FIA–FSP Forest Science Corner

Scenario planning being used to evaluate

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A scenario-based approach to planning is being used to evaluate the uncertain future supply of ecosystem services internationally, nationally, and regionally. Developed over the last several decades, these "structured accounts of a possible future" are starting to become more widely applied in resource management.

Internationally, the United Nations Millennium Ecosystem Assessment has adopted scenario planning to evaluate a set of possible trajectories for the global community that is based on the rate and extent of ecological change and the interaction with management policies. Trajectories range from measures that are protectionist/security-oriented to ones that are adaptive/community-oriented (Millennium Ecosystem Assessment 2005). Nationally, under the leadership of **Peter Duinker** from Dalhousie University, the Sustainable Forest Management Network (SFM Network) has also undertaken a scenario-planning project to address the range of possible future conditions of Canada's forests and forest sector in 2050 and to help policy makers, industry, government, and other stakeholders to adapt to change (Duinker 2008). Regionally, in southeastern British Columbia, a Forest Science Program (FSP) project led by **Don Morgan,** from the BC Ministry of Forests and Range (MFR) Research Branch is using scenario planning to understand the uncertainty associated with the current mountain pine beetle (MPB) outbreak and the implications for timber availability, and coarse- and fine- filter biodiversity (Morgan *et al.* in review).

What are scenarios?

Scenarios are "a structured account of a possible future" (Peterson *et al.* 2003) and when applied to natural resources and the environment, they usually include social and ecological dimensions. This is in contrast to predictions, which are estimates of future conditions based on what we know about the world today and assumptions of how the world may change. Predictions are based on structured experiments to derive parameters of system behaviour and are used, for example, in optimal decision making, where some benefit is maximized according to an expected probability distribution. Predictive models have served forest management very well in the past. However, as Canada's forests undergo rapid transformation, driven by changes in key driving forces such as technology, global markets, MPB, and climate change, predictions may not provide the insights required to manage for such an uncertain future. In contrast, scenarios take broad uncertainties into account; they are structured to include a range of plausible futures of what could be and do not predict what will be. Scenarios are designed specifically to lend insight into system drivers and to explore uncertainties in system behaviour. They allow managers to explore actions or inactions and how these may play out across a range of possible futures; scenarios are not about providing support for one particular future.

How do you define what is important in the scenarios?

Scenario-building starts with identifying key issues; for example, what is the impact of climate change on the future supply of forest products? Then, critical social and ecological forces that have the largest potential impact on the system and are the most uncertain—such as technological innovation and changes in the rate of natural disturbance—are used to define a small set of key scenarios. Project participants evaluate the uncertainties of these forces and their potential effects on the system and narrow them to a 2 x 2 matrix by identifying the main social and ecological forces of the system (Ogilvy and Schwartz 2004). These main forces then create the rationale for, and characterize, each scenario. Using this approach ensures that each scenario is qualitatively unique. Secondary forces and uncertainties are then added to the core scenarios. Some system trends may show up in all of the scenarios, while others may be specific to one particular scenario. Using a limited number of scenarios has the advantage of easing understanding and communication (Peterson *et al.* 2003, Ogilvy and Schwartz 2004, MA 2005).

Scenarios and the Sustainable Forest Management Network

Through 2008, the Sustainable Forest Management (SFM) Network is conducting a series of workshops across Canada to explore how various organizations see the forest and forest-sector future up to 2050. Participants in the workshops get to consider,

uncertain future supply of ecosystem services

among other things, the challenges of commodity prices, resource competition, loss of timber supply, mill closures and corporate mergers, all of which are currently playing out. They also consider futures that include interesting developments in climate change, resource conflicts, geopolitics, technology, and energy demands. Based on input from workshop participants, the project's four scenarios have been refined and readied for policy interpretation. Results of this scenario-planning effort will be communicated for the first time at the SFM Network's final conference in Ottawa, April 20–22, 2009. Afterward, results will be documented and communicated through magazine articles and a possible book and television documentary.

