

Sources and Science

A Guide to Experts at the
Pacific Southwest Research Station



United States
Department of Agriculture



Forest
Service



Pacific Southwest
Research Station

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A Message From the Station Director

The Pacific Southwest (PSW) Research Station carries out the research and development mission of the USDA Forest Service in California, Hawaii, and the U.S.-affiliated Pacific Islands. From the southern chaparral, montane Sierra Nevada, and coastal redwood ecosystems of California, across the ocean to the tropical wet and dry forests of Hawaii and the Pacific Islands, our scientists and professionals are dedicated to enhancing knowledge of complex natural resource issues and communicating this knowledge to society.

I invite you to browse this inaugural edition of our “experts guide” to meet our researchers, discover the diversity of the scientific work that we do, and see how our science is making a difference—today and tomorrow.

Deanna J. Stouder
Station Director

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How to Use *Sources and Science*

The Pacific Southwest (PSW) Research Station is a world leader in natural resources research through its scientific excellence and responsiveness to the needs of current and future generations. More than 50 scientists currently conduct research for the station. More than half of them are profiled in this guide.

This guide is divided into four broad categories representing the featured researchers' areas of expertise: economics and social research, fire and air, forests and plants, and wildlife and aquatics. A glossary and two indexes—by scientist and by subject—also are provided to help you understand and locate the information you need.

About PSW Research Station

- Established in 1926
- One of seven research units of the U.S. Department of Agriculture, Forest Service
- Headquarters in Albany, California
- Eight research facilities in nine locations across California, Hawaii, and the U.S.-affiliated Pacific Islands
- Thirteen experimental forests
- About 250 employees

How to Contact Us

For help getting in touch with the right expert for your story, call PSW Research Station's media desk at (510) 559-6327. You also can learn more about us online at <http://www.fs.fed.us/psw/>.



Deborah Chavez

Research social scientist; Riverside, California

Deborah Chavez is working to make the Forest Service and its programs relevant to the Nation's largest and fastest-growing constituent group—Latinos. Through her work, the research social scientist is helping to enhance the relationship Latinos and other ethnic groups have with the natural world.

Ask Her About

Nature-based recreation, race and ethnicity studies, law enforcement, trails, day-use recreation

Background

Ph.D., sociology, University of California, Riverside; member, International Association for Society and Natural Resources, National Association of Recreation Resource Planners

Chavez conducts a variety of studies that explore the public's use of natural resources and protected areas. She found, for example, that diverse youth overwhelmingly prefer nature-based activities that involve technology, like geocaching, to those that do not. She also conducted an adaptive outdoor recreation management study that identified key characteristics of outdoor recreation sites that served Latino groups in the Los Angeles area. Ultimately, these characteristics—like suitably sized picnic areas—were enhanced on the San Bernardino National Forest's Applewhite Picnic Area.

In the future, Chavez will develop syntheses of studies conducted over the past 20 years.



Patricia Winter

Research social scientist; Riverside, California

Patricia Winter is pursuing a line of inquiry that is at the core of the USDA Forest Service's mission of caring for the land and serving people. As a research social scientist, her work is aimed at helping the agency and other natural resource organizations to better understand and, by extension, better serve diverse urban and near-urban populations.

To conduct her research, Winter draws on a variety of quantitative and qualitative approaches from the social sciences, including surveys, interviews, observations, and archival analyses. Her work has shown, for example, that trust plays a pivotal role in agency-public interactions. These findings have led to the development of approaches for interacting and communicating with the public. More recently, her work has demonstrated the value of using community networks and ethnic media to reach diverse urban publics.

Ask Her About

Recreation management, communicating with diverse urban populations, role of social trust in land management, increasing environmentally responsible behavior

Background

Ph.D., psychology, The Claremont Graduate School; member, American Psychological Association, Society for the Psychological Study of Social Issues, Society for Risk Analysis



Jan Beyers

Plant ecologist; Riverside, California

After a fire burns through a landscape, one common management response is to conduct postfire watershed rehabilitation, which, ultimately, costs millions of dollars annually. Jan Beyers works to ensure that the efficacy of these treatments and their potential ecosystem effects are known.

Ask Her About

Postfire rehabilitation treatments, chaparral response to fire, fuel treatment effects on invasive species, fire response of rare species

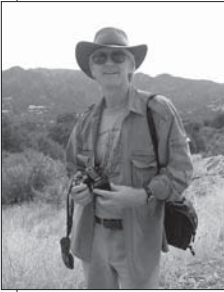
Background

Ph.D., botany, Duke University; member, Association for Fire Ecology, Ecological Society of America, International Association of Wildland Fire, Society for Conservation Biology

Beyers is a plant ecologist who focuses much of her research on the effectiveness of postfire rehabilitation treatments. In one study, she examined postfire ryegrass seeding in burned areas of chaparral in southern California and found that the practice had little effect on postfire erosion. The planting of ryegrass, in fact, interfered with the growth of native postfire flora. As a result of this study and others, little seeding is now done on burned areas of chaparral in the region, and use of ryegrass for postfire seeding has decreased throughout the state.

In collaboration with two colleagues, Beyers also published a review of the effectiveness of a wide range of postfire rehabilitation treatments. The report ultimately led to national-level funding and has stimulated a great deal of research on treatment effectiveness that is helping managers to decide if, or with what, to treat burned lands.

In the future, Beyers will continue studying the effectiveness of new postfire treatments, particularly those that are extremely expensive or controversial with the public, as well as the impacts of treatments on native vegetation recovery and effects on invasive plants.



Ask Him About

Air pollution, climate change, effects of wildland fires on air quality

Background

Ph.D., natural sciences,
Silesian University
(Katowice, Poland)

Andrzej Bytnerowicz

Ecologist; Riverside, California

A ndrzej Bytnerowicz is an expert on air pollution and the chemical environment of forests, integral aspects of the changing climate.

Bytnerowicz, an ecologist, is a pioneer of methods for characterizing the distribution of air pollution at large geographic scales, such as landscapes or regions. He draws on a network of passive samplers that detects concentrations of air pollutants in mountains and other remote areas and uses geostatistical software to create pollution distribution maps. He has developed a passive sampler for nitric acid vapor, the air pollutant responsible for a large portion of nitrogen deposition in western forests and ecosystems.

Bytnerowicz is motivated by his ability to contribute to the fundamental understanding of forests' chemical environments—an area that, he says, is largely unexplored yet extremely critical to understanding present and future forest changes.



Shyh-Chin Chen

Research meteorologist; Riverside, California

In a region like southern California, Shyh-Chin Chen's research is right at home. His work focuses on fire danger prediction—an invaluable service given the threat seasonal wildfires pose to lives, properties, and landscapes in the highly populated and fire-prone region.

As part of his research, Chen, a research meteorologist, develops fire danger forecasts using meteorological climate models. Such applications are critical to fire danger management. Chen also simulates large-scale weather patterns, which help to explain variations in regional climate.

