Northern Ecosystems Initiative
Integrated Cumulative Effect Thresholds Project

2004/2005 Project Overview

February, 2005

1. PROJECT OVERVIEW

The Northern Integrated Ecosystem Cumulative Effect Thresholds project (CE Thresholds project) is a cooperative project with seed funding provided by the Northern Ecosystems Initiative (NEI) Resource Use and Ecosystem Impact Partner Issue Table. This four year project consists of nine independent, but coordinated, studies undertaken by academic, government, and private consulting representatives with recognized expertise in cumulative effects assessment, thresholds, models, and decision-making processes.

The CE Thresholds project will develop a complementary suite of tools designed to bring northerners together to define 'made-in-the-North' thresholds or limits of acceptable change that balance important social and ecological values. The suite of capacity-building and decision-making tools includes: useful cumulative effect indicators for ecological and social systems; science-based 'dose-response curves' that relate changes in human activity intensity to indicator condition; 'integrated landscape models' to help northerners visualize change and evaluate management options and trade-offs; collaborative processes to incorporate traditional and local knowledge; and communication materials for workshops, presentations, and technical publications. Figure 1 shows how the independent studies will be integrated to address anticipated technical, political, and administrative issues. Study collaborators are:

1. **Aquatic Health**
   Dr. Monique Dube, National Water Research Institute
   Dr. Trefor Reynoldson, Acadia University
   Dr. Michael Sullivan, Alberta Sustainable Resource Development
2. **Wildlife - Woodland Caribou**
   Dr. Stan Boutin, University of Alberta
3. **Wildlife - Mammal and Bird Communities**
   Dr. Erin Bayne, University of Alberta
4. **Social and Economic**
   Dr. Marian Weber and Ross Mitchell, Alberta Research Council
   Dr. Vic Adamowicz and Dr. Naomi Krogman, University of Alberta
5. **Integrated Landscape Modeling Tools**
   Dr. Brad Stelfox, Forem Technologies Ltd.
6. **Implementation Tools**
   George Hegmann, Axys Environmental Consulting Ltd.
   Steven Kennett, Canadian Institute of Resources Law
7. **Yukon Liaison**
   Fritz Mueller, Canadian Wildlife Service
8. **Northwest Liaison**
   Leslie Wilson, Environment Canada
9. **Climate Change**
   (specialists to be determined)

10. **Coordinator**
    Terry Antoniuk, Salmo Consulting Inc.

Recent studies in northern Canada and elsewhere have identified cumulative effect thresholds as the highest priority research need and the most promising tool for assessing and managing cumulative effects (Wight 1994; Ziemer 1994; AENV 1999; Golder 1999; Macleod 2002; ELI 2003). Identification of numerical thresholds or limits is one of the most challenging aspects of land and resource management (MSRM 2003; Keough and Blahna 2004) because they must be:

1. Technically defensible;
2. Politically acceptable and socially appropriate; and
3. Administratively efficient.

The CE Thresholds project will develop and test technical, collaboration, and implementation tools using case studies in the boreal forest of the Yukon and Northwest Territories. The team will work with the Kaska Forest Resources Stewardship Council (KFRSC) on a case study in the Kaska Traditional Territory in the southeast Yukon. Several team members will also partner with the North Yukon Planning Commission (NYPC) on a smaller pilot study in the North Yukon. Local interest in additional case studies in the Slave Geological Province and Gwich'in Settlement Area in the NWT has also been expressed. The NEI CE Thresholds project is intended to enhance - not replace - existing land and resource management structures and initiatives in the case study areas.

The CE Thresholds team will work collaboratively with case study partners and other groups and individuals identified by them to develop a cumulative effects assessment and management 'toolbox' that incorporates a suite of ecological and social thresholds and reflects northern values, conditions, and opportunities. This cumulative effects toolbox, and the process used to develop it, will ultimately provide a model that can be applied beyond the case study areas in other parts of northern Canada.

1.1 BUILDING CUMULATIVE EFFECT MANAGEMENT TOOLS

1.1.1 Dose-response Curves

For this project, 'thresholds' are tools used to manage risks of human activity. These targets or limits provide a transparent approach to help affected First Nations and governments, residents, and land users define the appropriate balance between industrial development benefits and associated social and ecological risks. Clear and defensible information relating landscape disturbance to ecological or social conditions will help these groups and individuals to understand the inevitable trade-offs associated with regional and local land use alternatives.

