

# Managing Tree Species Diversity for Forest Resilience and Adaptability





Cariboo  
12/16 BGC Zones

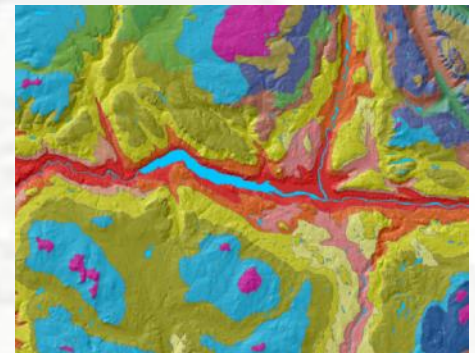
Thompson-Okanagan  
13/16 BGC Zones



# What IS diversity?

Variety in structure, composition and function  
across levels of ecological organization

- genes (different seed sources)
  - **species (Fd, Cw, Hw, Ba,...)**
    - ~4,000 other plant species in BC
  - ecosystems (BEC site series, rock outcrops, saline ponds, decayed log)
  - landscapes (BGC subzone, watershed, ecosection)
- variety at any one of these levels across scales of **space** and time
- **stand (within-stand)**
  - **landscape (among stands)**



# Species diversity is more than just number of species

- “Species Richness”
- Balance of species (evenness)
- “natural” species composition
- “Key” species



# Species diversity is one aspect of Ecosystem Resilience

*“the capacity of ecosystems to absorb disturbance without collapsing into a qualitatively different state that is controlled by a different set of ecological processes.”*

- Interplay processes between species and with environment
- Adaptive cycles
- Processes working at different time/space scales
- **Diversity**
- Biological legacy and “memory”
- Connectivity



# Diversity Is Insurance Against Uncertainty

1. Maintaining the ability of an ecosystem to **respond** to environmental change (including climate change)
2. Reduces ecosystem **vulnerability** to any single future disturbance event
3. Improves the potential for ecosystem **reorganization** following disturbance

“... complexity at a hierarchy of scales is a highly desirable attribute to maintain the capacity of ecosystems to gradually change in response to changing environmental conditions and provide benefits to future generations.”

E.A. Campbell *et al.* (2009)

# Climate Change = Increased Variability and Uncertainty

***If diversity improves  
adaptability to change, then  
diversity management is  
becoming more important***



# This is not new news...

## We Know

- Tree species diversity is important
- Climate change introduces greater uncertainty

### 2010 SISCO Winter Workshop

#### *Searching for Sustainability in*

Day One: Tuesday, April 13, 2010

8:25

Welcome & Opening Rem

Future Forest Ecos

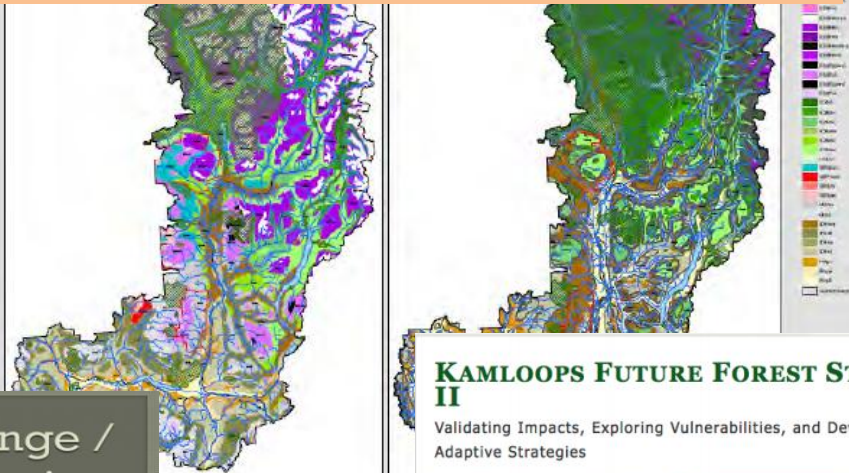
Pr

#### Climate Chan

Regeneration vuln  
dominant tree specie  
Britisl

Final Te

### ***Adapting Forest Management in the Kamloops TSA to Address Climate Change***



## Climate Change / Carbon and Grazing

Brian Wallace and Reg Newman

MFR Research Branch  
Kamloops, BC

September 11, 2009



Biodiversity in forest  
ecosystems and landscapes

THOMPSON RIVERS UNIVERSITY  
KAMLOOPS

FFESC Project No. 003

REGISTRATION

**Integrating Climate Change Adaptation Strategies  
with Sustainability and Socioeconomic Objectives  
for the Quesnel Timber Supply Area**

Ann Chan-McLeod  
UBC

Conference  
August 5-8, 2008



## KAMLOOPS FUTURE FOREST STRATEGY II

Validating Impacts, Exploring Vulnerabilities, and Developing Robust  
Adaptive Strategies

Feeds: Posts Comments



Photo: Courtesy of Dave Dohi

# Tree species diversity

## Stand Scale

**Focuses on the success of a single stand**

### **Tree Species Diversity:**

- Reduces:
  - risk of complete stand failure
  - pest outbreak severity
- Enhances:
  - stand yield in a changing environment
  - structural attributes of habitat diversity
  - range of forest products