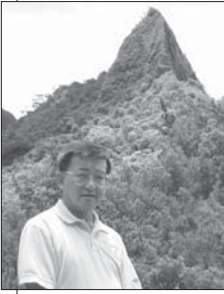
In the future, Chen will continue to focus his research on fire danger and behavior predictions, motivated, as he is, by work that contributes to the protection of communities.

Ask Him About

Climate dynamics, regional climate, weather and climate forecasts, fire danger

Background

Ph.D., atmospheric sciences, University of Illinois



Francis Fujioka

Research meteorologist; Riverside, California

Francis Fujioka is a research meteorologist whose work helps fire management agencies to protect firefighters and inhabitants of the wildland-urban interface.

Fujioka began work in this area in the 1980s, when he supervised the development of the Forest Service's monthly fire weather forecasting system and the use of numerical weather models for long-range fire weather forecasting. More recently, he has developed a method to analyze the uncertainty in fire spread predictions. Collectively, these projects contribute to a common goal of developing predictive tools for fire management that incorporate uncertainty for quantitative risk assessment.

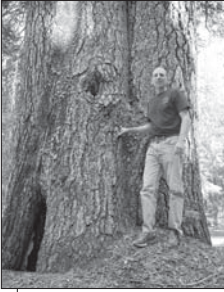
In the future, Fujioka plans to extend applications of modeling and remote sensing to fire management operations.

Ask Him About

Fire meteorology, fire climatology, weather and fire modeling

Background

Ph.D., earth sciences,
University of
California, Riverside;
member, American
Meteorological Society,
Sigma Xi Scientific
Research Society



Eric Knapp

Research ecologist; Redding, California

For Eric Knapp, frequent forays into the woods—to hike, backpack, and photograph—are ideal sources of research inspiration that provide valuable insights into the natural landscapes he studies.

Knapp is a research ecologist whose work examines both prescribed and wild fire and, particularly, their effect on plants and animals and interaction with silviculture and other practices. Historically, most wildfires in the West occurred during the late summer or early fall. Many prescribed fires, however, are ignited in the spring or early summer, at a time when plant growth and animal activity are at their height, raising the concern that the burns could have damaging ecological effects. Knapp's research has helped to determine the effects that seasonal timing can have on an ecosystem and suggests that fuels can be effectively managed with burning in any season.

Knapp also is interested in studying how fire suppression has changed forest structure. His colleagues have remapped historical research plots established 80 years ago, showing that tree density has more than doubled and stands have become much less variable than they were prior to logging and fire suppression. He is using the historical stand information to develop ideas for thinning forests in ways that restore some of the past complexity, while also making them more resilient to wildfire.

In the future, Knapp will apply the knowledge he has acquired from smaller, plot-based studies to the landscape to address broader forest management issues. In this way, he will continue to generate findings that guide the return of fire to fire-adapted forests of the Western United States.

Ask Him About

Fire ecology, fire effects on plants and animals, fuel management strategies, fire-silviculture interactions, landscape-scale wildfire severity patterns, effects of disturbance, forest change over time

Background

Ph.D., genetics, University of California, Davis



Constance Millar

Research climate ecologist; Albany, California

Constance Millar has found that spending as much time as possible in the mountains with her eyes open and her head theory-free is one of the best formulas for her research. It is in these field experiences that she generates questions and makes observations that guide her evolving studies.

Ask Her About

Response of subalpine forests to historical and current climate change, rock glaciers, American pikas, forest management amidst climate change, Sierra Nevada and Great Basin mountains

Background

Ph.D., genetics, University of California, Berkeley; co-director, Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT); co-chair, North American Global Observation Research Initiative in Alpine Environments (GLORIA) Chapter

Millar is a research climate ecologist whose work explores the response of forests and their inhabitants to climate change—both past and present. Her work has demonstrated, for example, that historical changes in forest composition, structure, and distribution in response to climate variability have been far more drastic than is often recognized. These insights provide clues to potential changes in future forests under global warming and offer a context for management response. As part of this research, Millar has documented complete extirpation and recolonizations by limber pine over the last 4,000 years in the Great Basin mountains. These major shifts correspond to century-long droughts that recurred periodically over the last millennia. Changes in forests at such a large scale have not been incorporated into management thinking and, thus, provide a larger window into potential future responses in the face of global warming.

In the future, Millar plans to continue studies aimed at better understanding historical and future responses of mountain ecosystems to climate variability.



Jim Simpson

Meteorologist; Davis, California

Jim Simpson's work provides a fiscal basis for planting, maintaining, and improving urban forests, or, as he refers to them, "the forests where we live."

In one pioneering study, Simpson, a meteorologist, worked with the Sacramento Municipal Utility District to evaluate the effect of the shade of 200,000 trees planted by the utility on residential space. Working from a very large number of properties and factoring in details on actual tree size and placement, building vintage, and window location, Simpson helped to develop benefits-based criteria for locating suitable tree planting sites that were used to evaluate the cost-effectiveness of the utility's shade tree program.

Simpson also provided detailed environmental analyses that formed the basis of tree guides and the Municipal Forest Resource Analysis. His work helped to identify and describe the benefits and costs of planting trees in a specific climate region, providing useful information to community officials and tree managers.

In the future, Simpson plans to develop better, easier-to-use tools that make the results of his research more accessible to diverse audiences.

Ask Him About

Urban forests' effects on building energy use, air quality, climate change

Background

Ph.D., forest meteorology, University of Washington



David Weise

Supervisory research forester;
Riverside, California

Ask Him About

Fire behavior, modeling fires, fuel moisture, landscape-scale vegetation models, use of prescribed fire

Background

Ph.D., wildland resource science, University of California, Berkeley; member, Society of American Foresters

Wildfire is a formidable natural resource issue in California—one need only look as far as the state’s devastating 2008 and 2009 fire seasons for proof. Models, such as those that predict fire spread, are essential to controlling wildfires and to managing prescribed burns. David Weise is conducting research aimed at updating these models—which were developed in the 1960s using dead fuels as their basis—so that they will better predict fire spread among live shrub fuels, like chaparral, which dominate much of California.

In one study, Weise, a supervisory research forester, explored the effects of wind speed and slope, two variables that can greatly affect fire behavior. Using a specially designed tilting wind tunnel, he was the first to examine the combined effects of the two variables on a fire’s rate of spread and flame length. Ultimately, he found that the existing model used to predict rate of spread could not accurately account for the combined effects of wind and slope. His findings led to new estimates for flame length.

In other work, he and a colleague conducted the first studies to evaluate how a cone calorimeter—a special fire safety tool—can be used to measure plant flammability. Findings from this study will inform the “low fire hazard” ratings often assigned to landscape plants and help homeowners and others to reduce fire hazards on their property.

