New decision-support framework

Tool supports decisions on

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A new decision-support and modelling framework is shedding light on some of the key conservation questions surrounding the survival of the Northern Spotted Owl in southwestern British Columbia. Built collaboratively by Cortex Consultants Inc., Gowlland Technologies Ltd., and the Canadian Spotted Owl Recovery Team (CSORT), this modelling framework integrates the most current research and expert knowledge on Spotted Owl habitat and population dynamics in British Columbia to provide critical information for making informed decisions about recovering Spotted Owl populations in this province.

Northern Spotted Owls are found in the Pacific Northwest from British Columbia to northern California. Throughout their range, Northern Spotted Owl populations are in decline: the drop has been so precipitous in British Columbia that without rigorous conservation and restoration efforts, this bird is at risk of becoming extirpated in the province. Numerous potential and known threats to the owl are implicated in the population decline, including loss and fragmentation of old-growth habitat through forest harvesting, lack of connectivity between areas of suitable habitat, competition and hybridization with Barred Owls, predation from the Great Horned Owl and other predators, climate change, and the West Nile virus. When the risks to Spotted Owls are combined with the potential socio-economic costs of recovering Spotted Owl populations in British Columbia, the importance of making timely policy decisions based on the best available knowledge becomes clear.

With that in mind, a core group of researchers and modellers has focused considerable effort over the last two years on building a spatial modelling framework that will help government make these policy trade-off decisions. Funded by British Columbia's Forest Investment Account, Forest Sciences Program (FIA-FSP), three British Columbia government ministries (Ministries of Forests; Sustainable Resource Management; and Water, Land and Air Protection), Interfor, and the Canadian Wildlife Service, these tools are also being used to answer key research questions related to recovering the Spotted Owl population in the province.

Model framework

As befits this difficult problem, the decision-support framework is complex: there are five integrated, spatially explicit model components. These components are:

1. a spatial timber supply and landscape dynamics model that projects forest growth and stand-replacing natural disturbance,
2. a Spotted Owl habitat classification model,
3. a spatial model for calculating locations and sizes of potential Spotted Owl territories,
4. a Spotted Owl population model, and
5. a structural connectivity model for assessing the connectedness of owl habitat.

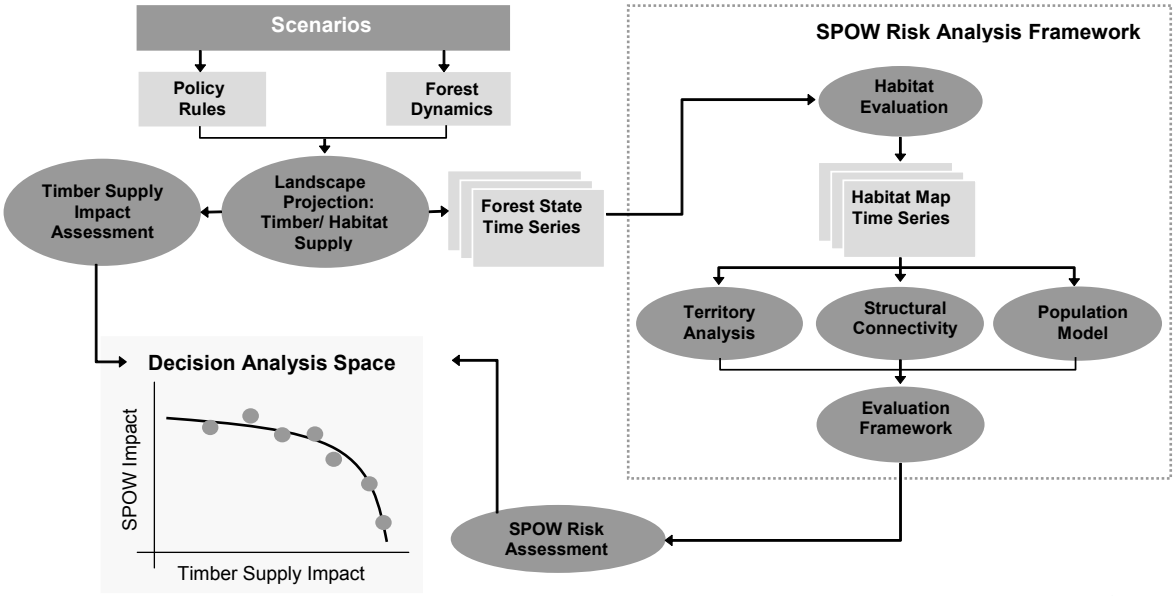

Figure 1 *Graphical representation showing the integration of various components of the spatial Northern Spotted Owl modelling framework. Produced by Cortex Consultants Inc.*

The integration of model components is shown in Figure 1.

