HydroEcological Landscapes and Processes (HELP) project:

Addresses questions from the 2006/07 SFMN Call for Proposals for the “Linkages between terrestrial, riparian, and aquatic ecosystems…” Research Priority Area:

Q1 What is the nature of the linkages between terrestrial, riparian, and aquatic ecosystems in unmanaged watersheds viewed from social, economic, and environmental perspectives?

Q2 How do management activities in one of terrestrial, riparian, or aquatic ecosystems affect social, economic, and environmental (including hydrologic, geomorphic, and ecological aspects) values in the other ecosystems?

Q3 Can watershed-based indicators that detect responses to management activities, that exceed the natural range of variability, be developed?

Rationale:

- **we need to manage our resources (esp. water) in a more sustainable fashion**
- **implies that we must understand controls on water resources in different landscapes across Canada (many of which are forested)**
- **need indicators of the hydrological functioning of forest landscapes that can be measured and monitored and that are relevant for each of these landscapes**
- **need to extrapolate information obtained from scientific research sites to other locations of interest; therefore indicators must be capable of being transferred between sites and across scales**
- **key prerequisite for integrating project results and developing relevant indicators for Canada's various forest regions is the ability to classify forest landscapes in terms of their hydrological properties and processes**
- **incorrect conceptual model of hydrological processes in a landscape of concern increases risk of employing mitigation strategies that will not protect aquatic systems from forest management activities**

HELP objectives:

1. Classify watersheds using hydroclimatic (HC), hydrogeomorphic (HG) and hydroecological (HE) criteria;
2. Identify indicators (e.g. peak flows, nutrient export, groundwater flow systems) that reflect HC/HG/HE characteristics and may potentially affected by forest management in a given watershed;
3. Create a database of measurements and models from previous and current studies related to HC/HG/HE processes, with representation from all of Canada's ecoclimatic regions;
4. Integrate and synthesize these data to develop models of natural variability of hydrologic, geomorphic and ecological processes and their natural variability in different forest landscapes;
5. Develop conceptual frameworks and indicators of the consequences of forest management activities for various watersheds (identified in *Obj.1*); and
6. Test the ability of various modelling strategies to assess cumulative effects of management activities in different forest landscapes and to translate results across hydroecologic landscapes.

Ecosystem management:

Fundamental objective: base land management on ability of landscape to sustain management activities without compromising ecosystem integrity

Corollary: EM involves emulating, to the extent possible, natural processes of disturbance governing environmental influences on ecosystems

(Montgomery 1995)

Montgomery (1995) – distinguishes between input and output oriented approaches to implementing EM

Input oriented: management activities tailored to processes operating in a landscape with the intent of minimizing potential impacts; based on causes rather than symptoms of environmental degradation

Output oriented: definition of limits to acceptable resource degradation; limits used to invoke modified management prescriptions in impacted areas with goal of minimizing further degradation; approach more suited to environmental monitoring?

How are we using/thinking about C&Is in this context?

At first glance, we seem to use C&Is in an output-oriented approach

However, they could also be used to define critical processes/locations/periods in a landscape that can be used to tailor management activities (input-oriented approach)

Critical questions to be answered when assessing current conditions using watershed analysis (from Montgomery et al. 1995)

1. What are the dominant disturbance regimes in this landscape?
2. How are they distributed spatially?
3. How frequently do they occur?
4. What impacts do they have on ecosystems?
5. What are trends in hillslope and channel conditions, and how tightly coupled are these trends to each other and land management activity within the basin?
6. How are wood, water, sediment and solutes delivered to and routed through the stream channel?
7. How are terrestrial and aquatic species distributed throughout the basin, and what are the dominant controls on their distribution and abundance?

“Such information allows development of a watershed-specific model both for the processes creating, modifying, and destroying habitat and for the past, current, and potential conditions of the biological systems inhabiting the watershed”

(Montgomery et al. 1995, p 378)