In the future, Weise will continue his examination of the various factors that influence fire spread in live shrub fuels, ultimately helping to improve the ability to predict fire behavior.



Susan Cordell

Research ecologist; Hilo, Hawaii

Susan Cordell has a deep-rooted passion for the unique ecosystems of Hawaii and the Pacific Islands. As a research ecologist, her work is aimed at preserving and restoring the native ecosystems of this region, many of which are threatened or endangered.

Ask Her About

Hawaiian and Pacific Island ecosystems, ecophysiology, functional ecology, tropical dry forests, restoring ecosystem processes

Background

Ph.D., botany-ecophysiology, University of Hawaii at Manoa; member, Ecological Society of America, Botanical Society of America, Society for Ecological Restoration

Much of Cordell's research focuses on ecosystem processes within tropical forests and the impacts of nonnative plant species on essential processes, like nutrient and water cycling. In Hawaii and the Pacific Islands, where high levels of endemic species are found, the introduction and spread of invasive species is particularly troubling for the relatively fragile ecology of the islands. Native species are poorly adapted to outcompete invasive species for resources and, often, the invasive species have no natural predators to keep them in check. Cordell also is exploring the factors that impact Pacific Island forests' ability to recover from disturbances and is generating findings that are providing the basis for ecosystem restoration and management activities.

Cordell says the most rewarding part of her research is inspiring others to conserve Hawaiian and Pacific Island ecosystems. In the future, she intends to continue developing research and collaborating with local communities to advance effective conservation, preservation, and restoration-related land management efforts.



Susan Frankel

Biologist; Albany, California

Ask Her About

Sudden oak death, forest pathology, invasive species, forest diseases and climate change

Background

M.S. and M.F.R., forest pathology and silviculture, University of Washington; member, American Phytopathological Society, California Oak Mortality Task Force, California Pest Council

When Susan Frankel joined the station in 2005, it was to address a forest health emergency. Five years earlier, sudden oak death (SOD), an exotic and invasive pathogen, was first discovered in the Bay Area. It ultimately was to devastate millions of oaks and tanoaks in coastal California and southern Oregon, destroying not only these symbols of great natural beauty and the valuable acorns they provide, but changing fire behavior patterns. A forest pathologist by training, Frankel developed and assumed leadership of the then newly established Sudden Oak Death Research Program, charged with developing treatments and strategies for slowing the spread of, managing, and, ultimately, eradicating the disease.

In the span of only a few short years, Frankel's program has developed field and laboratory diagnostic methods, management strategies, and basic biological understanding of the SOD pathogen's spread—all of which have been essential to the design of regulations in forests, nurseries, and residential landscapes. And because the SOD pathogen was new to science at the time, her program is a model for emergency research to respond to newly found invasive species.

In the future, Frankel plans to broaden her focus to include considerations of the role of climate change in forest pathogens, the economic and social impacts of tree diseases, patterns of tree mortality, and biosecurity and quarantine policy.



Christian Giardina

Research ecologist; Hilo, Hawaii

Ask Him About

Climate change,
global change,
carbon cycle science,
ecosystem ecology,
restoration

Background

Ph.D., biology,
University of Denver

The carbon cycle is central to discussions about climate change, with forests acknowledged as being potential sources or sinks of atmospheric carbon dioxide. Christian Giardina studies climate change and carbon cycle science, generating results that are informing managers' decisions about individual species and management strategies.

In one study, Giardina, a research ecologist, found that soil carbon decomposition is insensitive to temperature, a finding with significant implications for forest carbon storage in the face of climate change. He also found that tree species have variable and sometimes unpredictable effects on soil carbon quality and persistence.

The results of Giardina's work show that forests may continue to serve as global sinks of atmospheric carbon dioxide for years to come. In the future, he plans to study how climate change issues can be incorporated into large-scale restoration efforts.



Ask Him About

Wood development, genomics and genetics of trees, carbon sequestration

Background

Ph.D., biology, University of North Carolina-Chapel Hill; member, American Society of Plant Biology, International Association of Wood Anatomists

Andrew Groover

Geneticist; Davis, California

Wood—the indisputable basis of the Nation’s forest industry—is central to many of the topics that dominate today’s headlines, from carbon sequestration to greenhouse gas emissions. Andrew Groover is studying how the formation of this most vital resource is regulated at the most basic level—the genetic level.

Groover is a geneticist and Director of the station’s Institute of Forest Genetics, a laboratory that develops technologies for discovering and characterizing forest tree genes and that studies the role of those genes in regulating key biological processes. He and his colleagues have identified and characterized genes that directly influence basic wood properties, which can help with discussions of forest products, bioenergy, and carbon sequestration. Their findings also ultimately speak to the ecological relevance of wood in forest ecosystems. Groover also has participated in the interpretation of the *Populus* genome, the first fully sequenced genome for a forest tree.

In the future, Groover, who describes his research approach as genetic detective work, will expand the focus of his studies beyond individual genes to understand genetic relationships involved in forest tree development.



Ask Her About

Plant genetics,
genetic conservation,
molecular genetics

Background

Ph.D., genetics and
forestry, Oregon
State University

Valerie Hipkins

Geneticist; Placerville, California

As the foundation of life, it's not surprising that genes also contribute greatly to successful forest management. Our ability to establish and sustain healthy forests and rangelands—especially in the face of current pressures such as climate change—rests on our understanding of genetics, which help us to assess past, current, and future biological changes.

Valerie Hipkins' career is devoted to understanding genetic issues in forestry. As a geneticist and Director of the station's National Forest Genetics Laboratory (NFGEL), she works with resource managers throughout the United States to provide the genetic information they need to aid their management decisionmaking. She and her colleagues use state-of-the-art technology to address genetic conservation and management of plant species using numerous laboratory techniques, including DNA analyses. To help planning efforts on forest lands across the country, Hipkins and her colleagues generated genetic information on over 140 different plant species, including conifers, hardwoods, grasses, shrubs, and forbs.

In the future, Hipkins will continue to link science to management with a genetics emphasis to meet resource management needs. To her, forest genetics and the work being conducted at NFGEL are some of the best examples of objective-driven science, where outcomes are directed by managers, the people who ultimately use the findings.



Richard Flint Hughes

Research ecologist; Hilo, Hawaii

Motivated by a desire to help protect the world's forests and the biodiversity contained within them, Richard Flint Hughes is a research ecologist who specializes in the native ecosystems of Hawaii and the Pacific Islands. Hughes' work helps people to better understand the state of—and threats to—their forest resources.

