

Extension/UAES – Natural Resource Systems and Environment

Watershed Protection and Management

This area is intended to focus on soil and water management problems at whole watershed scales, as opposed to problems of more localized scale. These watersheds include the cropland of the U.S. as well as range and forest lands. Work in this area can encompass one or more of the following: flood prevention systems, sediment control, wind and water erosion control, and management strategies oriented toward water yield and quality.

Areas of work include but are not limited to:

- New concepts and mathematical expressions of the erosion processes by wind and water at the watershed scale
- Procedures for identifying sediment sources, predicting and measuring sediment deposition, and methods for sediment control
- Measures for controlling erosion on watershed lands and stream channel systems in rural and urban environments, and methods for reclaiming eroded lands
- Methods for quantifying the role of soil and vegetation in the hydrologic performance of watersheds and river basins, and the impact of management practices which change topographic and vegetative characteristics
- Improved procedures for use of watersheds and river basins to assure needed agricultural and forest products, keep soil erosion and sedimentation to an acceptable minimum, and supply reliable quantities of good quality water for domestic, agricultural, municipal, and industrial uses
- Alternative land and water management practices including cover manipulation to improve the quality, quantity, and timing of surface and subsurface water yields from watersheds and river basins
- Alternative systems for managing water storage and movement to reduce floods and dispose of excess water, maintain stable stream channels, and provide water for beneficial uses
- Design and implementation of practices for the reclamation of soils that have been drastically disturbed due to construction, surface mining, mineral extraction, and other causes.

Exclude:

- Economic and policy issues of watershed management

Management of Range Resources

This area includes work on biological processes and ecological relationships, improved range management techniques, and better appraisals of range conditions for production of livestock forage, water yield, and wildlife habitat.

Areas of work include but are not limited to:

- Improvement of rangeland evaluation methods to reduce costs and increase the usefulness of information obtained, including aerial photography, geographic information systems (GIS), trend projections, and computers for data analysis
- Appraisal to provide up-to-date information on the quality, quantity, and productivity of range resources
- Projecting future demand for range forage and other benefits normally related to the wise use of rangelands
- Physiology and ecology of rangeland plant communities

- Range characteristics, including identification, physiological requirements, and nutritive value of forage plants
- Understanding range ecosystems and their biotic and physical components
- Improvement through breeding and selection of browse plants for forage, protection, and aesthetic purposes
- Revegetation of deteriorated areas by seeding desirable species
- Systems for managing ranges including fertilization, mechanization, grazing pressure, and drainage to increase yields
- Management practices that harmonize grazing with timber growing, wildlife, recreation, and other land uses
- Riparian areas and wetlands associated with rangeland habitats and their importance to these ecosystems
- Forested range management
- Protection against insects and diseases
- Invasive/alien plant deterioration of rangelands.

Exclude:

- Work focused on improvement of wildlife habitat
- Watershed systems and cumulative effects
- Protection against fire
- Agroforestry
- Economic and policy issues of range management
- Use of prescribed fire for maintenance of range ecosystems
- Biological control of pests
- Integration of pest control tactics into an integrated pest management

Management and Control of Forest and Range Fires

Work in this area focuses on both wildfire and prescribed fire. It includes the development of new wildfire prevention methods, new technology for fuel hazard reduction, improved systems for wildfire prediction, detection, and effective attack and suppression technologies. Prescribed fire is used to maintain fire-dependent ecosystems without endangering resources and facilities. Work in this area focuses on where, when, and how to utilize prescribed fire.