Dose-response curves provide a scientific framework that can be used across disciplines to unify change measurement and integrate multiple factors. The first step is to examine individual biological, economic, social, and cultural responses along a continuum of

natural and human-induced landscape change to develop dose-response relationships (Figures 2 and 3). Relationships between ecological and social indicators can then be integrated and compared in a unified concept that has been difficult to achieve with previous approaches.

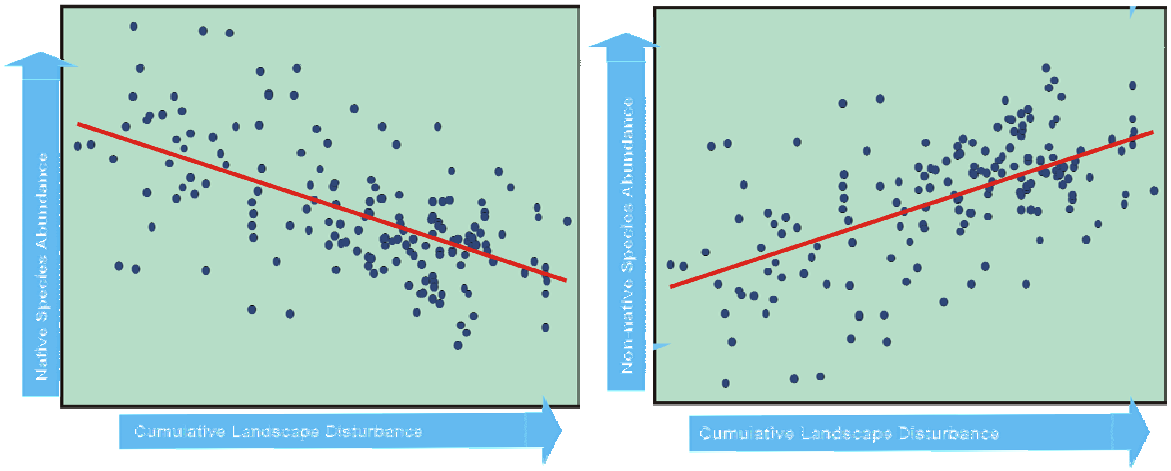

Figure 1. Hypothetical ecological dose-response curves relating native and non-native species abundance to landscape change.

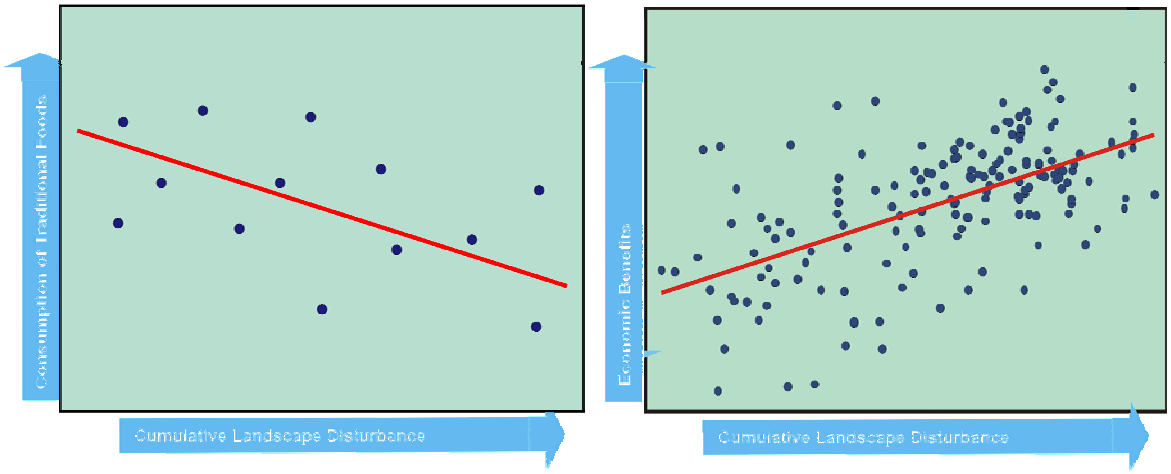

Figure 2. Hypothetical social dose-response curves relating consumption of traditional foods and economic output to landscape change.

A key advantage of dose-response curves is that they can be constructed using data from different areas encompassing a gradient of landscape changes. This allows effects of 'time lags' to be considered, and allows thresholds between acceptable and unacceptable conditions to be defined before the change actually occurs.