Ask Him About

Native Hawaiian ecosystems, biomass mapping, impacts of invasive species in Hawaii and the Pacific Islands, nutrient storage and cycling

Background

Ph.D., forest science, Oregon State University; member, Ecological Society of America; State of Hawaii's Natural Area Reserve Commission

One area of Hughes' research examines the impacts of invasive species on native forests. In a series of studies, he has documented the effects of the invasive and fast-growing albizia tree on Hawaii's wet lowland forests. He found that the presence of the invasive tree changed leaf litter quantity and quality, which changed decomposition rates and increased the amount of two key soil nutrients, nitrogen and phosphorus. The changes were a result not only of albizia invasion, but the subsequent invasion by other plants that the invasive tree facilitated. Resource managers from the State's Division of Forestry and Wildlife and National Park Systems of Hawaii and American Samoa have used these research results to control albizia populations across landscapes within their respective jurisdictions.

In other research, Hughes and his colleagues helped to develop an integrated satellite, airborne, and field-based mapping approach to accurately inventory forest carbon pools at multiple scales. This technique has been advanced by the United Nations Program for Reducing Emissions from Deforestation and Forest Degradation as an effective means to improve monitoring of carbon stocks around the world.



Sylvia Mori

Mathematical statistician; Albany, California

Sylvia Mori takes great pride in helping to ensure that scientific findings are sound and defensible. As a mathematical statistician, she partners with station scientists, university cooperators, and international colleagues to improve data sampling and analytical methods.

Mori thrives on the challenge of helping scientists to develop sound statistical methods to analyze complex data sets and present the results in such a way that they withstand scientific scrutiny. Her work allows her to combine her dual passions for biology and mathematics in a way that advances science.

Ask Her About

Experiment and sampling design, large-scale monitoring, statistical modeling, statistical computing

Background

M.A., statistics, University of California, Berkeley; M.A.; mathematics; Universidad Técnica del Estado; Santiago, Chile



Ask Him About

Fire and fuels, forest restoration, climate change, forest carbon, forest management, ecosystem health

Background

Ph.D., forest ecology, University of Washington

Malcolm North

Research forest ecologist; Davis, California

Malcolm North is a research forester who specializes in the study of disturbance effects on forests and ecosystem restoration. His work is driven by the realization that fuels need to be reduced in many western forests, yet the ecosystem effects of doing so are not well understood.

One major emphasis of North's work is managing forest carbon in wildfire-prone ecosystems. Because forests can be both major sources or sinks for carbon that contribute to global warming, he is examining how to best reduce carbon emissions and stabilize carbon stocks with fuel treatments.

North also is studying the ecological effects of fuel treatments. His work is helping managers and researchers to better understand how prescribed fire and mechanical thinning, which are used to reduce accumulated fuels, affect ecological processes and forest health.

In the future, North plans to explore carbon stocks and how carbon emissions may be reduced as the global climate changes.



Pamela Padgett

Plant biologist; Riverside, California

Ask Her About

Mineral nutrition of plants, effects of soil on plant communities, nitrogen deposition in atmosphere and soils, mechanisms for invasion and control of invasive plant species

Background

Ph.D.; botany and plant sciences; University of California, Riverside; member, National Atmospheric Deposition Program

Pamela Padgett's career was inspired by simple questions—like, for example, why does a rose look and grow differently than an apple? Ultimately, her informal inquiries led to a hearty appreciation for plants and the realization that they enabled the establishment of human cultures. Now, as a plant biologist, she studies how human cultures affect plants—through air pollution, disturbance, and the introduction of new species.

In one study, Padgett explored the impact of the air pollutant nitric acid on plants. Traditionally, nitrogen deposition has been regarded as an over-fertilization problem likely to promote increased plant growth. But, in laboratory experiments, she found that dry deposited nitric acid is absorbed directly through leaf surfaces, which enables the pollutant to bypass the normal regulatory mechanisms found in roots. Repeated deposits of nitric acid actually result in a chemical attack on a plant's protective wax layer, leaving them vulnerable to subsequent environmental and biological stressors.

In another study, she demonstrated that by changing nitrogen availability, one changes the plant community structure. Many plants in western ecosystems are adapted to relatively infertile environments—that is, those devoid of nitrogen and other nutrients that stimulate growth. Thus, when nitrogen is increased, it reduces the competitive advantage of these species, rendering them vulnerable to being overrun by less adapted plants, often invasive species.

In the future, Padgett plans to increase her interagency collaborations, ultimately guiding the management of public lands and encouraging the public to value their natural surroundings.



Ask Her About

Urban trees, urban tree measurement and growth, biomass, urban tree site assessment

Background

B.A., English, California State University, Sacramento; renewable natural resources, University of Nevada, Reno; member, California Urban Forest Council, Ecological Society of America

Paula Peper

Ecologist; Davis, California

Paula Peper is an ecologist at the Center for Urban Forest Research, where she and her colleagues work to improve the habitat in which people live—towns and cities—and to provide useful tools for urban forest managers, planners, and landscape architects.

Motivated by a desire to reduce the negative impacts that people have on the environment, Peper developed equations for tree height, crown diameter, leaf area, and diameter at breast height for 280 urban tree species. These equations form the basis of the iTree STRATUM software application, which estimates the environmental and aesthetic benefits of trees as well as costs of tree management. These equations also allow users of the national version of the Tree Carbon Calculator to estimate annual carbon storage to meet requirements for urban forest carbon project reporting protocols.

Peper also developed a nondestructive method for estimating leaf area of open-grown trees using digital photography. Her technique allows researchers and iTree STRATUM users to estimate urban trees' rainfall and stormwater interception, air quality benefits, and biomass.

In the future, Peper plans to work on refining tree growth models using statistical methods.



Ask Her About

Analyzing spatial and temporal data, probabilistic risk assessment of forest threats, statistical methodology

Background

Ph.D., statistics, University of California, Berkeley

Haiganoush Preisler

Mathematical statistician; Albany, California

For as long as she can remember, Haiganoush Preisler has loved working on puzzles. As a mathematical statistician, she works on puzzles every day and describes her work as the process of finding patterns in what appears to be chaos.

In collaboration with other scientists, Preisler has worked on a variety of projects, from the analysis of insect bioassay data to the modeling of animal movements with telemetry equipment. Recently, she has developed probabilistic risk models for evaluating and predicting impacts of forest threats—such as insect outbreaks, major wildfires and changing climate—on forest health.

Preisler's work is usually prompted by the need for statistical methodologies suitable for new data types as they are developed by other research scientists in the environmental sciences.



Martin Ritchie

Biometrician; Redding, California

Martin Ritchie is a biometrician who develops mathematical models to describe the dynamics of forest stands, particularly those that help land managers to better manage coniferous forests.

Ritchie has participated in several modeling efforts, including ORGANON and SYSTM-1. He was the primary developer of the CONIFERS growth and yield model, a computer-based simulator that allows foresters to predict the growth of young plantations in response to various management practices. He also has studied the effect of thinning on the accumulation of biomass in ponderosa pine forests in northern California. This work gives managers tools for quantifying biomass responses after thinning treatments, an important consideration when managing forest fuels to reduce fire severity.