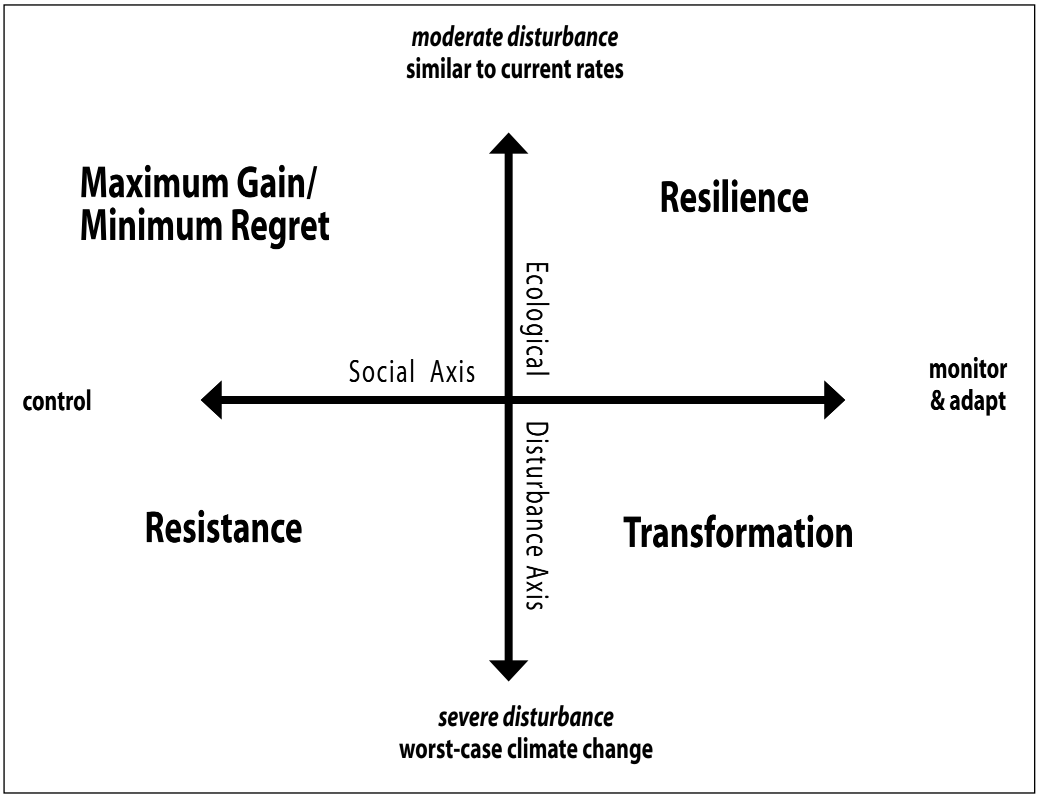

Figure 1. *Southeastern British Columbia scenario matrix.*

Scenario planning in southeastern British Columbia

In British Columbia, scenario-planning methods are being investigated to address the more specific question of the supply and trade-offs between providing fibre for wood products and maintaining biodiversity and an adequate amount of habitat for grizzly bears in an area experiencing a massive MPB outbreak. To explore this question, an analysis framework has been developed with four basic steps:

(1) Context, which identifies the focal issues and establishes collaboration between project participants and scientists.

(2) Current State, which describes the essential system attributes, including its structural components and functional relationships.

(3) Alternate States, which outline the human and ecological forces that could shape the system and their plausibility based on historic and possible future system behaviour.

(4) Scenarios, which use information provided by the previous steps to construct plausible trajectories of future social and ecological conditions.

The scenarios (Figure 1) are defined by an ecological disturbance axis ranging from moderate disturbance, similar to current rates and extent, to extreme disturbance driven by climate change. The other axis of the matrix is social. One end of this axis considers externally driven factors, including investment and control from outside of the community and dependence on large lumber mills to maximize timber production. The other end of the social axis is locally oriented, and includes more adaptive community-based initiatives, such as small-scale salvage and manufacturing.

