requests the authority to begin the search for 2 critical faculty positions that represent current and significant holes in of the Departments disciplinary strength. These positions are:

a. Ecological Communities and Adaption: This position would seek to hire an individual that would develop education and research programs that seek holistic solutions to complex environmental problems affecting the future functioning of forests. The individual would focus on ecological community and ecosystem interactions and have possible expertise in invasive species, fire effects under the potential changes associated with future climate change or ecosystem processes. These are all research areas that strongly interact with many faculty within the College and University.

   Currently, FES does not have capacity to teach several critical courses in this area that support several curricula. Key courses that are currently not being offered or are being taught by adjuncts or graduate students that could be supported by this position include:

   FS 545-Advanced Forest Community—a core foundations course for FES graduate students and a course highly subscribed by others in FERM, BPP and ENSC. Enrollment—15 students

   FES 341-Forest Ecology—a core foundational course for FERM, FES, NR, FW and ENSC undergraduate students—70 students

   FES445/545—Ecological Restoration—currently an elective course but in high demand by FERM. NR, RRM—80 students

FS 548—Biology of Invasive Plants---currently not being offered on-campus after the retirement of Dr. Steve Radosevich

b. Ecosystem Service Provision and Management: This position would focus on assessment or valuation of ecosystem services and their production, trade-off analysis to inform management of social and biological systems for ecosystem services, and/or evaluation of policies to promote ecosystem service-based rural development. Key courses that we currently are not offering due to lack of capacity or are being offered by temporary instructors that could be supported by this position include:

FES 355— Management for Multiple Resource Values—a required course in the FOR and NR curriculums that is currently being substituted for by courses outside the College that do not adequately meet the needs of our students.

FES 432—Economics of Recreation Resources—a course not offered for several years, but one that needs to be reconfigured around ecosystem services economics

FES 537—Valuation of Non-Market Resources

FOR 330—Forest Conservation Economics—a course needing consideration as to teaching commitment and inclusion in the future FES undergraduate curriculum

Additional faculty hires will need careful analysis as to how they meet future curricular, research and outreach needs. Key attributes of future hires include:

- Success in working in interdisciplinary teams
- Experience working internationally
- Serving as a mentor for diversity students and colleagues
- Knowledge of global change effects on social and ecological systems
- Success as an undergraduate and graduate instructor
- Evidence for high potential for attracting extramural funding to support a research program
- Evidence for high potential to develop an internationally –recognized research program

A list of possible future positions being discussed in FES is provided in Appendix 5.

Appendix 1. IMPORTANT NEXT STEPS IN THE EDUCATION MISSION

Although FES sees terrific interest in our new MS/PhD graduate program, we have not had the resources to fully integrate the biophysical and social sciences. Next steps include:

- Analyze match between educational needs and current staffing to identify key faculty hires that will contribute to the development of the new undergraduate degree, and provide value added coursed development for graduate programs
- Conduct a comprehensive curriculum review , modify and add courses to incorporate interdisciplinary learning outcomes across the spectrum of undergraduate and graduate courses to:
    - incorporate interdisciplinary learning outcomes.
    - identify and develop integrative problem-based graduate courses
    - identify/develop/consolidate courses focused on problem solving and data analysis
    - identify and develop graduate courses that incorporate international issues and experiences
- Research best-practices and existing methods for achieving interdisciplinary learning outcomes at the graduate and undergraduate levels and provide faculty development opportunities to incorporate these into the curriculum.
- Work with the College leadership to:
    - Develop study abroad programs for biophysical/human-dimensions research
    - Bring international students to FES programs,
    - Develop internships at OSU for international students and parallel internships abroad for US students
    - Support international organizations for OSU students.
- Investigate methods to generate departmental fellowships for doctoral students to undertake interdisciplinary research (bringing faculty together as co-advisors)
- Investigate opportunities for student internships with non-traditional stakeholder groups.
- Undertake research on developing a professional non-thesis Masters program that relies on a set of core interdisciplinary courses (the MNR may be adapted for on-campus delivery).
    - Investigate likely student numbers for 12, 15, and 21-month programs.
    - Analysis of competitor programs to determine potential comparative advantage.
    - Analysis of stakeholder/employer needs.
    - Development of core course sequence.
    - Incentives to get current faculty to teach the core courses.
    - Gap analysis – what hires would best support this teaching (which would also provide courses for thesis masters and PhD students) program?
    - How can tuition payments generate funding for interdisciplinary PhD students and other activities?
    - Determine mechanisms for core courses and tuition to generate TA-ships and GRA-ships to support PhD students, enabling expansion of our PhD program.

