Extension/UAES – Water and Soil Conservation and Uses

Appraisal of Soil Resources
Work in support of soil mapping is concerned with identifying the important soil parameters for use in crop production, site-specific management, forest and range resource evaluation, housing developments, zoning, waste management, environmental urban planning, and other land uses. Soil surveys can also be used to show soil characteristics such as spatial and temporal variability, susceptibility to frost heave or slippage, depth to water table, depth to rock or other impermeable barriers, bearing strength, flood hazard, and soil erosion potential that affect suitability of a site for specific uses.
Areas of work include but are not limited to:
• Physical, chemical, mechanical, and biological characteristics of soils needed in soil classification and management
• Identification of soil types and their suitability for specific uses
• Appraisal of how soils behave under different levels of management and use such as crop production, logging, grazing, water utilization and yield, and other agricultural, forestry, waste disposal, and non-agricultural uses
• Soil resource description and inventory, including their spatial and temporal variability
• Use of geographic information systems and remote sensing technologies.
Exclude:
• Soil testing for agricultural, forest, and range production

Soil, Plant, Water, and Nutrient Relationships
This knowledge area is concerned with the chemical and physical nature of interrelationships among soils, plants, water, and nutrients. The objective is to improve, maintain, or restore the inherent production capability of soils.
Areas of work include but are not limited to:
• Soil testing and plant analysis
• Resource development, conservation, and management
• Factors that limit root development of plants
• Development of practical methods for ameliorating unfavorable conditions, such as tillage pans, nutrient deficiencies, and improper air-water relationships
• Ways to maintain and improve soil structure by soil amendments and by soil, crop, tillage, and management systems
• The effect of physical, chemical, and biological properties of soils on soil structure, resistance to erosion, availability of plant nutrients, and the general environment for plant roots
• Chemical changes of nutrient elements in different kinds of soils and the factors affecting uptake by various crops
• Methods to make beneficial changes in energy dissipation and utilization in the soil-plant-atmosphere relationships
• Interrelationships between soil properties and their impacts on water storage and movement in the soil profile
• Effects and actions of biological organisms on soil and organic matter function and plant relationships
• Use of manures and other organic materials as plant nutrient sources.
Exclude:

• Precision farming methodology
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• Response of plant species to variables of soil, plant, water, and nutrient conditions
• Effects of erosion, fire, flood, and other natural hazards on the soil resource

Management of Saline and Sodic Soils and Salinity
This area is concerned with injurious accumulations of salts that may occur in the root zone of soil because salts move upward in the soil with water and are left behind as the water evaporates. Work in this area also concerns salts that can be leached downward to the groundwater or to a drainage system as the result of heavy rainfall or irrigation, as well as salinity and brackish water problems that may occur in seaboard areas.
Areas of work include but are not limited to:
• Leaching theory and methods to predict rates and amounts of various qualities of leaching waters and related drainage system requirements to reclaim soils having salt accumulations
• Methods of treating and managing saline irrigation water and leaching effluents
• Management criteria for use of brackish water of various qualities under a wide range of soil, crop, and environmental conditions
• Tillage, crop, soil amendment, leaching, and profile modification practices for crop production on saline and sodic soils
• Interactions of soil structure, dissolved and adsorbed ions, microbial activity, organic matter, and moisture movement in the root zone of salt affected soils
• Procedures and equipment for determining the salinity status of soils and irrigation waters
• Plants or cropping sequences for managing or improving saline soils
• Breeding and selection of salt tolerant varieties.
Exclude:
• Effects of human-caused salt pollution such as that from industrial sources

Protect Soil from Harmful Effects of Natural Elements
This work focuses on protection of soils from impairment as a result of natural events.
Areas of work include but are not limited to:
• Effects of wind and water erosion
• Effects of floods
• Effects of landslides
• Effects of wildfire
• Subsidence of organic soils.
Exclude:
• Resource development and conservation management

Conservation and Efficient Use of Water
Work in this area attempts to increase efficiency in collecting, storing, conveying, using, and reusing available water resources.
Areas of work include but are not limited to:
• Procedures to monitor and improve effectiveness of water storage in the soil profile and underground aquifers
• Improved water conservation practices such as residue management that will be compatible with modern mechanized agricultural practices

• Selection and breeding of plant varieties to make efficient use of water through the various stages of plant growth
• Alternative practical techniques for reducing water loss from plant, soil, and water surfaces
• Practices to enhance water infiltration, transmission, and use by plants
• Methods to conserve, replenish, and effectively use water in underground storage
• Studies or activities designed to control phreatophytes and aquatic weeds to reduce the damage or losses they cause
• Water in wetland and riparian systems
• Wetland construction or renovation.
Exclude:
• Aquatic weeds as a pollutant
• Economic and policy issues of water

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

Plant Biological Efficiency and Abiotic Stresses

This area focuses on understanding and improving plant productivity and quality affected by reduced inputs or abiotic stresses such as water, temperature, or nutrients.