B. Rogers



W. MacKenzie

# Tree species diversity

## Landscape Scale

**Focus on the overall success of the forest landscape (forest adaptability)**

- Cumulative effects of individual stand-level decisions
  - Risk of widespread losses from species-specific pests
- Regional population of species for adaptability to future climatic conditions
- Variation in stand management while meeting broader targets



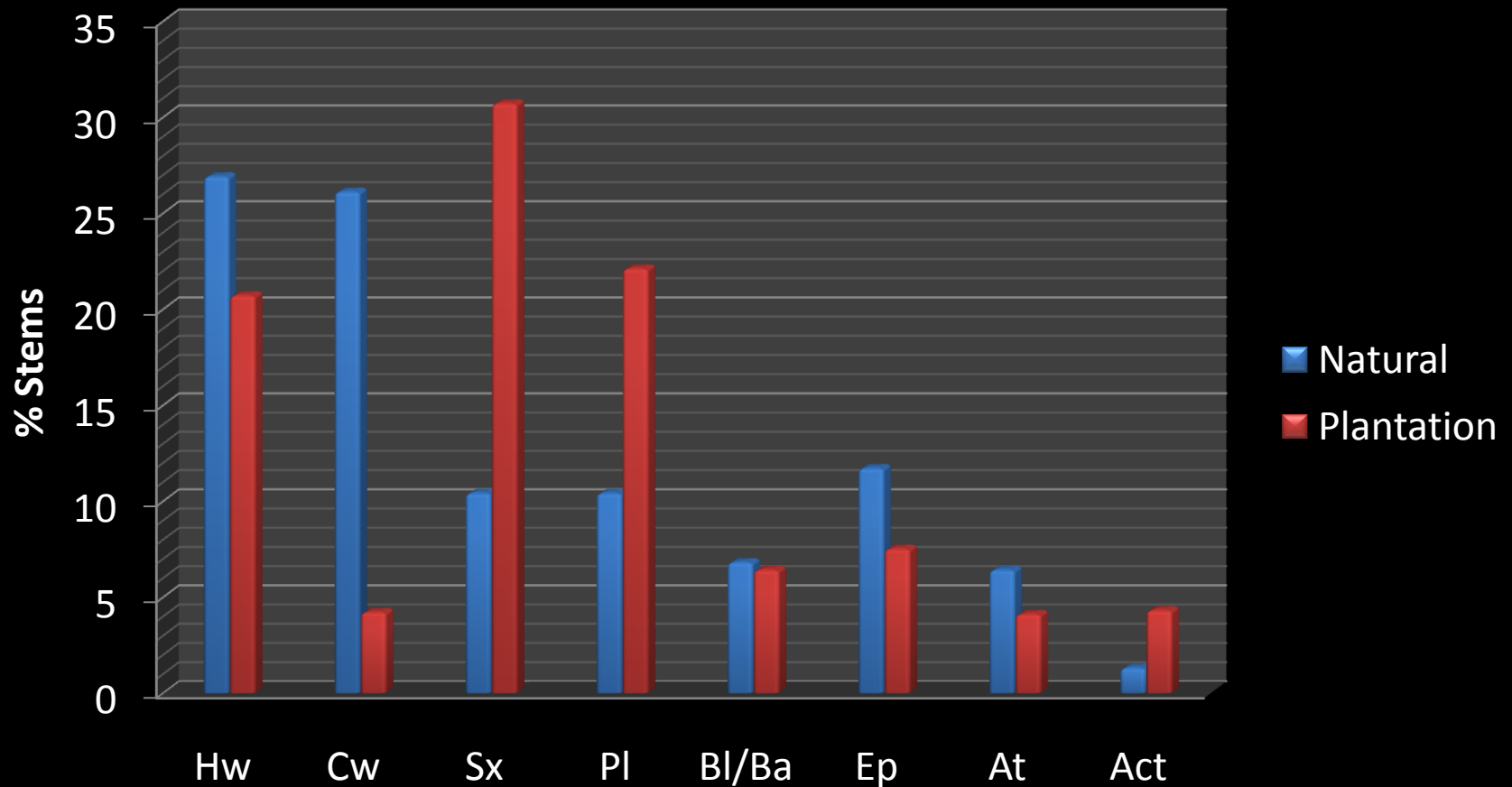
W. MacKenzie



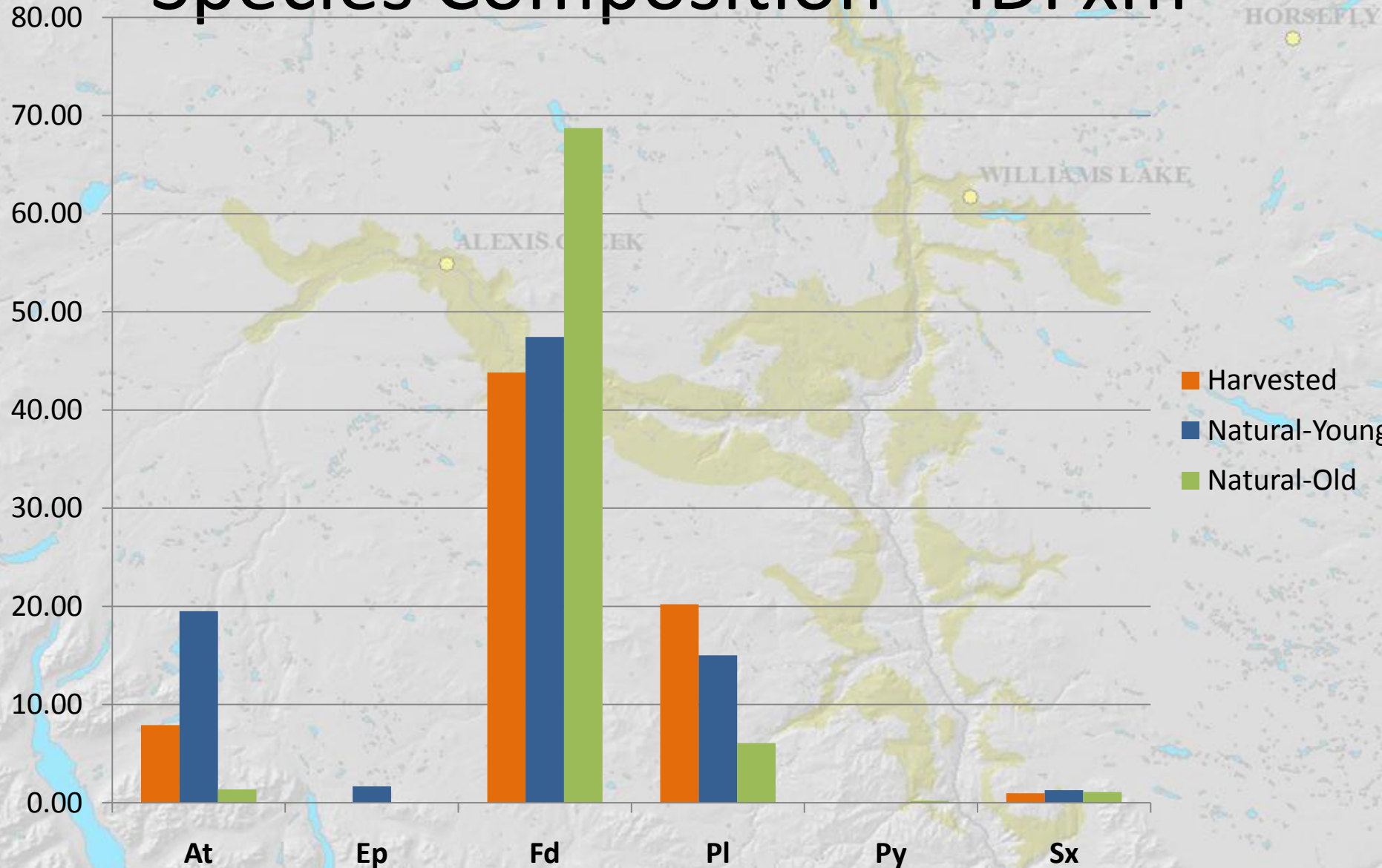
# Is there a diversity issue at a landscape level?

