



MSU's College of Agriculture in Bozeman, Montana is the ideal setting for students interested in the natural environment, ecology, biotechnology and the relationship between humans and the outdoors. Many of our "labs" are outdoors in the mountains, valleys and rangelands of beautiful southwestern Montana.

All programs of study are science-based. You will learn skills and study critical issues that prepare you to step into the challenges and opportunities of the working world. And, just as you are drawn to Montana for its unique balance of learning and lifestyle, our professors have also chosen MSU for its supportive, ambitious and down-to-earth atmosphere. As leaders in their fields, MSU faculty have chosen Bozeman for its dynamic, collaborative and inspiring setting.

The MSU College of Agriculture works closely with the Montana Agricultural Experiment Station (MAES), which conducts relevant research for the people of Montana, and MSU Extension, which disseminates the research findings through a network of county and reservation offices. Many College of Agriculture faculty and staff are fully or partially funded by MAES or MSU Extension.

If you want to be challenged, meet inspiring people, and prepare for a professional career in one of the most beautiful places on earth, the MSU College of Agriculture is for you.



## Our Focus: Learning for a Lifetime

Land Resources and Environmental Sciences (LRES) integrates coursework and research involving soils, vegetation, water, and organisms into a multi-disciplinary approach to understand and manage land resources. We focus on natural and managed landscapes, with fundamental and applied exploration of environmental sciences, agriculture, natural resources, and land management. We foster collaboration with allied disciplines, institutions and stakeholders to address land resource issues that are complex and that cross scales from the microscopic to the landscape.

LRES faculty members conduct cutting-edge investigations in specialized laboratories, modern greenhouses, and in the many outstanding and diverse natural laboratories within the Greater Yellowstone Ecosystem. We utilize public, farm and ranch lands across the state and region, as well as the MSU Post and Red Bluff research facilities. Our faculty are participants in and/or collaborators with the Center for Invasive Plant Management, the Reclamation Research Unit, the Thermal Biology Institute, Big Sky Institute, Spatial Analysis Center, and Research Centers throughout the state. The research conducted in LRES is recognized internationally for

its contributions to environmental sciences and land resources management.

Undergraduate programs lead to B.S. degrees in Environmental Sciences, Land Rehabilitation or Land Resource Sciences. Graduate programs offer M.S. or Ph.D. degrees in Land Resources and Environmental Sciences, an M.S. in Land Rehabilitation, and a cross-departmental M.S. in Entomology. Off-campus education programs provide research-based information, new technologies and basic education to land managers through the development of interpretive tools, learning groups, and education programs for agricultural production and natural resource management.

Our unique location in the Greater Yellowstone Ecosystem provides an unparalleled natural laboratory as well as diverse opportunities for recreation.

For more information about the Department of Land Resources and Environmental Sciences, contact:

334 Leon Johnson Hall  
 P.O. Box 173120  
 Bozeman, MT 59717-3120  
 Tel: 406-994-7060  
 Fax: 406-994-3933  
 Email: [lresinfo@montana.edu](mailto:lresinfo@montana.edu)

To find out more about our programs, contact us on the web at <http://landresources.montana.edu>

# Montana State University

## Land Resources & Environmental Science

*Integrating basic and applied sciences to understand and manage resources in agricultural and natural landscapes*



## Undergraduate Degree Programs

Students in LRES degree programs take core courses in biology, chemistry, earth science, ecology, mathematics, physics, soil science, economics, statistics and written and oral communication. Many of our upper division courses include valuable laboratory experiences. A senior-level capstone field course allows students to apply classroom knowledge to hands-on development of interdisciplinary solutions to real-world environmental problems.

LRES degrees prepare students for careers in environmental sciences, agriculture, land reclamation, and other natural resource fields with governmental agencies, private landowners, private industry, and the non-profit sector, and provide students a strong base for advanced graduate training.

### B.S. in Environmental Sciences

Choose from two options:

The **Environmental Biology** option is for students interested in the basic biology and ecology of organisms in natural and altered environments, and includes an emphasis on microbial systems.

The **Soil and Water Science** option prepares students who are interested in the physical, chemical and biological processes occurring in natural and managed soil and aquatic environments. Students gain appreciation for practical applications in watershed management, pollutant fate and transport, and other critical issues.



### B.S. in Land Rehabilitation

This curriculum is for students interested in reclamation and restoration ecology, including revegetation and soil remediation of sites degraded by industrial activities, recreational activities, invasive species or natural disturbances.

### B.S. in Land Resource Sciences

Choose from two options:

The **Land Resources Analysis and Management** option prepares students to inventory and analyze land resource information using state-of-the-art tools for mapping (GIS and GPS) and remote sensing, and to integrate that information with management concerns for informed land resource use and decision-making.