Areas of work include but are not limited to:

- Fire-related biology and ecology of plants and animals
- Atmospheric and ecosystem dynamics, patterns, and characteristics
- Physics and chemistry of combustion
- Behavior of fire as influenced by fire-starting agents, atmospheric circulation, and local weather, fuels, and topography
- Fire intelligence systems, including electronic methods, remote sensing, automatic measurement of fire environment, and computer integration of these factors into a fire danger rating system
- Reduction of fuel hazards through physical, chemical, and prescribed fire treatments
- Use of fire-resistant plants in home and building landscaping
- Creation of defensible space around homes and buildings
- Aerial and ground procedures for fighting fires
- Integrated prescribed fire control and forest management systems which minimize wildfire losses
- Use of prescribed fire to maintain the integrity and function of range ecosystems.

Exclude:

- Protecting soil from fire damage
- Protection from pollution

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- Control of hazards to fire fighting personnel
- Economic and policy issues of forest and range fire
- Development of community fire prevention, attack, and suppression plans and related homeland security activities

Management and Sustainability of Forest Resources

Work in this area focuses on the biology of forest plants and trees; ecology of forest ecosystems; tree breeding; forest nursery practices; silvicultural techniques to improve and regenerate forest stands; and assessing, modeling, monitoring, and forecasting forest ecosystems. Forest resources include both wood and non-wood products, often referred to as non-timber forest products or special forest products. Sustainable forest management criteria and indicators are outlined in international protocols.

Areas of work include but are not limited to:

- Intensive forest management
- Studies of forest ecosystem and community structure and function
- Physiology and ecology of forest trees and plant communities
- Selection and breeding of trees
- Forest health assessments and management practices to protect forests from insect and disease infestations
- Improvement of inventory methods to reduce costs and increase usefulness of information obtained, including emphasis on geographic information systems (GIS), aerial photography, trend projections, and use of computers for data analysis
- Appraisals and inventories for use in development of resource programs
- Seed orchard management, seed harvesting, processing, and storage methods
- Nursery culture, planting, and direct seeding
- Native and non-native invasive species that interfere with forest management objectives
- Techniques that result in natural regeneration
- Planning and modeling techniques for long-term management of forests for timber production in harmony with other uses, including wildlife and recreation
- Theory, instrumentation, and methods of mensuration for estimating timber growth, yield, and quality of products
- Cultural techniques, including spacing, fertilization, liming, and irrigation for the production of timber-related crops from improved strains
- Effects of environment and genetics on wood properties
- Causes and effects of forest fragmentation
- Relation of timber species and quality to wood properties and use
- Management objectives for privately-owned forest land
- Forest stewardship practices utilized by private forest landowners.

Exclude:

- Forest watersheds
- Protection against wildfire and fire-related biology and ecology of
- Agroforestry
- Urban forestry
- Forest recreation
- Forested range

- Economic and policy issues of forests and forestry
- Biological control of pests
- Integration of pest control tactics into an integrated pest management
- Use of prescribed fire and other measures to control competing vegetation, stand composition, and habitat characteristics
- Land use planning policies and procedures to reduce forest fragmentation and conversion
- Forest taxation, estate planning, and intergenerational transfer
- Christmas tree production

Agroforestry

Work in this area focuses on agroforestry practices that intentionally combine trees or shrubs with crop or livestock operations, or use trees at the agriculture/community interface to help create more integrated, diverse, and sustainable farms, non-industrial forests, ranches, and rural communities. Agroforestry practices are designed to incorporate the use of trees into agricultural settings to accomplish social, economic, and environmental objectives. The main types of agroforestry include alley cropping, riparian buffers, forest farming, windbreaks/shelterbelts, and silvopasture. Agroforestry practices often yield non-traditional tree and forest products such as mushrooms, boughs, medicinal plants, vines, and nuts.