## Landscape scale diversity assessment ICHmc2 pilot example (Banner *et al.*)

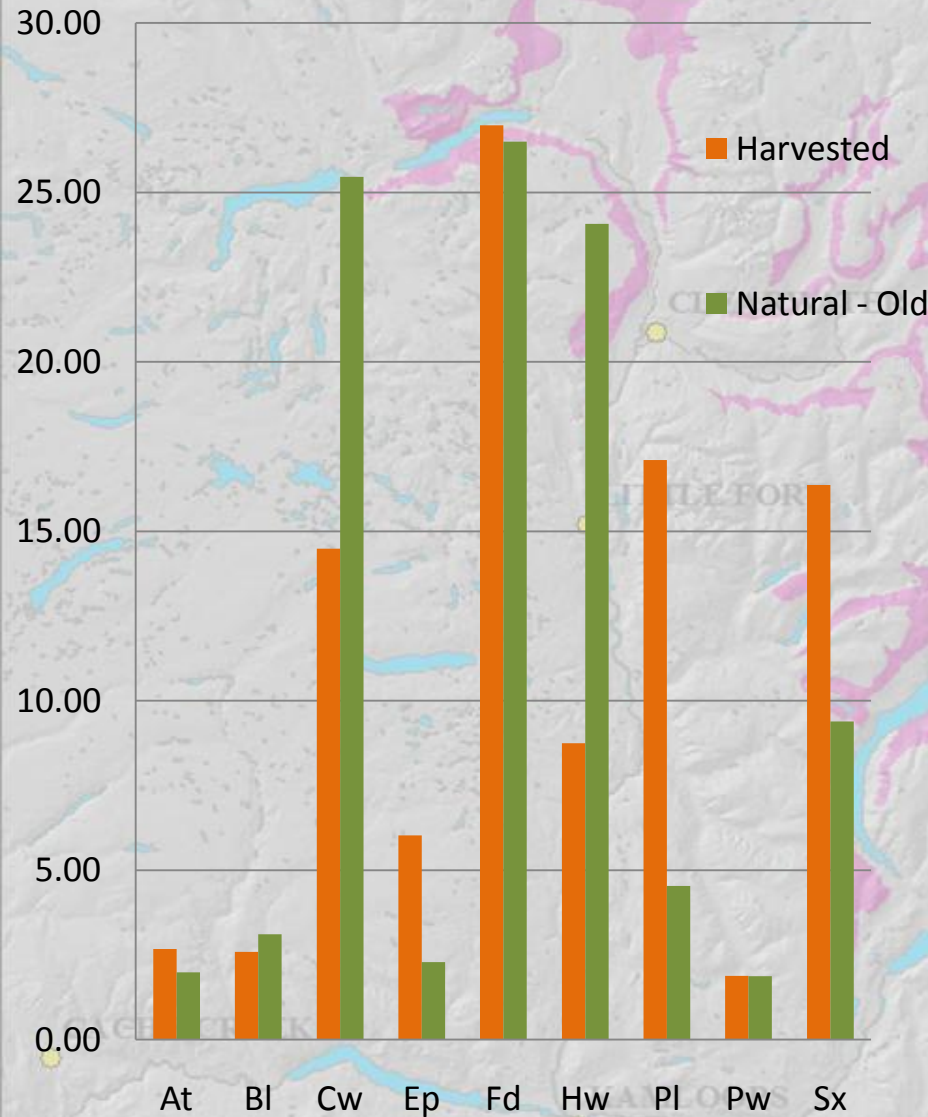
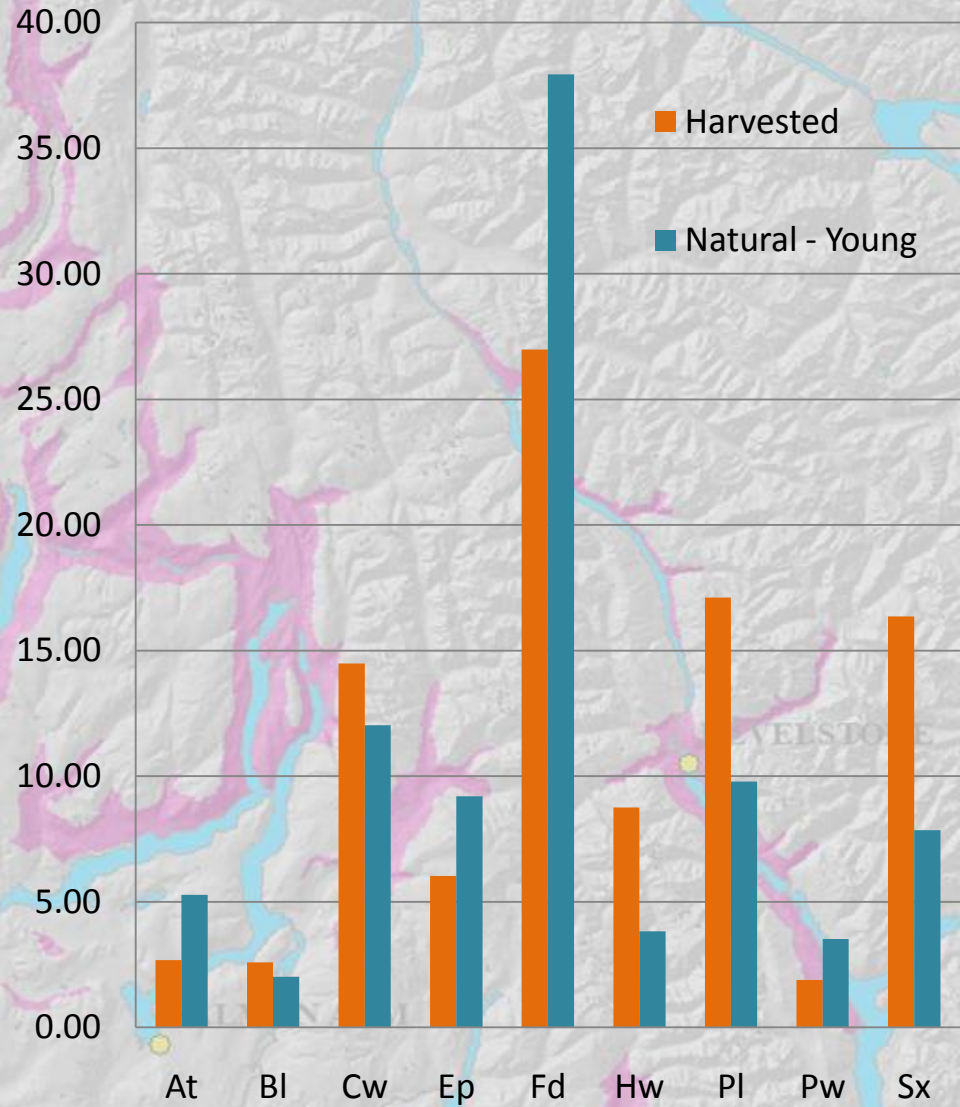
Landscape level species composition in ICHmc2 stands (<60yrs)