The **Agroecology** option offers training to work in contemporary agricultural management. Students may specialize in applied ecology, cropping systems, natural ecosystems, pest management, or policy and planning.

### LRES Undergraduate Minors

The Department offers or supports three minor degrees: **Soil Science** (LRES), **Entomology**, and **Water Resources** (both shared with other campus departments).



## Undergraduate, Graduate and Postdoctoral Research Opportunities

LRES research programs offer opportunities for advanced study beyond the B.S. degree, leading to an **M.S. in Land Resources and Environmental Sciences**, **M.S. in Land Rehabilitation**, **M.S. in Entomology**, or **Ph.D. in Land Resources and Environmental Sciences**. Undergraduates may participate in the discovery process through original research projects mentored by LRES faculty. Our research covers a wide range of topics, including:

### Agricultural Systems

Integrate soil and crop management principles with modern tools to maximize profitability and environmental stewardship in diversified cropping systems. Focal areas include:

- creation of more economical practices through cropping systems innovations
- impacts of technology (precision agriculture, nutrients, herbicides, GMOs) on agricultural systems
- integrated weed and insect pest management to develop economically viable, ecologically healthy and relatively weed- and pest-resistant rangeland and cropping systems (agroecosystems)
- interaction of landscape characteristics, climate, and agronomic practices on soil and water conservation, nutrient cycling, biodiversity, and pest dynamics
- land management and cropping systems strategies that mitigate greenhouse gas emissions or enhance soil functional capacity

### Analysis, Management and Decision Making

Apply biological, socio-economic and physical data to land resource management. Focus areas include:

- environmental and biological risk assessment with particular emphasis on pesticides, biotechnology, and invasive species
- risks and opportunities associated with climate change through long-term ecological research in the Greater Yellowstone and Antarctic regions
- modern tools for land analysis (satellite remote sensing, GIS, GPS, and computer decision support and simulation modeling)
- documenting soil-landscape patterns and causes of change to define strategies for using and sustaining land resources

### Environmental Biology and Microbiology

Research concerning microbial and plant ecology of natural and disturbed environments includes:

- microbial ecology of extreme geothermal environments in nearby Yellowstone National Park
- bioremediation ecology, where environmental biophysics and chemistry are combined with microbial ecology to understand the ecology of contaminant-degrading bacteria
- ecology of areas impacted by weeds, mining, recreation and other activities, including those at high elevations
- microbial ecology of Antarctic ecosystems focusing on the biogeochemistry, survival, and evolution of microbes associated with ice
- physiology, biochemistry and genetics of microbe-plant interactions

### Invasive Plants

Study invasive plant species in managed or wild lands, including ecologically-based management, revegetation of disturbed areas, and factors determining the distribution, survival and abundance of exotic plants. Areas of focus include:

- revegetation strategies for disturbed and invasive plant-dominated areas
- factors (soil, hydrology, climate and organisms) controlling distribution and success of invasive species
- evaluating above- and below-ground mechanisms of plant/environment interactions
- regulating plant community change to manage invasive species



### Land Rehabilitation

Research opportunities include partnerships with government agencies and private industry to develop cost-effective reclamation methods and to evaluate critical interrelationships within disturbed and reclaimed systems. Some specific areas of inquiry are:

- decision tools for large-scale land reclamation strategies
- geochemical characterization of sulfide mineral weathering
- phytostabilization of acid metalliferous mining wastes
- the influence of soil microorganisms on successful revegetation of disturbed lands
- ecological principles to restore plant communities

### Soil and Water Science

Faculty with expertise in soil and environmental physics, chemistry, hydrology, watershed analysis and modeling, limnology, microbiology, nutrient cycling, pedology, land rehabilitation and landscape science interact on research projects such as:

- biogeochemical cycling of trace elements associated with geothermal or mine impacted sites
- interactions between plants and soils, including water relationships, plant physiological ecology, biophysics and bioremediation
- interactions of climate, landscapes, plants, soils and humans
- nutrient loading and algal growth impacts on lake, reservoir, and river quality
- soil and water management alternatives to improve surface and ground water quality, such as vegetative filter strips, riparian and/or constructed wetlands, riparian zone hydrology, hillslope hydrology, and hyporheic zone hydrology
- land use impacts on hydrology, vegetation, and biogeochemistry
- watershed hydrologic modeling

### Entomology

Specialize in several areas of entomological science, and its interface with agricultural and natural resource sciences. Research areas include:

- insect behavior and ecology, as they relate to insect distribution, abundance, and evolution
- using arthropods, microorganisms and other natural enemies to regulate weed and insect pests in wildlands and crops
- integrated pest management and economic entomology for arthropod pests of small grains, forage and specialty crops
- insect-plant interactions, including chemical ecology and plant and insect physiology