Currently, Ritchie is studying large-scale spatial patterns in ponderosa pine forests, the development of mixed-conifer stands after wildfire, and the use of LIDAR imagery to inform management decisionmaking.

Ask Him About

Forest modeling, silviculture and management of interior pine or mixed-conifer forests, growth and yield, biometrics

Background

Ph.D., forest biometrics, Oregon State University; member, Society of American Foresters, American Statistical Association



Paul Scowcroft

Research forester; Hilo, Hawaii

In Paul Scowcroft's own words, he is in the business of finding ways to help damaged forests heal. Scowcroft is a research forester whose work is aimed at successfully restoring and managing mid- and upper-elevation native Hawaiian forests.

Ask Him About

Native Hawaiian forests and terrestrial ecosystems, koa, human-assisted forest restoration, ecological impact of wild ungulates

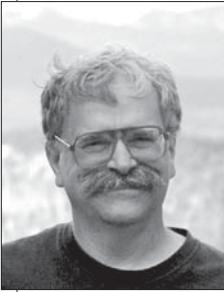
Background

M.S., wildland fire ecology, University of Missouri; member, Soil Science Society of America

Much of Scowcroft's work is centered on koa, a fast-growing overstory tree that is native to Hawaii and a key species in reforestation plans in the islands. His work contributed to development of the first koa stocking guidelines, which help to guide how the species should be grown and managed. Private landholders in Hawaii, including The Nature Conservancy and Kamehameha Schools, have begun using the guidelines to design koa thinning operations. Recently, he and his colleagues produced a report that summarizes the ecology and silviculture of koa.

Scowcroft's work also identifies obstacles that impede restoration of native Hawaiian species on degraded landscapes and evaluates strategies to improve success. His research demonstrates that intact, self-sustaining native forests provide ecosystem services that alien-dominated or degraded landscapes cannot.

In the future, Scowcroft plans to continue developing and refining silvicultural guidelines for managing koa forests for wood as well as a host of other important ecosystem services.



Carl Skinner

Geographer; Redding, California

Before Carl Skinner became a scientist, he spent 20 years in fire services working in both fire suppression and prescribed fire application. He credits this experience for providing him with a background in fire behavior that has proven to be a tremendous asset in interpreting fire history and severity patterns.

Ask Him About

Fire ecology, fire history, fire-climate interactions, forest fuel management, climate change

Background

M.A., geography; California State University, Chico; member, Association for Fire Ecology, International Association of Landscape Ecologists, Tree-Ring Society

Skinner is a geographer whose studies are among the first to describe fire's long-term influence on wildlife habitat distribution and riparian environments. In a series of studies, he described the climate-fire-vegetation interactions in the complex landscapes of northern California and found, contrary to conventional wisdom, that within a particular climate zone, topography appears to have controlled fire parameters more than did vegetation type. Managers can use his work to help plan landscape-scale management strategies for a variety of activities, including fire hazard reduction.

The 2002 Cone Fire burned 2,000 acres in the Blacks Mountain Experimental Forest, serendipitously giving Skinner and his colleagues the opportunity to assess the effectiveness of several previous silvicultural treatments in influencing the fire's behavior. Since the burn, Skinner has been planning and conducting postfire effects research that includes studies of postfire salvage logging on fuels and understory succession.

In the future, Skinner plans to continue researching the influences of climatic variation on fire regimes and their combined influences on forest vegetation dynamics.



Ask Him About

Silviculture, tree physiology ecology, vegetation competition, stand growth models, managing forests for carbon

Background

Ph.D., forestry, University of Idaho; member, Society of American Foresters, Ecological Society of America

Jianwei Zhang

Research forester; Redding, California

Having grown up in northwest China in a remote village with no running water or electricity, Jianwei Zhang is accustomed to experiencing firsthand the complexity and harmony of natural ecosystems. In fact, he credits his youth with fostering in him a desire to understand these systems and to manage them sustainably.

Zhang is a research forester whose research examines the effect of forest management on long-term stand dynamics. In one study, he analyzed long-term data gathered from plots of ponderosa pine, white fir, and red fir and found that thinning stands of these trees not only enhanced economic value—by increasing the growth of the remaining trees—but also significantly reduced fuel buildup. These quantitative findings can help managers with their stand treatment projects.

In past research projects, Zhang pioneered the use of a stable carbon isotope to study population variation in the water-use efficiency of forest trees, which provided a new, extensively cited tool to study the physiological response of trees to their environment.

In the future, Zhang will continue his silvicultural research using physiological ecology techniques with the overarching goal of developing state-of-the-art tools for use in multiple-resource management.



Christopher Fettig

Research entomologist; Davis, California

Ask Him About

Impact of prescribed fire and mechanical fuel treatments on forest health, monitoring and managing bark beetles, economic importance of bark beetles

Background

Ph.D., forest entomology, University of Georgia; member, Association for Fire Ecology, California Forest Pest Council, Entomological Society of America

As far as many coniferous forests are concerned, no agent wreaks more havoc than the bark beetle. By tunneling through the trees' bark to lay their eggs, the insects have, in the last decade, caused unprecedented levels of tree mortality throughout much of the Western United States. Bark beetle outbreaks have a broad range of impacts, from reduced timber production and real estate values to decreased biodiversity and carbon storage.

Christopher Fettig is a research entomologist who is developing methods for managing and monitoring bark beetles. Recently, for example, he demonstrated that special types of chemicals, known as semiochemicals—which contain pheromones that discourage beetle aggregation and that mimic the odor of nonhost trees—can be successful in protecting ponderosa pine from western pine beetle attack. Fettig has repeated these results in several additional studies, paving the way for registration of the chemical as a new biopesticide for protecting individual trees from bark beetle attack.

Fettig also is studying the role fuel treatments and prescribed fires have on subsequent levels of bark-beetle-caused tree mortality. To date, his research demonstrates that some bark beetle activity is exacerbated by these types of treatments in the short term. In response to his findings, he developed guidelines that assist resource managers charged with reducing fire risk, especially in the wildland-urban interface.

In the future, Fettig plans to continue developing knowledge and tools that allow managers to better care for forest resources.



Ask Her About

Bark beetle pheromones, beetle-fungal-host interactions, invasive species, effect of silviculture treatments on soil arthropods

Background

Ph.D., forest entomology, University of California, Berkeley; member, Entomological Society of America, Entomological Society of Canada, International Society of Chemical Ecology

Nancy Gillette

Research entomologist; Albany, California

Bark beetles pack a one-two punch and can be devastating forest pests—they can kill conifers by boring through their bark to lay their eggs and can also introduce pathogens directly into a tree's vulnerable core. Nancy Gillette is a research entomologist whose work is generating enhanced methods for minimizing bark beetle damage to coniferous forests.