Areas of work include but are not limited to:

- Biological interactions created or altered by agroforestry plantings
- Ecological roles of agroforestry systems at the landscape level
- Techniques for establishment, management, and renovation of agroforestry practices
- Enhancing performance of agroforestry plantings for economic, social, and environmental services, and rural development
- Selection and breeding of plant materials for agroforestry
- Protection of trees and shrubs in agroforestry plantings from damage by animals, wildfire, floods, insects, diseases, or other harmful agents
- Identification of new and innovative woody plant species and arrangements to enhance economic returns from agroforestry practices (e.g., specialty crops: medicinal herbs, floral products, Christmas trees, wood products)
- Generating income-producing opportunities from land devoted to conservation oriented agroforestry
- Integrating agroforestry technologies and plant materials into appropriate conservation or production systems for farms, ranches, communities, and nonindustrial forests
- Identifying social and economic constraints to agroforestry adoption
- Land use planning tools to integrate agroforestry practices into watersheds
- Role of agroforestry systems (e.g., crop production, biodiversity, and carbon sequestration) to mitigate hypothesized negative impacts of climate change.

Exclude:

- Management of forests
- Biological control of pests
- Integration of pest control tactics into an integrated pest management

Outdoor Recreation

Work on outdoor recreation focuses on the management of lands for recreation and the

coordination of this use with other land resources. It involves problems in management of physical resources, as well as socioeconomic relationships of users of the resources. Areas of work include but are not limited to:

- Determining the demand for outdoor recreation
- Criteria for selecting sites that will attract and support heavy recreation use
- Developing practical methods to maintain existing recreation sites and restoring

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those depleted by heavy use

- Requirements for aesthetic landscapes and means for producing and maintaining them
- Methods for the protection, management, and recreational use of wilderness-type historical and archeological areas and scenic landscapes
- Management systems and special equipment and facilities that will minimize dangers from fire, avalanches, and other natural hazards
- Understanding of visitor preferences and attitudes regarding outdoor recreation opportunities.

Exclude:

- Economic evaluation of recreation and recreation resources
- Recreation policy

Aquatic and Terrestrial Wildlife

This area focuses on invertebrate and vertebrate animal species that occur naturally in forest, range, and agricultural lands and waters, and marine environments. Work includes determining biological and ecological requirements of species, factors influencing population dynamics, interspecific relationships, methods for maintaining and enhancing habitats, and management approaches for sustaining wildlife harvests while maintaining population, species, and community viability.

Areas of work include but are not limited to:

- Life histories and population dynamics of wildlife, including non-game and threatened or endangered species
- Ecological and physiological requirements of fish and wildlife, including other organisms and plants that provide food and shelter
- Improving terrestrial wildlife habitat through such measures as seeding, planting, prescribed burning, spraying, fertilizing, and manipulation of native vegetation
- Improving fish habitat and food supplies through management and restoration of riparian and aquatic vegetation, and lake and stream physical and chemical habitat features
- Breeding and feeding habits, movement patterns, and other behavior of wildlife
- Interspecific relationships such as competition and predation that affect the wellbeing of wildlife populations
- Protection of wildlife from arthropods, parasites and diseases, invasive nonnative organisms, and other hazards, except pollutants
- Effects of agricultural, forest, and rangeland management practices on wildlife communities
- Management approaches for achieving balance between society's and wildlife's need and use of land and water resources.

Exclude:

- Pollution prevention and mitigation
- New and improved animal products
- Farm-raised fish, shellfish, game and fur-bearing animals, and other wildlife

- Economics and monetary valuing of wildlife
- Protection of crops from vertebrate pests
- Protection of livestock from vertebrate pests
- Protection of humans from diseases transmitted from wildlife
- Wildlife policy

Conservation of Biological Diversity

In a natural resources context, work on biological diversity (biodiversity) conservation focuses on the description, measurement, assessment, and management of plant and animal variation in nature. It includes diversity at the genetic, species, and ecosystem levels in forest, range, and agriculturally-influenced ecosystems. The objective is to preserve, enhance, and restore natural biodiversity to levels compatible with societal uses of natural resources.

Areas of work include but are not limited to:

- Biodiversity inventories of public and private lands and waters
- Comparisons of biodiversity between habitats, ecoregions, and natural and culturally-impacted areas
- Mechanisms that influence biodiversity
- The role of biodiversity in ecosystem function, stability, and resilience
- Impacts of agricultural, forestry, and rangeland management practices on biodiversity
- Effects of non-native invasive species on biodiversity
- Management approaches for conserving and restoring biodiversity.