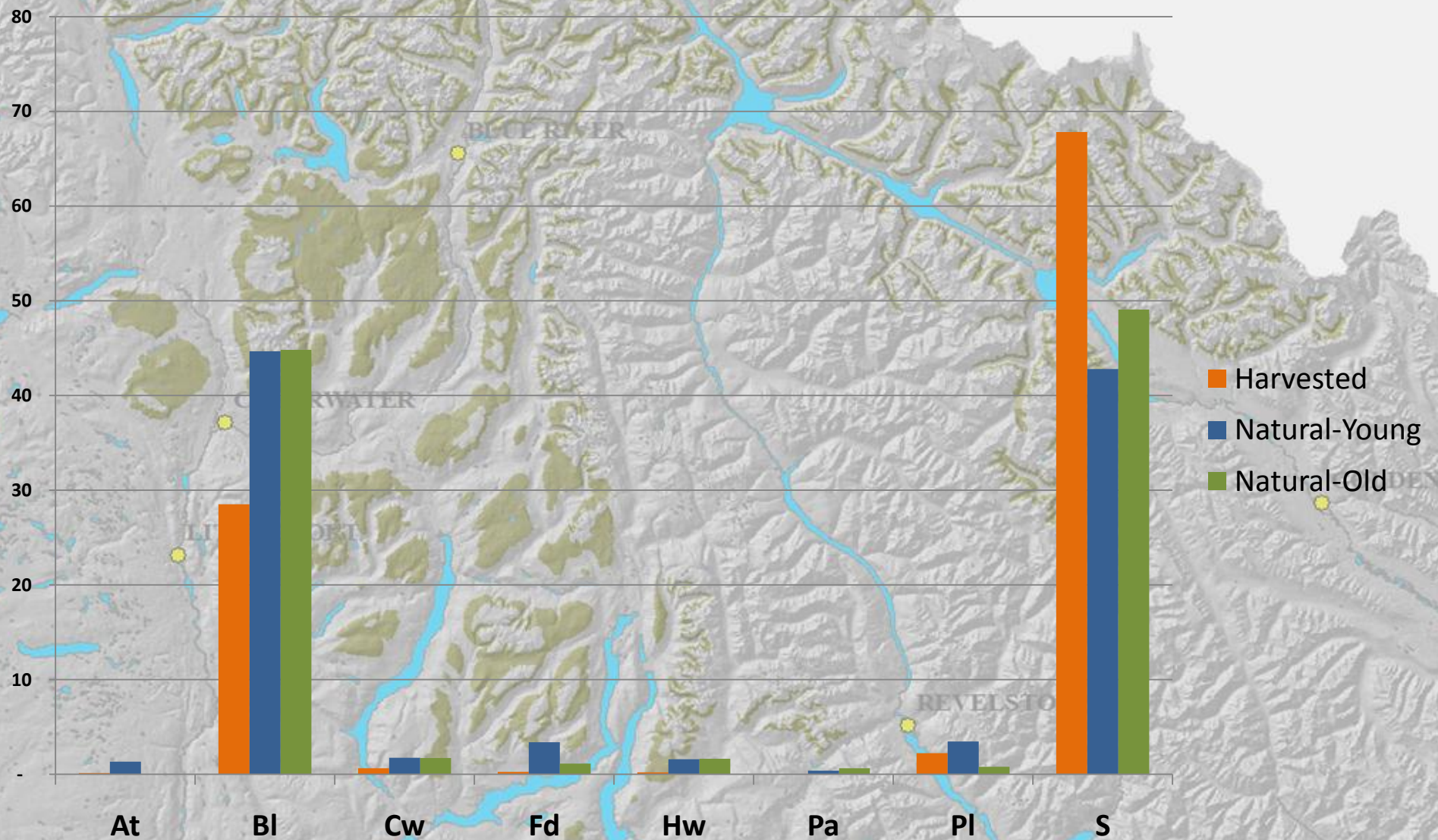
# Species Composition – IDFxm



# Species Composition – ICHmw3

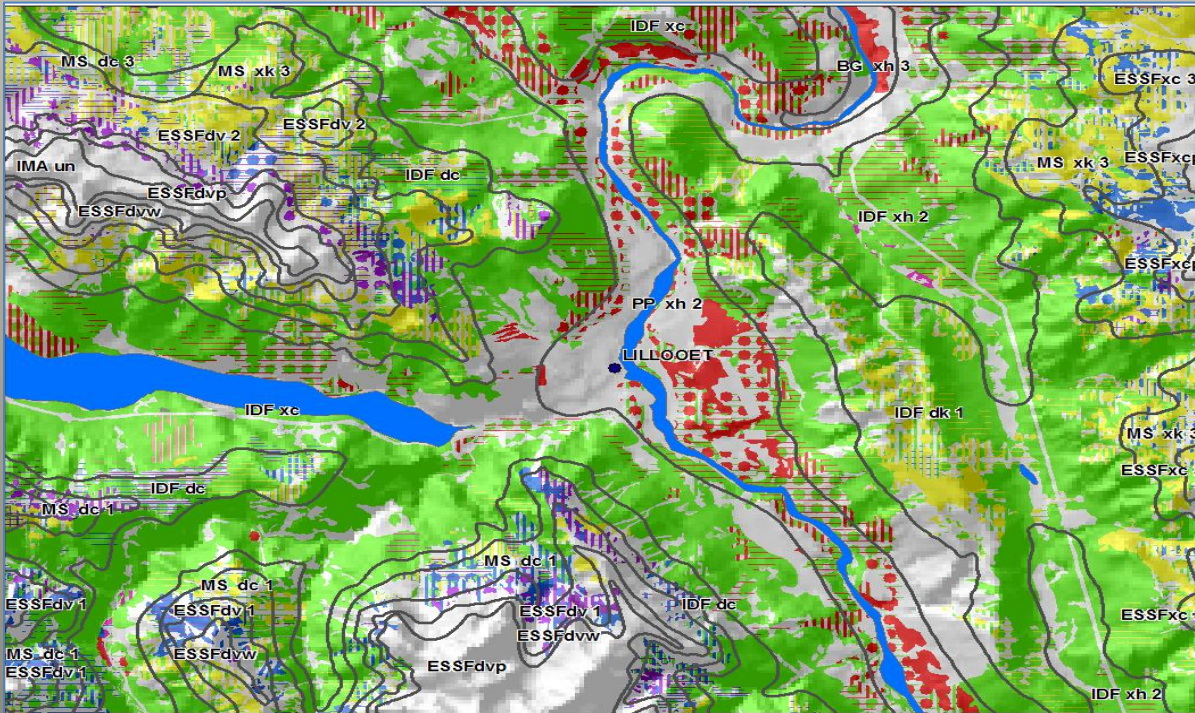