Much of Gillette's work is aimed at exploring the use of pheromones to deter beetles from attacking trees. These special olfactory chemicals can be applied directly to trees or their surroundings and act as a repellent, often by mimicking the odor of nonhost trees. In her studies, Gillette has developed pheromone-releasing flakes that can be applied from the ground or from aircraft, providing significant and landscape-scale protection of conifers from bark beetle attack.

Gillette's other work is focused on assessing the effects of prescribed fires on the abundance and diversity of soil arthropods, like mites and spiders.

In the future, Gillette will be collaborating with colleagues from the United States, China, and South Africa to document the types and relatedness of fungal pathogens that are carried by bark beetles. This work will allow scientists to identify new fungal strains carried by native and exotic beetles.



Ask Her About

Forest and stream interactions, water and air quality, landscape ecology, forest ecosystem processes, ecological risk assessment, environmental monitoring

Background

Doctorate of Environmental Science and Engineering, University of California, Los Angeles; member, Ecological Society of America, International Association of Landscape Ecology, American Geophysical Union

Carolyn Hunsaker

Research ecologist; Fresno, California

According to Carolyn Hunsaker, Sierra Nevada forests are the natural water tanks of California, with 60 percent of the state's water originating as small streams within the mountainous landscape.

Hunsaker is a research ecologist who specializes in stream ecosystems, watersheds, and landscape ecology. Recently, she established an experimental watershed study in the Sierra Nevada that integrates the physical, chemical, and biological elements of the watershed and studies them over the long term. Her findings will not only generate new science, but help to address the design and financial challenges of conducting experiments at the landscape scale.

She also was the first to publish on regional ecological risk assessment—particularly how it differs from conventional risk assessment—a result of invited work she conducted for the Environmental Protection Agency.

In the future, she plans to continue examining ecosystems holistically at the watershed scale, rather than as a series of disparate parts. She also will be evaluating approaches to managing forests that are subjected to multiple stressors, such as climate change and air pollution.



Tracy Johnson

Research entomologist; Volcano, Hawaii

The amazing diversity of the world's tens of millions of insect species and their interactions is what originally attracted Tracy Johnson to the field of entomology. What has sustained this research entomologist in the two decades since has been the opportunity to study those interactions in ways that make a real difference to people and the natural world.

Ask Him About

Biological control (biocontrol) of invasive plants, insect ecology, post-release monitoring of biocontrol agents, impacts of biocontrol

Background

Ph.D., entomology, North Carolina State University; member, Entomological Society of America, Hawaiian Entomological Society

Johnson's research focuses on developing and evaluating biological control, or biocontrol, of nonnative invasive plants. Biocontrol is a management approach that involves the careful introduction of a plant-feeding insect or disease to control the growth or spread of an invasive plant. His work begins with targeting invasive plants that are most amenable to biocontrol, followed by careful evaluation of potential control agents and thorough assessment of their impacts following their release in the environment.

In developing biocontrol agents as potential tools for management of key invasive plants, Johnson presents test results to state regulators, managers, and citizens. His recent work has focused on a highly host-specific natural predator of strawberry guava, a Brazilian tree that outcompetes native species. He also is directing collaborative studies with researchers in Costa Rica and Brazil to identify natural predators of Miconia, a tree that is widely recognized as the most threatening invasive plant in Hawaii and other Pacific Islands.

Johnson enjoys the challenge of using the best available science to guide applications of biocontrol as a tool for managing invasive species—research that requires a long-term commitment given that typical projects may take 20 years or more from start to finish.



Kathleen Matthews

Research aquatic ecologist; Albany, California

Ask Her About

Native fish and amphibian ecology, habitat requirements for aquatic species, exotic trout, amphibian declines, the effect of climate change on native species in the Sierra Nevada

Background

Ph.D., fisheries, University of Washington; member, Ecological Society of America, American Fisheries Society, Society for Conservation Biology

Kathleen Matthews, a research aquatic ecologist, studies high-elevation amphibians and fish—among the most imperiled species in the world, owing to both their biological characteristics and habitat requirements. Amphibians of all types are extremely sensitive to changes in their external environment, and those living in mountain ecosystems will likely be some of the first species affected by a warming climate.

Much of Matthews' research explores the impact of disturbances—like invasive species, cattle grazing, and climatic change—on amphibian and fish populations. Her work has helped, for example, to document the link between introduced trout and the decline of the native mountain yellow-legged frog in California's Sierra Nevada. Her findings resulted in management changes, including reduced stocking for recreational fishing, removal of the trout in Sierra Nevada's national parks, and restoration strategies for the declining frog. In subsequent studies, Matthews expanded her work to examine the link between fish stocking; potential climate change impacts, like a lower-than-average snowpack; and mountain yellow-frog populations. She discovered that nonnative trout restricted frogs' access to larger and deeper lakes, forcing them to breed in ponds that were prone to dry up in low snowpack years. This research highlights the cumulative impact of fish stocking and climate change.

In the future, Matthews intends to continue exploring the impact reduced snowpacks and warmer temperatures might have on high-elevation native species such as golden trout, the California state fish, and amphibians.



Kathryn Purcell

Research wildlife biologist; Fresno, California

California's beautiful and diverse landscapes are attractive to humans and wildlife alike. But, with the state's exponential population growth and resulting conflicts, how can we best accommodate the needs of humans and wildlife? Research wildlife biologist Kathryn Purcell is exploring the conservation needs of wildlife species to help address this important question.

Ask Her About

Bird habitat and nest-site selection, invasive species, fishers in the Sierra Nevada, wildlife response to habitat alteration

Background

Ph.D., ecology, evolution, and conservation biology, University of Nevada, Reno

One major emphasis of Purcell's current research is the fisher, a forest carnivore that has been extirpated from large portions of its historical range and that, as a result, is potentially vulnerable to extinction in some areas, like the southern Sierra Nevada. The important need to manage forest fuels to protect communities in the Sierra Nevada by reducing risk of catastrophic fire may alter the habitat elements critical to fishers, at least in the short term. Purcell's research is addressing the effects of timber harvest and fuels treatments on fishers and their habitats. Her work involves a combination of live trapping and radio-collaring, most recently with miniaturized global positioning system collars that provide fine-scale data on movement patterns that, until now, have been impossible to collect. She also is using scat-detecting dogs, specially trained to locate fisher fecal matter, which can provide insights on habitat occupancy and use and which can be used as the basis for genetic analysis.

Another of her research emphases explores the habitat requirements needed to maintain healthy bird populations in the face of habitat degradation and destruction, invasive species, and climate change. She is particularly interested in the factors that affect bird abundance and reproductive success and the relationship between the two.