Exclude:

- Genetic diversity of agriculturally important plants
- Genetic diversity of agriculturally important animals

Air Resource Protection and Management

This knowledge area focuses on investigations that quantify emissions, fate and transport, and practices to mitigate emissions of particulate matter and gases from agriculture and forestry practices. Work includes emissions from animal feeding operations, controlled burning, and tillage, and volatilization/transport to the atmosphere of naturally occurring or anthropogenic chemical compounds.

Areas of work include but are not limited to:

- Short and long-range transport of particulates and gases by wind through the atmosphere
- Procedures for measuring and monitoring of particulates, gases, and odors, as well as precursors to the formation of atmospheric particulates and ozone
- Effects and remedial measures related to atmospheric deposition
- Emissions to the atmosphere from land application of animal wastes, animal housing, and edge of field boundaries
- Inventories of emission factors to help agriculture and forestry comply with regulatory requirements
- Management practices that reduce or mitigate particulates, gases, and odors as well as greenhouse gases from agriculture and forestry production practices to the atmosphere.

Exclude:

- Mitigation of odors, dust, and noise hazardous to humans
- Indoor air quality

Natural Resource and Environmental Economics

This work focuses on understanding economic relationships, decisions, and impacts relating to the management and use of public and private natural resources, and the environment. Work in this area also focuses on the economics of improving the efficiency of agricultural, forest, and rangeland use while minimizing negative impacts on the environment.

Areas of work include but are not limited to the economics of:

- Water resources
- Forestry
- Recreation, leisure, and tourism
- Land resources, use, and management
- Wildlife and fisheries
- Agrochemical management
- Waste management, including animal wastes
- Mineral resources and energy
- Environment
- Weather and climate change
- Market and non-market value of natural resources.

Exclude:

- Financial aspects of real estate
- Land use planning or zoning
- Policy
- Conflict resolution

Primary Program Emphasis Areas – Areas of Work Defined

2007 Addendum

Natural Resource Systems and Environment

Urban Forestry

This work concentrates on the use of trees to improve or maintain the quality of urban and suburban environments and to enhance natural beauty through tree plantings. Tree plantings for special purposes include: visual screening, noise suppression, air quality improvement, shade, and beautification. Identification and development of species capable of living under adverse conditions such as smoke, air pollution, compacted soils, deficient or excessive moisture, and other unfavorable conditions associated with urban environments is included in this category.

Areas of work include but are not limited to:

- Selection and breeding of trees for urban environments, shade, and other special characteristics
- Protection of trees from damage by animals, wildfire, floods, insects, diseases, or other harmful agents
- Methods of site preparation and tree establishment appropriate for special purpose plantings
- Urban tree biology, including culture and maintenance of urban trees and stands
- Soil and site requirements of species needed to improve the environment
- Physical, biological, wildlife, and social benefits of urban trees/forests, including psychological and physical health

- Multiple effects of urban forests such as lowering the "heat island" effect, reduction of air and water pollution, and improvement of property values.

Exclude:

- Commercial products
- Studies specific to pollution
- Agroforestry
- Economic and policy issues of urban forests
- Biological control of pests
- Integration of pest control tactics into an integrated pest management (IPM) system
- Suburban/urban shade tree/street tree commissions
- Management of urban forestry volunteers and programs.

Weather and Climate

Work on the impact of weather and climate on agriculture and natural resources focuses on three tasks: (1) characterize existing climatic patterns and propose more effective ways of adjusting to these patterns, (2) specify modifications in management approaches that are desirable to farm, forest, and rangeland managers, and (3) learn how potential modifications affect agriculture or natural ecology.