# Species Composition – ESSFwc2



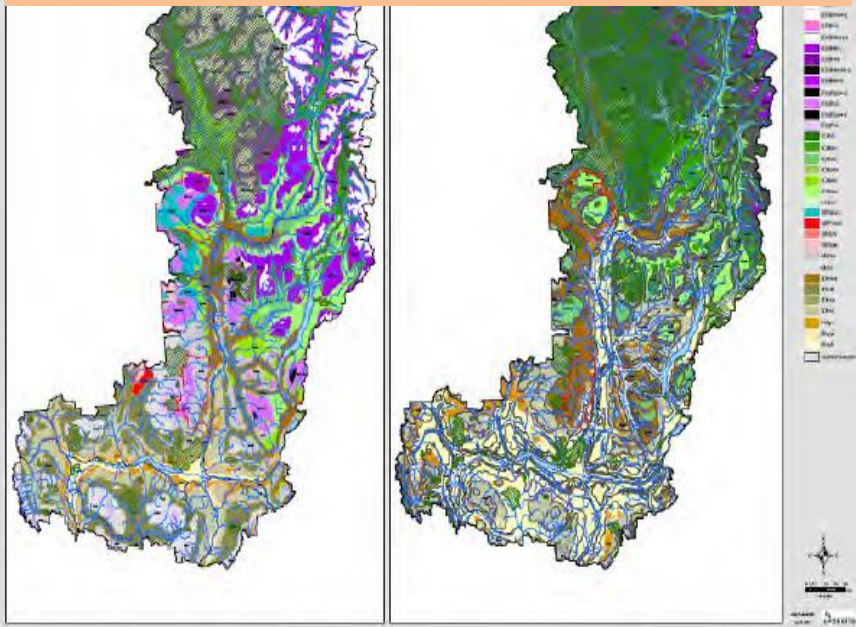
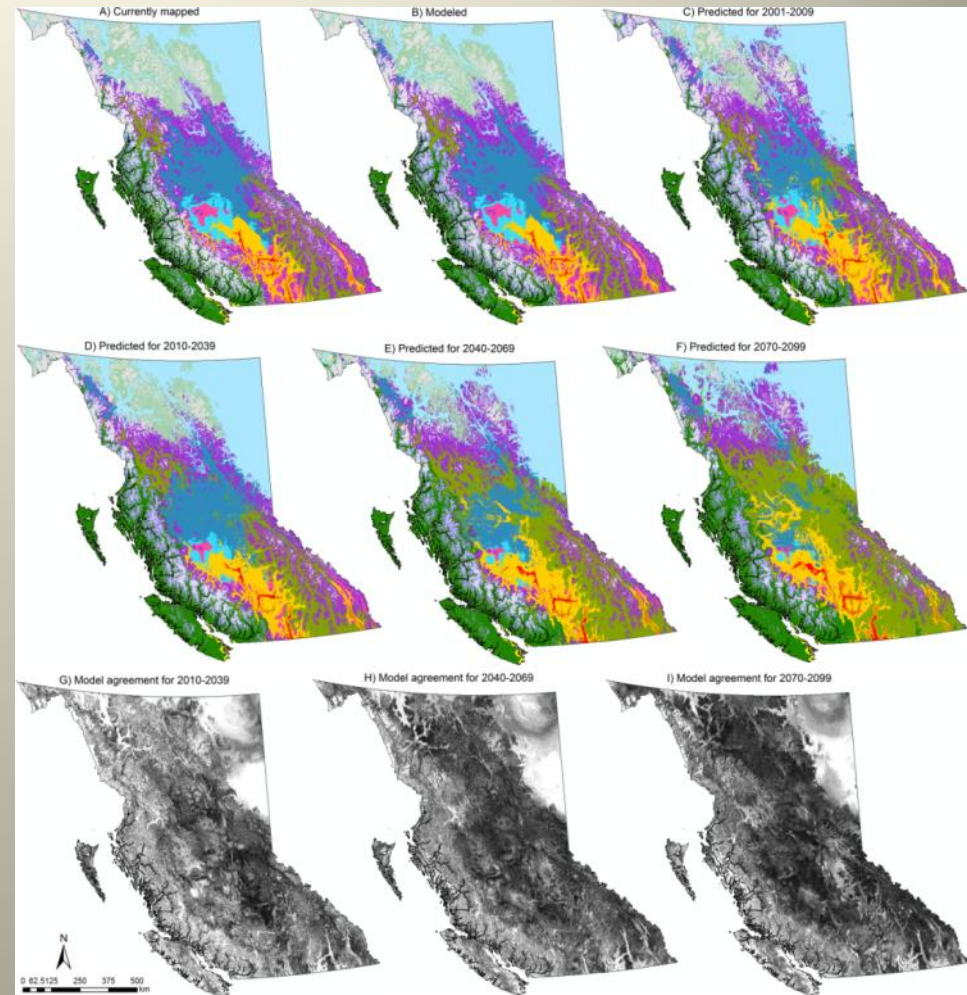
# What ecology tools are available to look at tree species diversity?

