

CASE STUDY HIGHLIGHTS



- **Manages more than five million acres of land: forests, farms, commercial properties & underwater lands**
- **8% increase in NPV**
- **28% increase in spotted owl habitat**

Washington State Department of Natural Resources: Utilizing GIS and Spatial Analytics to Manage Public and Commercial Interests

“The proposal earned more money in the short-term and created more suitable northern spotted owl habitat in the long-term without a significant decrease in the long-term sustainable harvest.”

The Washington State Department of Natural Resources (DNR) serves the state by managing and protecting more than five million acres of land, which includes forest, range, commercial, agricultural and aquatic lands. Other state agencies are responsible for managing and protecting natural resources and the environment. However, Washington State DNR manages these lands for varying purposes. “State trust lands” are managed to provide specific beneficiaries with a flow of income from sustainable forestry and other activities. The department accomplishes this by selling the right to harvest timber, and leases trust lands for agricultural production, communications sites and wind towers. In addition, its role involves managing marine bedlands and beaches, lakes and rivers as a ‘public trust,’ working to serve the continuation of navigation and commerce. Stewardship of 134,000 acres of natural areas statewide protects examples of Washington’s significant ecological heritage and native species.

Most of the trust lands were granted by the federal government to Washington State in 1889, at statehood. The state’s legislature (as trustee) provides direction to DNR as trust manager. DNR has a clear legal duty to the trust beneficiaries, though it must carry out these responsibilities while including other regulations and policies goals such as environmental protections, and public use and recreation.

Since 1970, DNR-managed trust lands have generated \$7.1 billion, which is used to support public schools, state universities and institutions, and county services. These lands provide many other public benefits too: a habitat for fish and wildlife, a source of clean and abundant water and public access for outdoor recreation. State Aquatic lands have generated \$334 million that pays for their management and for aquatic land restoration and public access projects across the state.

Managing the lands is only half the story. The agency also protects water, slopes and other public resources on private forestlands. Two of its largest and most important responsibilities are fire prevention and suppression and regulating forest practices (timber harvest and related activities). Additionally, the agency plays an important role in the conservation of habitat for listed, threatened and endangered plant and animal species under the Endangered Species Act.

UTILIZING TECHNOLOGY TO ANALYZE COMPLEX DECISIONS

DNR is led by three guiding principles: manage the state's resources sustainably; make decisions based on sound science; and make decisions in the public interest and with the public's knowledge. Core to these principles is the ability to create an effective management model that allows the department to make the best possible decisions for the citizens of Washington. It must consider a complex set of variables using science, data and information to guide its decisions.

To help manage such a complex set of assets, requirements and demands, DNR uses spatial data, growth and yield data and policy and procedure information as inputs into Remsoft Spatial Planning Software. The software creates a long-term sustainable management schedule for wood supply, habitat, biodiversity, watershed management and other forest values that can be viewed in tabular and graphical format or on a range of maps.

Specifically, DNR uses Esri's ArcGIS and Remsoft's spatial scheduling software to understand the spatial relationships of its assets—particularly the forest assets—enabling them to answer questions such as: What is going to be harvested and where? Are there sensitive resource areas located near a proposed harvest site? What areas are designated as dispersal habitat for the northern spotted owl? With more than one million records in DNR's GIS, and various DNR policies and external regulations, DNR builds models for planning and scheduling so that many considerations can be incorporated into the decision-making process.

The Remsoft's Spatial Planning System helps DNR build deep, holistic spatially-based models; in other words, DNR can model decisions within a plan based on where assets are located their proximity to each other. The combination of Esri's ArcGIS and Remsoft's Spatial Planning Software enables DNR to incorporate sustainability planning, conservation, harvesting and other variables into a holistic analysis.

SUSTAINABLE MANAGEMENT THROUGH DECISION MODELING

For most of the forested state trust lands, DNR has a 70-to 100-year Habitat Conservation Plan, an agreement with the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration Fisheries Service to develop and conserve habitats for species that are federally listed as at some risk of extinction. One area of forested State Trust lands in the vicinity of Mount Rainier is designated as a 'dispersal management area' for the northern spotted owl, which is listed as threatened under the Endangered Species Act. Dispersal habitat is the area in which the owl hunts for food, a new mate or a nesting area. Northern spotted owls are very territorial and intolerant of habitat disturbance, and only approximately 500 pairs remain in the state of Washington. Further complicating protection of the species, for their foraging and movement, the owls prefer older complex forest structures with multiple layering of the tree canopies. This allows the owls fly through and perching opportunities. It is also a favorite habitat condition for their primary food source, the northern flying squirrel.