The CE Thresholds team proposes to develop several types of compatible dose-response curves for the southeast Yukon so that they may be incorporated into one or more integrated landscape modelling tools. These include:

- Ecological dose-response curves that describe the relationship between human and natural disturbance (including climate change) and aquatic species, community, or ecosystem response.
- Ecological dose-response curves that relate access to fisheries quality.
- Ecological dose-response curves that describe the relationship between human and natural disturbance (including climate change) and wildlife species, community, or ecosystem response.
- Well-being or social preference functions that compare preferences for different ecological, social, and economic conditions within and between communities and document the heterogeneity in preferences (critical features of well-being are defined in cooperation with local groups, in this case, the TWG and designated Kaska liaisons). These relationships will illustrate the trade-offs between ecological, social, and economic responses to landscape change.

CE Thresholds team ecologists will work collaboratively with the KFRSC, NYPC, First Nations, and local fisheries, wildlife users and managers to incorporate traditional and local environmental knowledge into aquatic and wildlife dose-response curves.

CE Thresholds team social scientists will work with the TWG, KFRSC, and Kaska Tribal Council to identify affected groups and individuals who should be involved in the development of social preference, and trade-off curves.

In many cases however, obvious technical thresholds between acceptable and unacceptable conditions do not exist (Figures 2 and 3). Because of this, trade-offs among social, economic, cultural, and ecological factors must be considered when using these dose-response curves to define politically and socially responsible targets, limits, or thresholds.

1.1.2 Integrated Landscape Modelling

A critical step – as experience elsewhere clearly demonstrates – is to give all affected groups and individuals the opportunity to cooperatively define limits of acceptable change. Cumulative effects management is a shared responsibility that will be most effective when indicators, targets, thresholds, and land management options are accepted as both reasonable and based upon best available science and traditional and local knowledge.

Integrated landscape models use information on natural disturbance, current landscape conditions, and existing and likely land use patterns to simulate future conditions. This allows affected groups and individuals to visualize the effect of various development scenarios and management options. These simulations also allow trade-offs between

social and ecological indicators to be clearly evaluated so that the preferred (as defined by residents and managers) land and resource management plans can be developed.

Integrated landscape modelling is best conducted as an iterative process where the modelling team interacts with a wider set of groups and individuals. In early stages, developing agreed-upon scenarios of likely future development activities in the southeast Yukon represents a significant challenge because there is considerable uncertainty associated with development projections in comparatively undeveloped areas. Government agencies, First Nations, and industry members will have particular interest in ensuring that development scenarios accurately reflect their perceptions of likely activity levels.

Sufficient resources will need to be allocated to incorporate traditional and local knowledge and expertise, ensure that affected groups and individuals support modelling assumptions and findings, and revise simulations to reflect local input. This has been a critical gap elsewhere, but is essential to ensure that aboriginal cultures, values and knowledge play an appropriate role in both social and ecological components of the southeast Yukon case study. TK is likely to cover a substantial time period and can add important historical perspective on the response of people, plants, and animals to changes in the environment. It is also necessary to ensure that the project builds northern capacity so that residents are able to continue to apply this approach to resource management.

The CE Thresholds team will work in accordance with rules and procedures outlined in the TK Protocol in collaboration with the KFRSC, and designated Kaska liaisons. The initial work of the CE Thresholds social team is intended to provide information on community or social preferences for different land management and economic development options. The social team will need guidance of the KFRSC and designated Kaska Nation representative(s) to define land management and economic development options and manner that well-being or social preference is measured.

Local knowledge held by some long-time non-aboriginal residents of the Yukon may be similar to TK in some ways, and the CE Thresholds team also wishes to collect and incorporate this knowledge in a consistent fashion.

The ultimate goal of the CE Thresholds team is to develop trade-off curves that combine ecological and social dose-response curves in a consistent manner so that integrated landscape modelling tools can allow the ecological, social and economic values of various development scenarios in the southeast Yukon region to be directly visualized.

The KFRSC intends to use integrated landscape modelling tools to support trade-off evaluations and ultimately identify politically acceptable zoning, thresholds, targets, or limits of acceptable change. Under the direction of the Scenario Working Group, two complementary models will be used for the southeast Yukon case study: Woodstock/Stanley, and ALCES North. Using both Woodstock-Stanley and ALCES North modelling tools provides an opportunity to apply the strengths of each model. It will also provide northern land users and managers with a real-world demonstration of

how these two complementary tools can be used to inform land use evaluations and decision-making.

The ALCES North model will be used in the North Yukon in collaboration with the NYPC.

1.1.3 Implementation Tools

Natural resource use and management is typically guided through various administrative and regulatory processes implemented by different levels of government. In the Yukon, this includes the regional, territorial, federal, and First Nation governments. Although a collective response is the most efficient method to manage cumulative effects risk, governments often act independently because of their legislative mandates.