Steve Seybold

Research entomologist; Davis, California

Ask Him About

Forest insect biology and management, bark beetles, wood-boring beetles, insect pheromones, chemical ecology, invasive species, molecular biology, wood products entomology

Background

Ph.D., entomological sciences, University of California, Berkeley; member, Entomological Society of America, Entomological Society of Canada, International Society of Chemical Ecology

Bark beetles are the most damaging pests of coniferous forests in the Northern Hemisphere and may, depending on the species, attack conifers and hardwoods in urban landscapes and in the wildland-urban interface. Understanding the biology, chemical ecology, and management of these important forest pests is critical to protecting future forest resources—and is exactly what drives Steve Seybold in his research.

Seybold is a research entomologist who specializes in the study of bark and wood-boring beetles. He and his colleagues are characterizing the invasive bark beetle and woodborer fauna of California and other Western U.S. States. The discoveries and descriptions of the life histories and behaviors of these insects are an important first step to understanding their pest status in U.S. forests. Seybold and colleagues also were the first to isolate specific genes from bark beetles that the insects use to detoxify defense chemicals released by trees under attack. The isolation of these genes provides a site for the next generation of bark beetle control tools.

In the future, Seybold plans to explore issues of drought and bark beetle-caused tree mortality, bark beetle and woodborer invasions of California's national forests, and new threats to native oaks and walnuts.



Hartwell Welsh, Jr.

Research wildlife biologist; Arcata, California

Amphibians are in steep decline worldwide, representing the sixth—and what may very well be the greatest—wave of extinctions the planet has ever witnessed. Hartwell Welsh is conducting research aimed at preserving these unique creatures and highlighting their importance within ecosystems.

Ask Him About

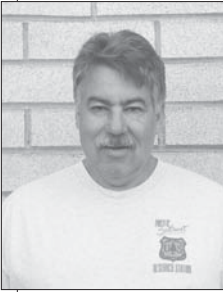
Amphibians as indicators of ecosystem status, link between amphibian and reptile distribution patterns and landscape processes, habitat modeling

Background

Ph.D., wildland resource sciences, University of California, Berkeley; member, Society for Conservation Biology, Society for the Study of Amphibians and Reptiles, American Society of Ichthyology and Herpetology

Welsh has led studies on the use of amphibians as indicators of both terrestrial and aquatic ecosystem status. Amphibians are extremely sensitive to relatively small changes in microclimate and are habitat specialists highly adapted to specific environmental features. These characteristics allow them to serve as veritable barometers of ecosystem health and status. Most recently, Welsh developed a blueprint for using amphibians in Pacific Northwest streams to monitor their potential to support ecological services, such as production of commercially valuable salmonid species.

In other studies, Welsh developed habitat models for many forest amphibians and reptiles of the Pacific Northwest. These models provide managers with a description of the habitat requirements of these species, which allow the managers to address human-caused stresses such as timber harvest and water diversions. One of Welsh's latest models was created using Forest Inventory and Analysis (FIA) data, a unique approach that was not initially envisioned within the FIA Program.



Peter Wohlgemuth

Hydrologist; Riverside, California

Peter Wohlgemuth subscribes to the belief that real-world problems are best solved by field research and that the best research, in turn, has management applications. Wohlgemuth is a hydrologist who studies postfire erosion and treatment strategies.

Ask Him About

Postfire erosion, sediment fluxes, geomorphology

Background

M.A., geography, California State University, Northridge; member, American Geophysical Union, Association for Fire Ecology

In one study, Wohlgemuth found that prescribed fires reduce the soil erosion from subsequent wildfires, suggesting that prescribed burns may be a sediment management tool in addition to helping to manage vegetation or reduce fuel buildup. Wohlgemuth found that prescribed fires reduced postfire cleanup costs and, perhaps, even the need for expensive soil retention structures.

In a second study, Wohlgemuth discovered that seeding with ryegrass is not an effective postfire erosion control measure, although the grass species has long been a standard erosion control plant in California. Wohlgemuth's field tests revealed that ryegrass replaced, rather than augmented, the cover of postfire native regrowth and was no better at reducing erosion than unseeded controls. His findings helped to steer postfire management response away from seeding as an erosion-control technique.

In the future, Wohlgemuth—who enjoys working outdoors on real-world problems—will continue to quantify and model postfire sediment changes for planning and risk assessment.



Ask Him About

Mammals, monitoring, noninvasive research methods, forest management, carnivores

Background

Ph.D., zoology and ecology, North Carolina State University; member, Ecological Society of America, Society for Conservation Biology, American Society of Mammalogists

William Zielinski

Research ecologist; Arcata, California

William Zielinski is an expert on forest carnivores. His research explores two concurrent themes: understanding the effects of forest management on carnivorous mammals and developing survey and quantitative methods for studying mammals and biodiversity. Much of his work is centered on rare or threatened species, like the American marten and fisher.

In the future, Zielinski plans to continue his studies of forest management's effects on biodiversity and help managers to reduce the likelihood of extinctions of threatened species.

Glossary

An asterisk (*) indicates a term that is defined elsewhere in the glossary.

A

adaptive management—approach in which findings and results of studies are continually incorporated into the management process so that it more accurately reflects reality and accommodates a dynamic system.

amphibian—a cold-blooded species (which, thus, relies on the external environment for temperature regulation) that spends some portion of its life in water. See also ectotherm.*

anadromous—a fish species that is born in freshwater, matures in marine (saltwater) ecosystems, and then returns to freshwater to reproduce.

anthropogenic—refers to changes or effects that are human-caused or in which people are otherwise closely involved.

B

biocontrol—a management approach that involves the careful introduction of a host-specific insect or disease to reduce a pest population and its negative impacts.

biodiversity—variation in species or life forms within a landscape or ecosystem. Promoting biodiversity often is an objective of ecosystem management.

biogeography—study of the geographic distributions of species and the factors that control them.

biomass—broadly defined, refers to the entire collection of living organisms and dead organic material an ecosystem supports; can include grasses, trees, insects, fish, birds, and mammals. More typically, is used in reference to the amount of living and dead vegetative material an ecosystem is capable of supporting.

biopesticide—naturally occurring substances, such as fungal or plant extracts, that control pests.

burn window—period during which prescribed burns should be ignited to maximize their efficacy and minimize undesirable effects. Burn windows typically occur within a set range of months each year but are subject to local weather conditions as well as other factors.

C

carbon emissions—the release of carbon previously stored in trees into the atmosphere as a result of prescribed burning, wildfire, management activities, or forest thinning.

carbon sequestration—the process by which forests or other vegetative landscapes remove and store carbon from the atmosphere.

carbon stocks—refers to the entire supply of carbon stored within forests and other forms of terrestrial vegetation.

carnivore—a meat-eating species.

conifer—a tree, usually evergreen, whose reproductive bodies (seeds) are contained within a cone.

crown—the upper portion of a tree or plant; ultimately forms the canopy.

D

deciduous—perennial plants that lose their foliage for part of the year.

disturbance—broad term referring to any event that disrupts an ecosystem and its components; includes fire, insect and disease outbreaks, and thinning.