In a recent project DNR reviewed and revised its management within these dispersal management areas. The habitat was too densely forested, which hindered the ability of the owls to fly between the trees. Using Esri data and Remsoft models, DNR demonstrated that alternative habitat definitions allow the department to continue to meet their fiduciary responsibility to beneficiaries, but also create livable owl habitat.

State governments throughout the United States secure Esri Enterprise License Agreements (ELAs) to quickly deploy ArcGIS software throughout many departments, simplifying software procurement and administration. ArcGIS is an open and interoperable technology platform that provides advanced visualization and cartographic capabilities, spatial analysis and geographic data management. It is used by analysts, decision makers, field staff and the public to author, serve, and use geographic information. These ELAs also include the use of core Esri products such as ArcInfo, ArcEditor and ArcView, which can be tailored to meet users' enterprise GIS needs.

With its Esri ELA, the Washington State Department of Natural Resources has created more than one million spatial data records, which serve as an input into the Remsoft Spatial Analytics System. The Remsoft software uses true optimization to empower Washington State DNR to create models that enable the best possible land management choices, based on the Esri spatial data, growth and yield information and policy/procedure constraints.

New Remsoft models enabled DNR to demonstrate the benefits of selectively thinning the forest to the U.S. Fish and Wildlife Service and NOAA Fisheries Service. After obtaining the necessary approvals, DNR used the models to determine the appropriate field operation schedules that would work within policy for maintaining the habitats.

According to DNR staff, the power of the Remsoft and Esri solution is the ability to project outcomes spatially – this has helped DNR communicate high level views of assets, treatments, constraints and outputs to key stakeholders, while still being able to dive into the details when necessary. Developing outputs, whether habitats or harvest schedules, that are meaningful to people and being able to share those to explicitly demonstrate how a decision affects an outcome is incredibly valuable.

“We can write pages and pages of reports, show table after table of data and talk for hours about the benefit of a particular decision, but when we show a map with how that decision will affect habitat, revenue or the forest, our stakeholders immediately understand the decision at hand,” said Angus Brodie, assistant division manager, Washington State Department of Natural Resources. “Stakeholders may not understand all of the science of modeling an owl habitat or the information that goes into an evaluation tool, but they do understand a visual map. It’s much easier to win the confidence of people that what you’re proposing to do is much better than what has been done in the past if you can display it visually.”

IN SUMMARY,

The proposal earned more money in the short-term and created more suitable northern spotted owl habitat in the long-term without a significant decrease in the long-term sustainable harvest.

How was this achieved? Multiple goals are achieved through a combination of thinning and final rotation harvests of overly dense forests now for a better habitat tomorrow.

Table ES-1. Summary of Forest Management and Financial Analysis of the Proposed Alternatives for the Planning Unit

Mgmt. Alt.	Harvest Level Decade 1	Gross Revenue Decade 1	Long-term sustainable harvest level ¹	Cumulative NPV ² after 100 years	Percent of Unit in Older-Forest Conditions ³ by 2067	Date NSO ⁵ Dispersal Mgmt Area reach 50% SP ⁶ Movement Habitat	Date NSO NRF ⁷ Mgmt Area reach 50% South Puget Movement Habitat	Growing Stock Change after 100 years
	MMBF	\$ Millions	MMBF	\$ Millions	Acres	Decade	Decade	Percent
A	374	95	378	178	16%	**	2057	152%
B	367	106	320	171	21%	2047	2057	170%
C	410	126	313	179	26%	2037	2057	162%

1) Average over a projection of 100 years, 2) Net Present Value, 3) Niche diversification and fully functional forest development stages, 4) Alternative does not reach a 50 percent target of South Puget Movement habitat in the dispersal management area in the 100 year projection, 5) Northern Spotted Owl (NSO), 6) South Puget, 7) Nesting, Roosting, Foraging

Executive Summary

Northern Spotted Owl habitat Classes	Alt A No Action (What we were doing)	Alt B (What we proposed and what got approved by Board)
Desired future condition	Current 1997 HCP strategy	15 % South Puget dispersal and 35% MoRF @ LPU
NPV (\$/millions)	251	272
Long-term timber harvest (MMBF/yr)	48	45
Timber harvest 1st decade (MMBF/yr)	41	56
Revenue 1st decade (\$/millions/yr)	14	19
Habitat Change 2067*		
Dispersal	8%	28%
Movement, Roosting and Foraging	6%	20%
Nesting	5%	9%