

# Innovative Spatial Data Analysis and Visualization Supports Impact Assessments of Federal Lands

*Argonne National Laboratory's extensive experience and technical capabilities in using spatial models and data to analyze, visualize, and model regional environmental and socioeconomic characteristics are used to support impact assessments for proposed energy developments on Federal lands*

## Problem/Opportunity

Federal lands often contain valuable natural and cultural resources that must be managed for a variety of uses that can benefit the Nation. One potential use is energy resource development, such as recovering coal, oil, or gas or installing wind or solar energy technologies and transmission lines. Before Federal lands can be developed, the agencies that manage them must conduct a thorough impact assessment to ensure that development will not result in adverse effects or that such effects can be minimized through mitigation strategies. The assessments must also examine whether the development will cause conflicts with competing land uses.

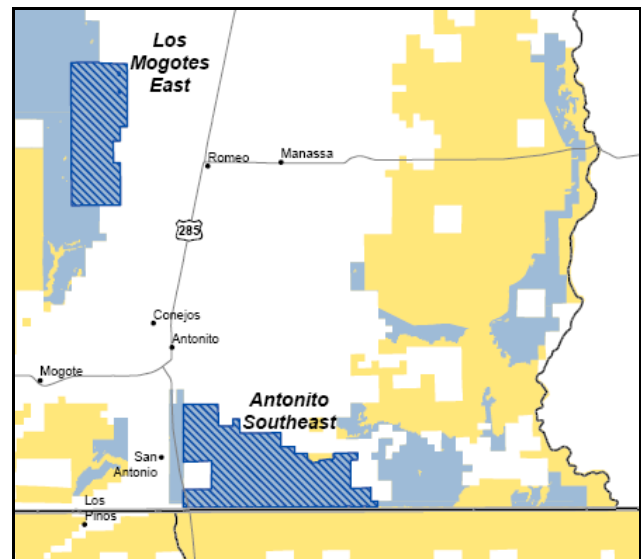
## Approach

Argonne's Environmental Sciences (EVS) Division has extensive experience in evaluating the potential impacts of energy developments on Federal lands. This experience includes the following:

- Development of both land-based and offshore wind and solar collectors,
- Oil recovery from shale and tar sands,
- Siting of electrical transmission lines, and
- Development of oil and gas pipelines.

Each of the impact assessments prepared by EVS has required the application of innovative tools and spatial data sets operated within geographic information systems (GIS). Through these evaluations, Argonne has developed nationally recognized technical expertise and computing capabilities to analyze and update existing GIS data sets,

incorporate information on data uncertainties, and develop and apply spatial modeling techniques.



*Use of GIS Data to Evaluate Solar Energy Development on Federal Lands*

Through the use of spatial analysis, EVS evaluates tradeoffs in radiological, environmental, socioeconomic, and health impacts. By creating and manipulating multiple GIS data sets and analyzing spatial dynamics, EVS scientists are able to clearly demonstrate a range of possible impacts. We interact with various agencies and stakeholders to analyze and present impacts and appropriate mitigation measures in support of decision making. EVS expertise also includes evaluating compliance with the National Environmental Policy Act and other regulatory and licensing requirements.

## Capabilities

### Access to Extensive Databases

EVS has developed and maintains access to a wide range of spatial databases that are useful for evaluating the potential impacts of proposed energy and other development on Federal lands. Our spatial data sources include publicly available and limited-access government data, commercial data, and compilations of information from Federal agency sources with more current or specific records.

### Analysis of Complex Spatial Relationships among Multiple Environmental Factors

EVS impact assessments of Federal lands typically link models of interactions arising from several environmental parameters with GIS data focusing on the spatial distributions of those parameters. In one example, EVS scientists evaluated the potential impacts of large-scale deployment of solar technology by combining GIS-based studies of alternative land uses, near-term and long-term employment requirements and associated local and regional socioeconomic impacts, air quality impacts of constructing the system and associated access roads, and likely impacts of animal habitat disturbance. In another example, siting a coal-to-liquids plant involved consideration of the tradeoffs of positioning the facility near coal resources without limiting access to other users of the resources, methods for providing shared access to water, and ways to avoid impacts to scenic vistas.

### Display of Analytical Results

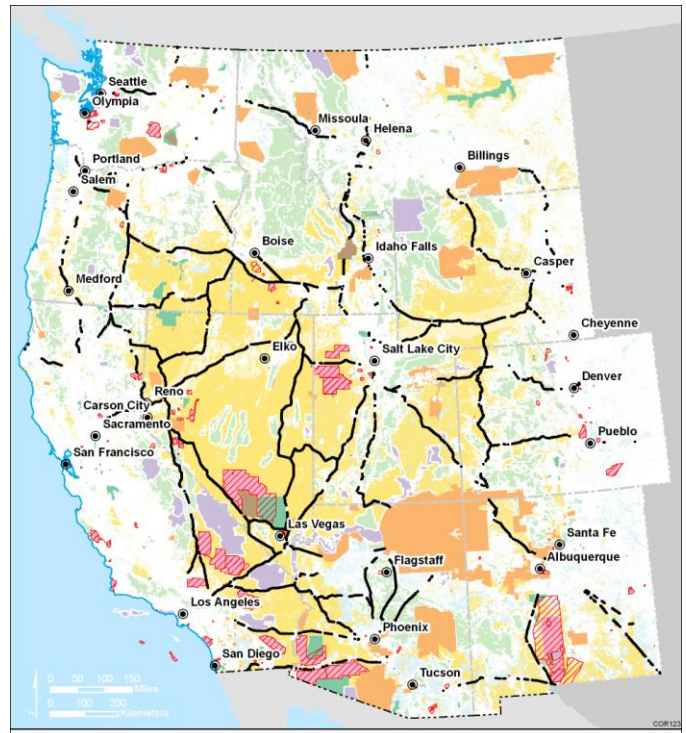
Computer displays of spatial data and analytical results provide decision makers and stakeholders with easily understandable representations of potential impacts from proposed development. Such displays were critical in the EVS evaluation of west-wide energy transport corridors, paving the way for a new generation of energy development using wind and solar resources.

### Illustration of Visual Impacts

EVS models also realistically illustrate impacts on aesthetics from various visual perspectives by applying advanced GIS-based computational tools to digital imagery data sets. To assist in analyzing and visualizing, EVS scientists utilize landscape models coupled to GIS data to provide the core operational system. Specific model variables and parameters contained within the GIS are photorealistically positioned within a 3-D landscape to provide a quantitative, but visual, interface for model initialization, scenario development, and model output.

## Support for Database Development

EVS continuously updates spatial databases related to energy development on Federal lands. For example, new or changing data about areas with sensitive ecosystems must be incorporated into the GIS in order to evaluate impacts on regional ecosystems.



*Access to GIS Data and Related Computational Tools Were Critical to the Analysis of West-Wide Energy Corridors on Federal Lands*