Appendix 2. IMPORTANT NEXT STEPS AND NEEDS FOR THE RESEARCH MISSION

To encourage more integrated biophysical and social science research, FES will seek ways to:

- Review global natural resources issues and problems identify critical integrative issues and research needs that FES is positioned to address to
    - Identify specific disciplinary gaps to address these needs
    - Identify the first set of 2-3 research themes and provide incentives to faculty to come together as teams to work in a theme area. Theme areas change with time.
- Creation of a visiting scholar program, bringing distinguished scholars who are already skilled at integration. As part of this program, we could create an interdisciplinary postdoctoral scholar position that could be paired with the distinguished visiting scholar.
- New faculty hires must have solid disciplinary foundations and understand that they are expected to conduct some of their research in integrated teams.
- Fund grant-writing support for large, integrated project proposals; fund support for retreats and brainstorming sessions around new grant opportunities (i.e. the crucial ideas stage that comes well in advance of the actual grant writing stage).
- Reward participation in integrated research teams in promotion decisions.
- Foster collaborations within and among departments by
    - Creating informal opportunities for conversations (e.g., brainstorming around a problem, challenge, topic), then seed emergent efforts in creative ways, taking weight off faculty to create space for these synthetic efforts.
    - Develop a seminar and discussion series that fosters discussion about, or exemplifies interdisciplinary approaches to research.
    - Hosting an annual on-campus conference with leading integrative thinkers around an important topic that then might lead to a series of published volumes.
- Support the creation of research infrastructure within the college to aide our efforts in grants and contracts. Seek the appointment of an FES-specific development officer.
- Link departmental GRA funds to co-advised integrated research projects
- Link TA funds from the newly developing undergraduate curriculum – specifically, new interdisciplinary courses that are team taught could have TA support provided to graduate students conducting integrated research.
- Apply one two-year Richardson Fellowship per year to an incoming graduate student who will be working with an integrative project.

Appendix 3. IMPORTANT NEXT STEPS FOR FES OUTREACH MISSION

To expand the mission of FES outreach, we will seek to:

- A major initiative is to work with and represent COF to a broadened base of stakeholders including conservation-based NGO's, land management agencies, foundations, and non-traditional industries. Examples of entities that would be engaged include The Nature Conservancy, Ecotrust, Pew Charitable Trust, Tribes, and business interests centered around tourism, and ecoservices.

Appendix 4. Examples of FES disciplinary science.

