Pacific Northwest NATIONAL LABORATORY

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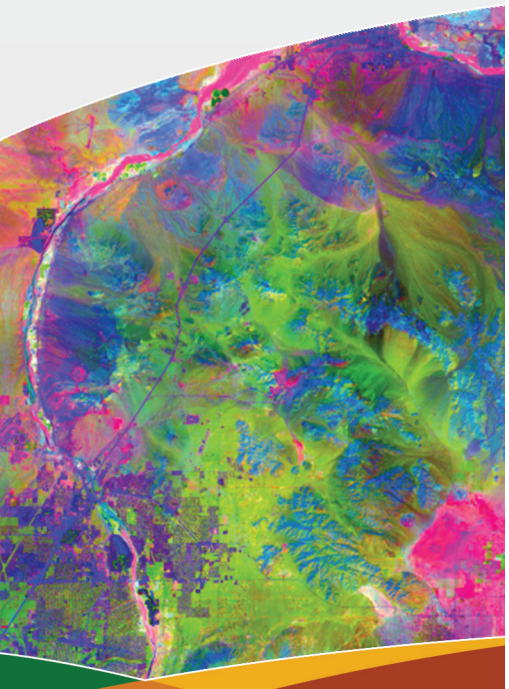
Remote Sensing for Energy and Environment Applications

Today's complex energy and environmental challenges require accurate and timely information at a wide range of scales. Satellite and aerial imagery can provide dynamic data to help address environmental challenges and support ecosystem models for energy development, land use management and critical habitat protection. Effective use of this remote sensing data requires an in-depth understanding of imaging systems, detection physics, and spatial data processing. Pacific Northwest National Laboratory (PNNL) can provide the remote sensing and ecological interpretation expertise.

ANALYSIS EXPERTISE

The Ecology Group at PNNL has more than 25 years of experience in developing and applying sophisticated algorithms that transform imagery into the types of information needed to perform comprehensive, broad-scale assessments. Working with multidisciplinary teams, our scientists have developed numerous analytical products, for both public and private land management entities, using remote sensing geospatial analysis to support energy development and environmental assessments. Myriad platforms provide the data for these analyses, including satellite and airborne, hyperspectral, multispectral, thermal infrared, LiDAR (Light Detection and Ranging) and RADAR.

Satellite image of the Mojave Desert transformed to highlight geologic and vegetation features



CAPABILITIES

- Delivering geospatial fusion of remotely sensed data from multiple sensors including optical, thermal, RADAR and LiDAR
- Classifying and quantifying land cover changes including upland and riparian habitat structure and fragmentation, distribution of invasive plant species, fuel characteristics of existing vegetation, and landscape characteristics affecting hydrologic functions
- Developing geostatistical techniques to combine remotely sensed data with discrete ground measures to provide spatially continuous descriptive variables for modeling
- Providing automated and interactive feature extraction from remotely sensed imagery
- Performing ground validation and ecological interpretation of analytical outputs.

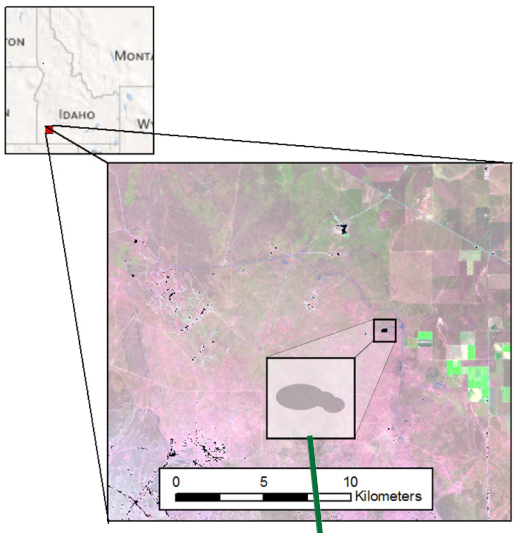
PNNL provides comprehensive environmental solutions, including field data collection and interpretation

SOLUTIONS

The Ecology Group works with remote sensing imagery that spans a broad range of temporal (weeks to decades) and spatial (from local to continental scales) resolutions to develop products to characterize environmental features or input model parameters. In addition to delivering algorithm solutions and data processing, our ecologists provide ecological interpretation of analysis results to gain the highest value information from the image sources.

U.S. DEPARTMENT OF ENERGY

Early Detection of Environmental Stress



Locations of environmental stress (black) in Snake River Plain, Idaho

- Use satellite data to detect and map environmental anomalies
- Increase sensitivity of stress detection by fusing GIS information with satellite data to highlight areas of concern
- Satellite data derivatives are analyzed by GIS strata to identify areas at the statistical extreme for the region
- Statistical anomalies represent issues of concern

Client	Application
U.S. Department of Energy	• Habitat Suitability Models for Sensitive Wildlife Species
U.S. Department of Defense	• Predictive Tools to Manage Altered Fire Regimes Caused by Plant Invasions in the Mojave Desert • Mapping Invasive Species over Fort Lewis • Adaptive Framework for Management of Military Operations in Arid/Semi-Arid Regions to Minimize Watershed and Instream Impacts
U.S. Bureau of Land Management	• Post-Fire Classification and Characterization • Environmental Stress Detection in Rangelands • Mapping Shrub Canopy Characteristics
U.S. Fish and Wildlife Service	• Vegetation Mapping and Assessment
Naval Research Laboratory	• Hyperspectral Remote Sensing Analysis of Nearshore Waters in the Pacific Northwest
National Geospatial Intelligence Agency	• Automatic Feature Extraction of Transportation and Hydrological Features for Map Updating
NASA	• Detection of Crop Stress Via Hyperspectral Signature Analysis
Bureau of Ocean Energy Management, Regulation and Enforcement	• Using Synthetic Aperture Radar (SAR) to Identify and Characterize Overwintering Areas of Fish in Ice-Covered Arctic Rivers

PUTTING REMOTE SENSING TO WORK FOR YOU

Models that transform images to information allow rapid updates to include current information in geographic information system (GIS) analyses. Using remotely sensed data, the Ecology Group can provide seamless estimates of spatially distributed parameters for modeling the ecosystem processes and functions across landscapes. When coupled with ground-based, discrete data and geostatistical techniques, remote sensing can be effectively employed in studies requiring spatially distributed, continuous variables.

Information on Remote Environmental Solutions

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Ecology Group

The primary goal of the Ecology Group is to develop and deploy science and technology to help governmental agencies and corporate land managers accomplish their primary missions while protecting and enhancing ecological resources. Our research and technology development activities cover a broad range of land and water resources issues. We offer scientific knowledge of ecosystem management that balances operational demands with effective stewardship of natural resources.

To learn more about the Ecology Group, please contact **David Geist**, Ecology Group Manager, at (509) 371-7165 or visit our website at http://ecology.pnnl.gov/.

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