Areas of work include but are not limited to:

- Understanding the sequences and duration of weather events and the response of relevant biota
- Probabilities of occurrence of weather conditions critical to agricultural operations.
- Methods for incorporating climatology in the strategies, forecasts, and decisionmaking tactics of agriculture
- Biological consequences of climatic changes
- Drivers of weather, climate, or climate change
- Mechanisms by which micrometeorology controls the reentry of pesticides, herbicides, and other agricultural chemicals into the atmosphere
- Micro- and meso-climatological conditions regulating the airborne transport of insects, bacteria, fungi, and other particulates
- Mechanisms by which micrometeorology affects gas and water exchange at the plant-atmosphere boundary layer.

Exclude:

- Lightning and other weather-related forest fires
- Weather/climate data obtained from integrated pest management activity

Pollution Prevention and Mitigation

Work in this area is concerned with preventing, alleviating, and mitigating pollution initiated by agricultural and forestry practices and its detrimental effects on agricultural plants, animals, soil, air, water, and humans. Potential pollutants include: organic pesticides, radio-nuclides, fertilizer chemicals, growth regulating chemicals, animal and crop wastes, mulching materials, pathogenic microorganisms, heavy metals, salts used on roads for de-icing, and allergens. This work focuses on agricultural production, not on health hazards to humans, which are covered in, Hazards to Human Health and Safety.

Areas of work include but are not limited to:

- Sources, character, intensity, and causes of pollution from agricultural and forestry practices and frequency of occurrence

- Behavior and fate of pesticides and other pollutants in soil and water
- Tolerance of plants, animals, humans, and insects to pollutants, including low levels of pollutants for prolonged periods of time
- Breeding and selection of forest and range plants resistant to pollution
- Public policy that would reduce pollution
- New or alternative agricultural and forestry practices and methods of reducing and controlling pollution to levels that are not harmful to natural resources, plants, animals, and humans, or methods that will prevent emission of the pollutant
- Role and use of living organisms in removing pollutants from the environment
- Minimum environmental quality standards for natural resource health and integrity
- Methodology and instrumentation for detection of pollutants and methods of analysis
- Methods of monitoring water, soil, and other media for pollutants and maintenance of networks that conduct this monitoring
- Methods and equipment for protecting plants and animals from pollutants
- Protection against radiation, noise, and other hazards
- Remediation of polluted areas
- Aquatic weeds as a pollutant
- Modeling pollutant load and delivery to soil and water resources.

Exclude:

- Trees to enhance urban and suburban environments
- Protecting humans from harmful effects of microorganisms and naturally occurring toxins
- Collecting, moving, storing, recycling, or disposing of plant, animal, and radioactive or industrial wastes
- Measurement, monitoring, and mitigation of airborne particulates, dust, ozone, odors, volatile organic compounds, gases, combustion products, smoke, and smog
- Effects and remedial measures related to atmospheric deposition
- Safe methods for disposing of pesticides or other agricultural chemicals
- Methods and equipment to protect humans from pollutants
- Protection of humans from non-food allergens and toxins, and poisonous plants
- Protection of humans from radiation
- Mitigation of odors, dust, and noise hazardous to humans

Waste Disposal, Recycling, and Reuse

Work in this area includes all aspects of collecting, storing, transporting, treating, recycling, and utilizing waste products from agriculture, forestry, and other origins. The development of value-added or alternative products from waste products is included.

Areas of work include but are not limited to:

- Methods of collecting, storing, moving, treating, and disposing of animal, plant, food processing, municipal, and industrial wastes
- Development of products from waste materials, including biofuels
- Engineering and analysis of projected and existing waste disposal systems and pesticide containers
- Recycling pre- and post-consumer wastes
- Improved methods for mitigating environmental impacts and biosecurity risks from agricultural, forestry, municipal, and industrial wastes.

Exclude:

- Pollution prevention and mitigation of soil and water resources
- Pollution prevention and mitigation of air resources
- First use of under-utilized co-products