- Major revisions to BEC in Thompson-Okanagan
- Landscape level ecological unit (subzone/variant)
- Ecologically suitable species (by site and BGC)



# Modelling BGCs

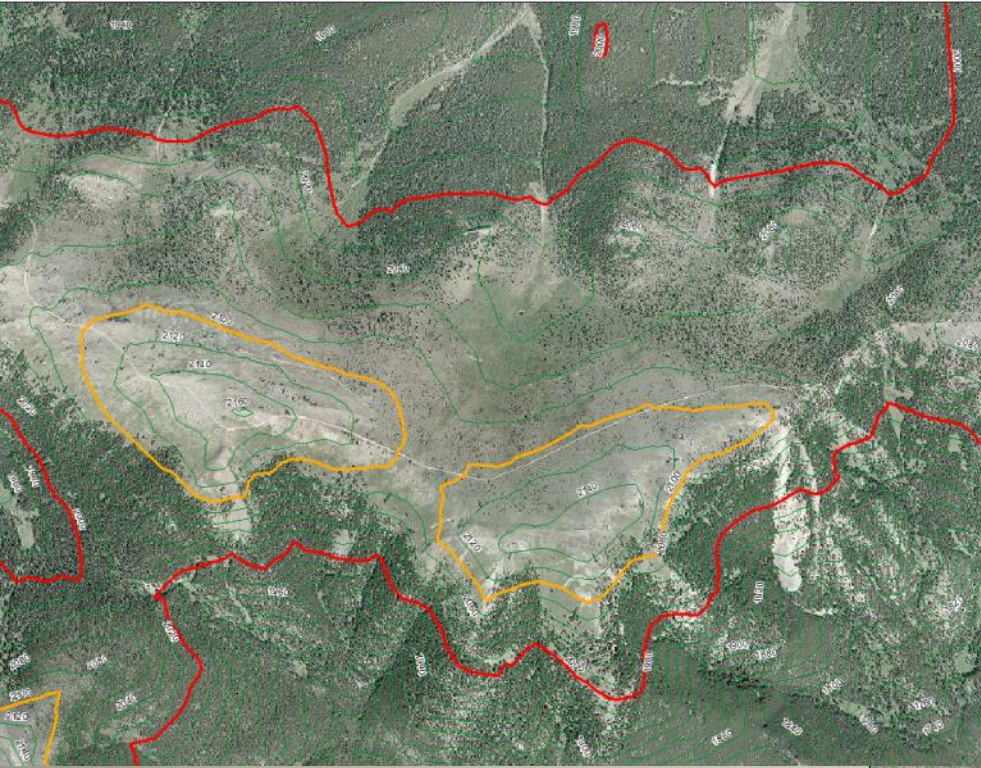
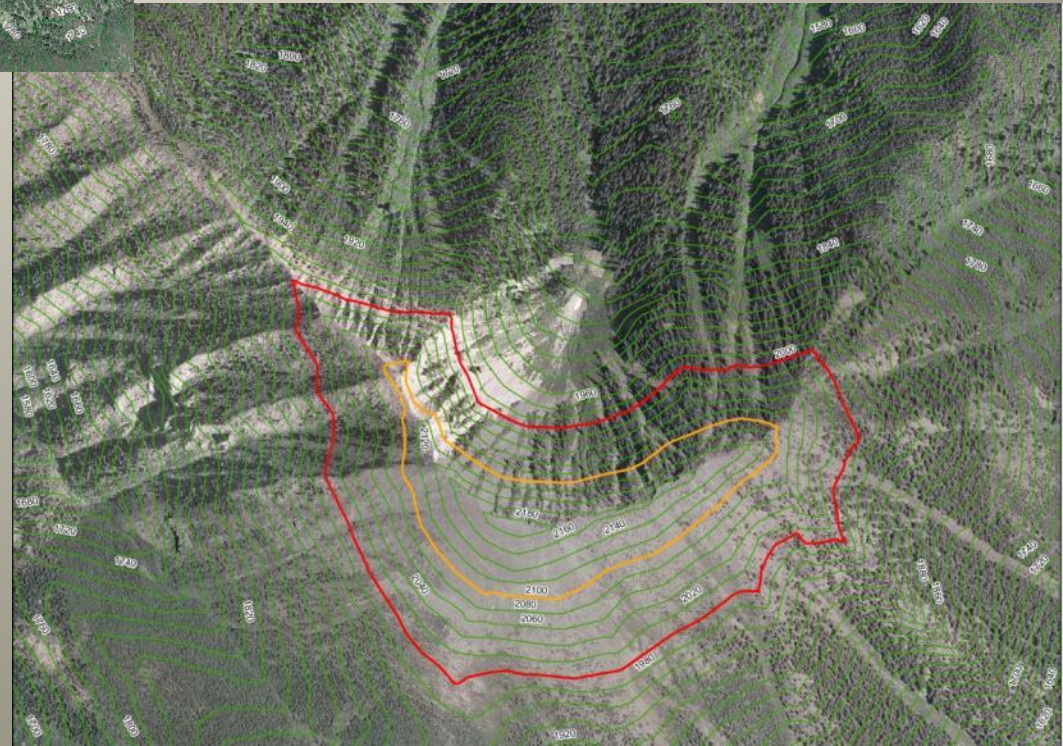
## ***Adapting Forest Management in the Kamloops TSA to Address Climate Change***



Wang et al.  
2011 in prep.