Four scenarios were constructed based on the social and environmental conditions described by the quadrants of the matrix. Landscape simulation models were built for each scenario to help clarify their underlying management and ecological assumptions and allowing an analysis of the trade-offs among ecosystem services.

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Scenarios are intentionally extreme

The resistance and transformation scenarios are both characterized by rates and extent of disturbance far greater than today's. Under both scenarios, grasslands are expanded, the woodlands extend into the alpine, and water availability is reduced.

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The maximum gain/minimum regret and resilience scenarios are ecologically similar, but socially different. For these two scenarios, the rate and extent of future natural disturbance is similar to current rates—including MPB—but the management assumptions differ. The maximum gain/minimum regret scenario is more interventionist, where the rate of timber harvest is maximized and the system is managed under an assumption of being able to control future landscape condition through management interventions. In contrast, the resilience scenario assumes to influence only future landscape condition and relies more heavily on monitoring and rapid adaptation to new conditions. It includes a smaller area available for conventional timber production, but has a large salvage-only zone that facilitates adaptation to future harvesting opportunities.

The resistance and transformation scenarios are both characterized by rates and extent of disturbance far greater than today's. Under both scenarios, grasslands are expanded, the woodlands extend into the alpine, and water availability is reduced. These scenarios base biotic shifts on changes in the current climate envelopes, which shift according to changes in temperature and precipitation forecasted in downscaled general circulation models (GCM; Hamann and Wang 2006). In the resistance scenario, all possible effort is made to continue to provide forest products, including salvaging timber in areas that were reserved to meet conservation objectives. Under the transformation scenario, an effort is made to adapt to a changing ecological regime, including shifting away from traditional forestry to one that is focused on salvage and includes other non-forestry economic activities, such as livestock production, food crops, and recreation. These scenarios show what might occur in the future and help to inform project participants of the future implications of current decisions on timber available for harvest, coarse-filter biodiversity, and grizzly bear habitat.

Through the work being done by the United Nations Millennium Ecosystem Assessment, SFM Network, and MFR Research Branch, scenarios are being generated to provide insights into possible futures and on how decisions today can influence the future. As well, scenarios allow a better understanding of what can be gained, what we have control over, and what conditions we must respond and adapt to. The scenarios are intentionally extreme in an effort to capture the widest possible range of future conditions; the future could actually contain a combination of elements from each. Working together through these exercises, we can develop a clearer idea of the future we would like and what steps take us closer to that vision.

Literature Cited

Cumming, G. S., G. Barnes, S. Perz, M. Schmink, K. E. Sieving, J. Southworth, M. Binford, R. D. Holt, C. Stickler, and T. Van Holt. 2005. An exploratory framework for the empirical measurement of resilience. Ecosystems 8:975–987.

Duinker, P. 2008. Scenarios of the Forest Futures Project: Why and How We Created Them, and How to Use Them. Sustainable Forest Management Network. online at: ***http://www.sfmnetwork.ca/html/forest_futures_e.html***

Millennium Ecosystem Assessment. 2005. Chapter 2 in Ecosystems and human well-being: Scenarios. Island Press, Washington, D.C., USA. online at: ***http://www.millenniumassessment.org/***

Morgan, D.G., A. Fall and R. McCann. *In* Review. A Social-Ecological Framework to Evaluate Trade-offs and Uncertainties in Ecosystem Services: A Case Study in the Cranbrook Timber Supply Area.

Ogilvy, J. and P. Schwartz. 2004. Plotting your scenarios. Global Business Network, Emeryville, California, USA.

Peterson, G. D., G. S. Cumming, and S. R. Carpenter. 2003. Scenario planning: a tool for conservation in an uncertain world. Conservation Biology 17:358–366.