Areas of work include but are not limited to:

- Biological mechanisms that affect actual or potential yields
- Biological mechanisms related to water use and survival of water stresses (e.g., drought, flooding)
- Biological mechanisms related to the use of nutrients and survival of nutrient stress
- Biological mechanisms related to survival of temperature stress (including freezing, chilling, and heat)
- Breeding (including genetic engineering) for biological efficiency or stress tolerance
- Cultural practices to improve biological efficiency or stress tolerance.

Exclude:

- Basic plant biology
- Integration into production management systems
- Breeding (including genetic engineering) for quality improvement
- Breeding (including genetic engineering) for host plant resistance
- Breeding (including genetic engineering) for crop-weed management
- Evaluation of germplasm for variation in biological efficiency or stress tolerance
- Effects of abiotic factors on pests
- Effects of pollution stress on plants
- Forest and range plants

Plant Management Systems

This area focuses on integration of production practices into an integrated system for managing annual and perennial plant population densities, fertility, irrigation, precision agriculture, and other cultural practices in an efficient and effective manner.

Areas of work include but are not limited to:

- Application of remote sensing and other automated sampling methodologies in managing plant population densities, fertility, irrigation, and other cultural practices
- Modeling and decision support systems for use in managing plant population densities, fertility, irrigation, and cultural practices
- Evaluation of integrated production management systems
- Organic agriculture – plant production management systems
- Sustainable agriculture – plant production systems
- Scale (size) related plant production systems that may affect farm viability
- Biosecurity in plant production systems
- Gardening and Master Gardening programs.

Exclude:

- Development of integrated pest management systems
- Application of remote sensing and other automated sampling methodologies for pest management
- Modeling and decision support systems for pest management
- Basic studies and information related to improving, maintaining, or restoring the inherent production capability of soils
- Forest and range plants
- Biodiversity in plant production systems

Weeds Affecting Plants

This area focuses on yield and quality affected by competition from indigenous and exotic weeds, including aquatic weeds and parasitic plants.

Areas of work include but are not limited to:

- Population dynamics and ecology
- Biosystematics/taxonomy
- Effects of abiotic factors such as temperature, water, or nutrients
- Weed seed studies, including dormancy, survival, and depredation
- Cultural practices (including solar sterilization) to reduce weed populations or effects
- Breeding (including genetic engineering) for crop-weed management
- Efficacy, product performance, application technology, and population management with conventional pesticides and biopesticides (including growth regulators)
- Pest resistance to weed control methods and strategies
- Development of sampling protocols (including economic injury levels and remote sensing and other automated sampling methodologies) and predictive models for weeds
- Biosecurity measures to limit invasive weeds in plant management systems.

Exclude:

- Integration of control tactics into systems for managing single weed species or weed complexes
- Biological control
- Breeding (including genetic engineering) for biological efficiency
- Control of competing vegetation in urban forestry and agroforestry
- Protection of wildlife and natural resources from aquatic weeds
- Development of sampling protocols and predictive models for weed complexes
- Development of remote sensing instruments
- Toxic effects of weeds on animals
- Effects of weeds on human health, including allergies and toxicity
- Fundamental areas of plant genetics
- Movement and dispersal resulting from airborne transport of weeds

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

Water and Soil Conservation and Use

Instrumentation and Control Systems
This work includes instrumentation and information systems that are important elements in all aspects of pre- and post-production agriculture. Sensors for detecting, monitoring, and processing of collected data and those that can provide improved control of the production and processing of biological materials, non-biological materials, and biohazards are included in this area.
Areas of work include but are not limited to:
• Development of instruments, technologies, and procedures that enhance agricultural efforts
• Determining accurate and precise standards of measurement
Development of sensors, image processing techniques, automation, decision support systems, controls, and models
• Development of global imaging systems and global positioning systems (GPS) to enhance agricultural efforts.
Exclude:
• Experimental design and statistics

Drainage and Irrigation Systems and Facilities
Water management, to include surface and subsurface drainage and all irrigation systems, is part of this work. Equipment, system design, theory, modeling, installation, operation, and maintenance of drainage and irrigation systems for more efficient use of land, water, and capital resources are included.
Areas of work include but are not limited to:
• Theory of water flow for more efficient water management system design
• Methods of automating water management systems to reduce labor and increase efficiency
• New concepts and improved design of drainage systems for more efficient production and environmental improvement
• New materials, systems, equipment, and installation techniques to reduce construction and maintenance costs of drainage and irrigation systems
• Use of solar energy and air turbulence to speed drying of poorly drained soils
• Methods for combining irrigation, drainage, and tailwater return flow systems to increase efficiency of water and system use
• Improved design of water management systems to reduce planning and construction costs and assure public safety
• Methods for determining irrigation water requirements giving consideration to

water use by plants, effective rainfall, and water losses during and following application
• Equipment for uniform distribution of irrigation water with particular emphases on overhead and subsurface systems
• Improved technology to measure and control losses of agrochemicals from irrigated lands.
Exclude:
• Drainage related to controlling salinity