How the framework is applied

The framework uses information about a potential management scenario, together with forest dynamics, as input into the landscape projection and timber supply component. The output from this model is used in two ways. First, it is used to directly assess the impacts of a particular scenario on timber

recovery of Northern Spotted Owl

supply (left side of Figure 1). Second, on a hectare-by-hectare basis, land cover is classified based on specified definitions of being either nesting, foraging, or unsuitable habitat, and rated according to the "movement cost" to an owl of moving through the habitat (right side of Figure 1). The output of this process, a series of habitat maps identifying suitable habitat in one-hectare cells through time, can be used to determine (1) how this habitat could potentially be grouped into functional landscape-level breeding territories for Spotted Owls, (2) the important areas of connectivity between functional territories, and (3) the likely changes in the Spotted Owl population. All of this information can then be brought into an evaluation framework to determine the risks of a particular management scenario to Spotted Owl populations. Information from both streams (timber supply impact and Spotted Owl habitat/population impact) is integrated within a decision analysis space that maps the relative impact to Spotted Owls against the corresponding timber supply impacts.

Who can use the framework?

With so many integrated components, researchers, policy makers and, eventually, forest managers, can benefit from using this modelling framework. Policy makers can use the framework to determine the relative benefits of different forest protection scenarios for Spotted Owl habitat, potential territories, and resulting populations, as well as the corresponding socio-economic impacts. Researchers can use the framework to provide information on a number of questions related to Spotted Owl biology. While the model components are currently designed to provide strategic-level information, in the future the framework could be modified to provide insight into specific operational questions regarding management options in Spotted Owl habitat. With this use in mind, stakeholders have been engaged from the beginning of this process, both to increase their understanding of the models themselves and to solicit their input into next steps during model development.

What has the framework told us so far?

To date, the modelling team has tested a variety of research-type questions through "learning experiments," and a variety of policy questions through "policy scenarios." This information is being used both to help guide recovery actions and research efforts for the CSORT, and to aid in policy decisions about how to best manage the Spotted Owl in British Columbia. Results from these experiments will be made available in the technical document for the project, due to be released as a B.C. Ministry of Forests and Range report in winter 2006.

Next steps

A critical next step in the development and implementation of the decision-support framework is to verify the data on which the models are built through a thorough peer review, which is currently under way. The modelling team hopes to work with policy makers and stakeholders in the coming year to further refine policy scenarios, to verify some of the assumptions about the population dynamics, and to examine the relative benefits of alternative management options on Spotted Owl habitat. In addition, the Canadian Spotted Owl Recovery Team will use this tool to guide the implementation of recovery strategies to help ensure the continued survival of the Spotted Owl in British Columbia.

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Key innovations used in the framework

A number of key innovations were used in the Spotted Owl decision-support framework, including the following:

- **Development of a long-term equilibrium landscape (LTE).** The LTE (current landscape projected forward 10 000 years under a natural disturbance regime) allows the modelling team to ask questions about how changing key aspects of Spotted Owl biology impacts the population in the absence of effects created by the particular history of the current landscape.
- **Selection of experimental vital rates.** Declining vital rates for the owl make it difficult to evaluate how the population would likely react to different forest management scenarios. The modelling team circumvented this problem by using the LTE landscape to calibrate a set of vital rates for the owl, which allowed for a stable population.
- **Modelling for multiple management units.** Because the range of the owl in British Columbia encompasses five forest management units, the modelling team had to create a seamless database for the entire area and develop a methodology for estimating sustainable long-term harvest flows simultaneously across multiple management units.
- **Modelling for natural disturbance.** The modelling team used an innovative, empirical method based on inventory data for estimating natural disturbance rates across the different ecological zones within the range of the Spotted Owl.
- **Use of a Bayesian Belief Network (BBN) to classify critical habitat.** The CSORT and the modelling team are using a BBN to integrate expert opinion into their recommendations about which areas of potential Spotted Owl habitat are most critical for protection. A BBN is a model that essentially quantifies how things interact and cause specific outcomes. A description of BBNs can be found at ***www.spiritone.com/~brucem/BBN_intro/what_are_bbns.html***

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