Will alpine areas  
shrink with a  
warmer climate.....

...or expand in  
some areas??



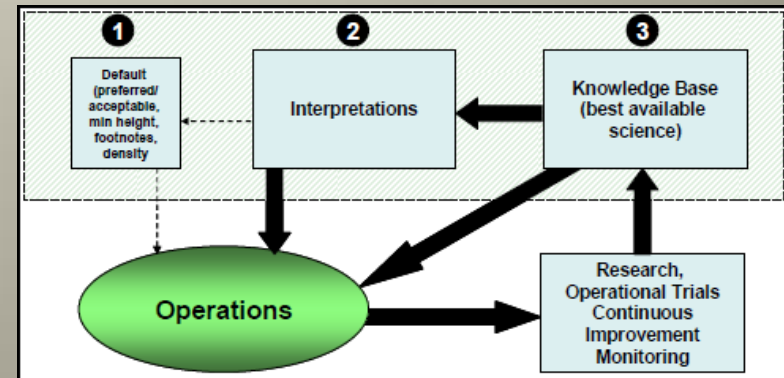
# Tree Species Selection Tool

Compiled species information presented in the BEC framework for ecologically-suitable species and the ecological factors (environmental and forest health) limiting their performance.

- **Goal** : To provide easy access to current scientific information needed to support decision-making for
  - Stand and landscape levels
  - Short and long term objectives

Expected release – 2011 for the Northern Interior BEC subzone/variants

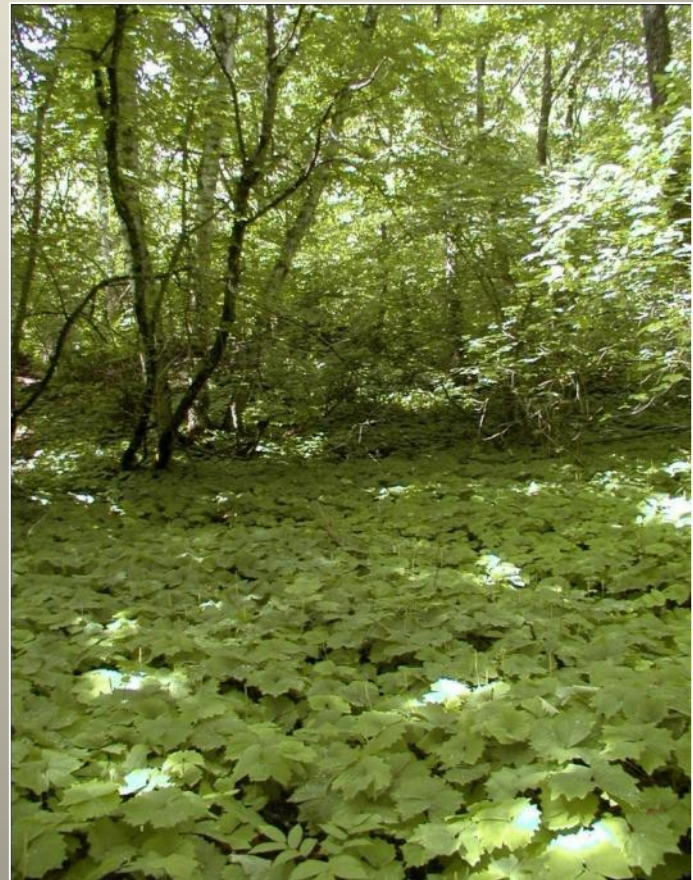
<http://www.for.gov.bc.ca/hfp/silviculture/TSS.htm>



# Tree Species Selection Tool

**Ecologically Suitable Species –  
Tree Species Selection Project  
definition:**

“Coniferous or deciduous tree species that are adapted to a site’s environmental conditions, including the variability in these conditions that may occur over time.”



# **Landscape Species Strategy Project (Quesnel TSA)**

**Component 1 – Species Profile Analysis**

**Component 2 – Landscape Species Targets**

**Component 3 – Landscape Species Strategy**

# Decisions

1. Which scale is appropriate for diversity management?
2. What is the geographical unit we should evaluate diversity in?
3. What is the tree spp. diversity baseline?
4. What is our diversity objective?



# A Diversity Approach Would...

- Promote and accept a wider range of management intents
- Encourage species mixes
- Reduce levels of species conversion in landscape
- Consider uncertainty and climate change in species selection
- Reduce efforts to bring all stands to a uniform standard
- Encourage experimentation and adaptive management
- Evaluate success at a landscape scale to allow variable management at the stand level
- Evaluate success over longer time scales



Diversify, diversify, diversify.....

**Monitor, monitor, monitor.....**