- Identification of the importance of dead wood in forest systems for both biodiversity and ecosystem services.
- Decision analysis for tropical forest management that incorporates both uncertainty about forest functions/values and irreversibility of deforestation.
- Research on public attitudes and experiences at marine life conservation districts in Hawaii formed the basis for new state-level management and policy plans for marine protected areas in this state.
- Identification of the impacts of crime on public lands led to the development of management strategies to improve recreational opportunities.
- Widely cited work on trophic cascades in ecosystems and the relevance of this to policy on predator control across systems.
- Spatial modeling of human resource use and its impact on park siting, sizing, and management decisions.
- Foundational research on the use of remote sensing to identify changes in forest and other land cover at local and global scales.
- Key research on carbon sequestration in forests that is affecting global forest policy.
- Basic research that has transformed tree genomics
- Elucidation of the critical role of mycorrhizal fungi in tree nutrient uptake and growth as well as the mechanism for fungi dispersal.
- Applied and basic research on the spotted owl and other old growth-associated species that led to the development of the North West Forest Plan and other similar environmental policy globally.
- Analyzing the impact of developing country land/forest institutions on rural welfare and resource quality.
- Identification of the impacts of crime on public lands led to the development of management strategies to improve recreational opportunities.
- Spatial modeling of human resource use and its impact on park siting, sizing, and management decisions.
- Foundational research on the use of remote sensing to identify changes in forest and other land cover at local and global scales.
- Understanding the biological basis of wood quality to enhance the ability of managers to use forest resources efficiently.
- Developing tools to accelerate conventional tree breeding by genome-wide DNA selection methods.
- Enhanced understanding of plant traits through detailed genetic mapping, gene expression, and epigenomic analyses.
- Analysis of public and visitor tradeoffs across social, economic, and ecologic dimensions in contexts from national park amenity development in Norway to ecolodges in the Ecuadorian Amazon to urban growth boundary expansion in Oregon; the latter includes assessment in both monetary and subjective well-being metrics.
- Evaluation of public communication strategies to enhance forest restoration efforts in Oregon and the western U.S.

- Analysis of visitor price responsiveness in South Africa, the South Pacific, and Latin America, that led to increased funding for protected area management.
- Assessment of contributions to economic development from natural area visitation in the US, Sweden, Australia, and Belize. In Central Oregon, assessment of tourism's contribution to amenity-led migration.
- Long-term relationship with the Joint Fire Science Program, examining relationships between federal agencies and community stakeholders to improve decision-making strategies in pre-fire and post-fire settings.
- Development of the Northwest Fire Science Consortium which is a JFSP sponsored fire science delivery system to increase researcher understanding of the needs of wildland fire practitioners.
- An integral research partner in a long-term (5 year) interdisciplinary study of the Great Basin sage steppe ecosystem. This involves over 30 scientists from four federal agencies and five universities.
- Long-term relationship with the National Science Foundation involving 1) the interface of LTER research and local publics and 2) the adaptation of ecological and human communities to climate change under the Coupled Natural-Human Systems Program.
- Examining the multi-party interactions of agencies and groups working on Collaborative Forest Landscape Restoration Projects (CFLRP's).

Appendix 5. Possible additional faculty positions being considered.

a. **Ecological Policy and Public Lands Management**: This position would have a primary emphasis in working with diverse stakeholders to find solutions currently constraining balanced approaches to the management of public lands.
b. **Integrated Resource Planning and Decision-making (Social Science**): This position would focus on interdisciplinary approaches for collaborative planning at the landscape scale. The individual will have experience in engaging diverse groups of individuals (agencies managers, researchers, NGO's, citizens) for problem identification and multi-party decision-making in natural resource communities.
c. **Urban Landscapes and Community Development:** This position would be targeted at key forest and landscape needs associated with metropolitan regions. Needs are associated with tree health, livability associated with parks and trails, and involvement of public organizations in managing urban landscapes.
d. **Ecosystems to Earth Processes**. This position would focus on the interactions among the earth's ecosystems, land and atmosphere to understand how these interactions influence the behavior of ecosystems, including responses to future changes. Multi-scale analysis of global change issues, from landscape to region and globe. It may include innovations to quantify the biogeochemistry, biophysical, and biodiversity of ecosystems over regions to the globe, or shifts in complex systems and new approaches for anticipating critical transitions.
e. **Conservation Social Science:** This position requires an individual that has the ability to engage diverse groups of individuals and work on collaborative problem solving around key natural resource issues.
f. **Metagenome and Functional Analysis:** This position would use new genome sequencing tools and associated systems analysis for assessing biodiversity and forest health. This would provide new insights into forest species interactions, and physiological mechanisms important to adaptation and productivity.
g. **Interactions of Human and Ecological Systems:** This position would explore both how humans perceive, modify and use ecological systems and how ecological systems affect human perceptions and actions.
h. **Fire-Landscape Interactions:** This position would examine the interactions among the human and natural landscape features to better understand how fire does and will affect ecological communities and processes and/or human communities and processes.