E

ecological risk assessment—systematic identification and evaluation of a single or a collection of risks (or threats) to individual species or entire ecosystems.

ecology—a field of study concerned with the interactions of organisms and their environment.

ectotherm—a species that relies on the external environment for temperature regulation.

ecosystem services—components of nature directly enjoyed, consumed, or used to yield human well-being; includes water, food and fiber, and biologically diverse natural land cover.

emissions—in fire science, refers to the byproducts of fire that are put into the air; includes soot, carbon dioxide, water, and other compounds that are found in smoke.

eutrophication—An excessive influx of nutrients, like nitrogen, to a body of water that triggers a period of explosive plant growth. Typically, as the plants die and decompose, natural cycles and chemical balances are disrupted.

extirpation—local extinction, or die-off, of a species that continues to persist in other parts of its range.

F

fire adapted—refers to organisms or ecosystems that have historically experienced wildfire as a periodic disturbance agent and are resilient to its effects.

fire behavior—refers to the growth, spread, and characteristics a wildfire exhibits. Fire behavior is influenced by a host of factors, including terrain and local weather conditions.

fire exclusion—strategy in which fire is actively avoided, usually by means of suppressing lightning or human-caused ignitions.

fire history—historical pattern and characteristics of wildfire in an ecosystem. Often, a useful consideration when managing fire-adapted* landscapes.

flammability—refers to the ability of fuel* to burn and the resulting intensity.

forb—a nonwoody flowering plant that is not a grass; includes legumes.

fuel—in fire science, refers to organic matter that can burn in a fire; includes live and dead standing trees, dead and downed logs and branches, pine needles, leaves, grasses, and shrubs.

fuel consumption—in fire science, the process by which fire converts fuel* to energy (heat) and combustion byproducts, such as ash, charcoal, and smoke or emissions. Knowledge of the amount and rate of fuel consumption can help to predict fire effects, intensity, and severity.

fuel reduction—management activity in which fuel* is altered or altogether removed to lower the likelihood, intensity, or severity of wildfire.

G

gene—molecular unit that carries a species' genetic material.

genome—the entire collection of a species' genetic material.

genomics—the study of the genomes* and genes* of species.

geomorphology—the study of the processes that shape the physical features of the Earth.

H

habitat—the place where a species lives and where it finds the specific kinds of food, shelter, and other components necessary for its survival and successful reproduction.

hardwood—a deciduous,* non-conifer* tree; such as maple, alder, and willow.

heterogeneity—variation or diversity in condition or state.

I

indicator species—a species that is intimately associated with one or more of an ecosystem's components. The presence and abundance of an indicator species in an ecosystem can be an indication of that ecosystem's health as well as the presence or abundance of other species in the ecosystem.

integrated resource management—management of various resource values so that they are utilized in the combination that best meets present and future needs.

invasive species—species that occur outside of their native range and that are detrimental to the new ecosystems they inhabit; includes plants, animals, and pathogens.*

L

land use—the use (purpose) to which land is put by people; includes protected areas, plantations, pastures, and human settlements.

landscape ecology—study of how ecological patterns and processes interact across space (landscapes).

long-term ecosystem productivity—managing ecosystems to provide goods and services without reducing the land's capability to provide that rate of production in the future.

M

meteorology—the study of weather and climate patterns and phenomena.

microclimate—refers to local-level (small-scale) climatic conditions, such as the temperature and humidity within a forested stand.

P

pathogen—a disease-causing agent; includes bacteria, viruses, and fungi.

pathology—the study of diseases, their causes, and distribution.

phenology—study of the life history characteristics of a species, particularly as they are related to time of the year.

pheromone—naturally occurring chemicals that insects and related species emit to communicate with one another. Typically odorless to people, pheromones can be harvested and synthetically created to influence insect behavior.

pioneer plant—plant that is adapted to colonize and grow in a site following a disturbance.*

prescribed fire—a fire that is intentionally set and carefully monitored to achieve certain management objectives, like reducing a landscape’s fuel* load. Also referred to as a prescribed burn.

R

range shift—phenomenon in which the historical or native range of a species expands or retracts in response to climatic variability and change.

recolonization—process in which a species returns to an area it once inhabited; may occur rapidly or gradually over time.

resilience—used in reference to ecosystems that are capable of withstanding or favorably recovering from disturbance,* such as insect outbreaks or fire.

restoration—strategy in which an ecosystem is actively managed to return it to a previous or sustainable condition or state.

riparian—an ecosystem bordering a stream, river, or lake that is strongly influenced by the adjacent body of water.

S

semiochemical—chemicals produced by one organism that produce an effect, usually behavioral, in another organism. In forest pest management, semiochemicals are applied to individual host trees or forest stands to discourage pest infestation.

seral—refers to a stage of forest development. Early seral (also known as early successional) refers to relatively young forests with simple attributes; late seral (also known as late successional) refers to mature forests with complex attributes, such as coarse woody debris, snags,* and spatial heterogeneity.*

silviculture—the science of controlling the vegetation, growth, composition, and health of forests to meet the objectives of landowners.

snag—standing dead tree.

spatial heterogeneity—typically refers to variation in the amount and diversity of trees, shrubs, and understory plants at various vertical and horizontal areas within a forest. High levels of spatial heterogeneity are believed important for healthy, resilient* forests.

spatial scale—the resolution of the scale of reference; includes individual tree, stand, and landscape scales.

special forest product—a harvestable nontimber forest product that has commercial, medicinal, or craft value; includes mushrooms and floral greens.

stand—in forestry and silviculture, refers to a contiguous group of trees of relatively similar age, composition, and structure, so as to be a distinguishable unit.

stressor—a physical or biological component that reduces the vigor of organisms or ecosystems and potentially reduces their resilience* to other stressors; includes invasive species,* contaminants, drought, and fungal pathogens.*

succession—the growth and change of a forest over time and the replacement of an earlier stage of development with a newer phase (as in early seral* to late seral*).

T

temporal scale—the scale of reference that refers to the distribution of a variable across time; includes daily, monthly, and annual resolution of data.

thinning—the removal of some, but not all, trees or vegetation in a forest or landscape.

treatment—a forest management intervention applied to achieve a particular objective; includes fuel* treatments.

U

understory—the lower, or ground, portion of a forest; often consists of grasses, shrubs, and immature trees.

ungulate—hoofed plant-eating species, such as feral pigs and deer.

urbanization—a land use* change involving the conversion of rural lands (such as agricultural land) to developed areas (such as residential areas or commercial sites). Urban and developed areas consist of residential, industrial, commercial, and institutional lands.

W

watershed—the part of a landscape where precipitation flows into a single river system.

wildland-urban interface (WUI)—area at which a wildland (such as a forest, range, or woodland) intersects with a developed area, such as a residential community. As urbanization* continues and expands into wildlands, the WUI grows, often translating into an increased risk of severe wildfires, as human lives and structures become involved.

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Notes

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