An implementation framework can be used to organize and guide independent and cooperative initiatives in a way that contributes to broader cumulative effects assessment and management. Such a framework most commonly uses a suite of tools (best practices, targets, thresholds, and project assessment) to link project-specific and regional or resource management actions. This recognizes the value of what already exists or is proposed. It also provides sufficient flexibility to allow initiatives to progress independently, converging when ready in a coordinated fashion.

The CE Thresholds team will begin work on a conceptual implementation framework concurrently with dose-response curve development. This will allow potential cooperative management measures to be critically evaluated and fine-tuned as part of the integrated landscape modelling process.

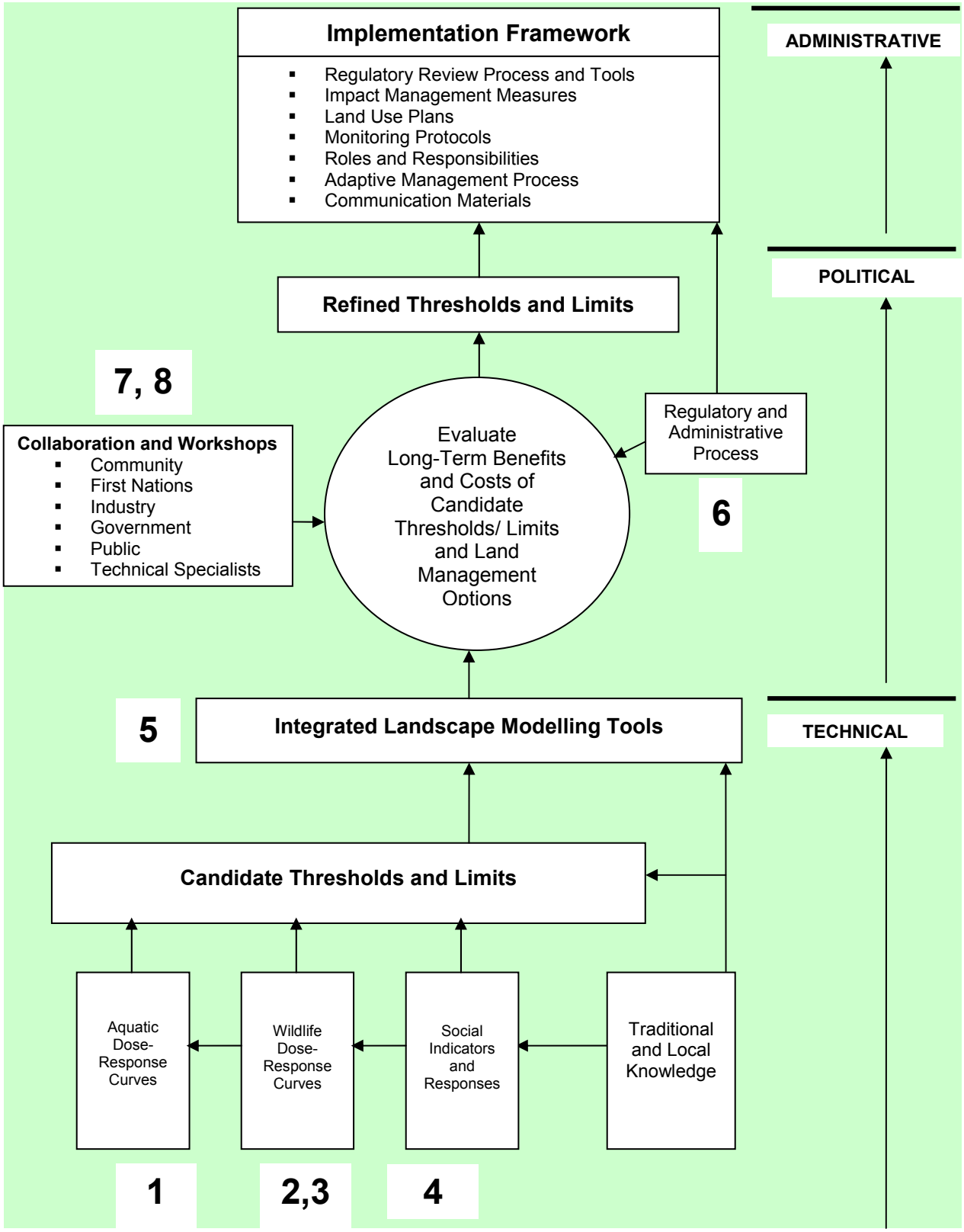

Figure 3. Northern Integrated Ecosystem Cumulative Effect Thresholds Project component integration.