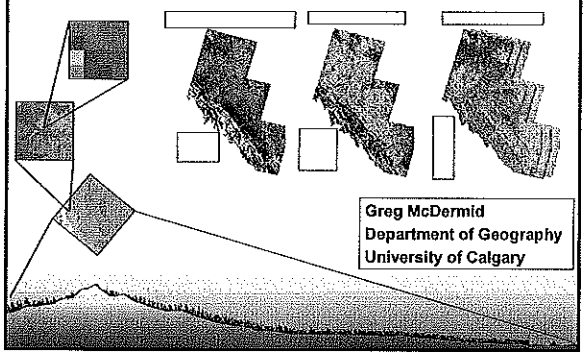
foothills
MODEL FOREST
research growing into practice.

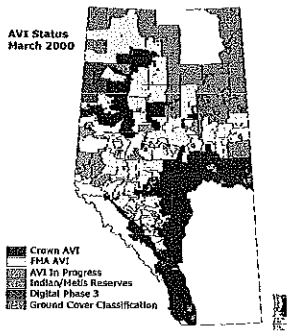
Remote Sensing Maps: History, Background, and Development



Greg McDermid
Department of Geography
University of Calgary

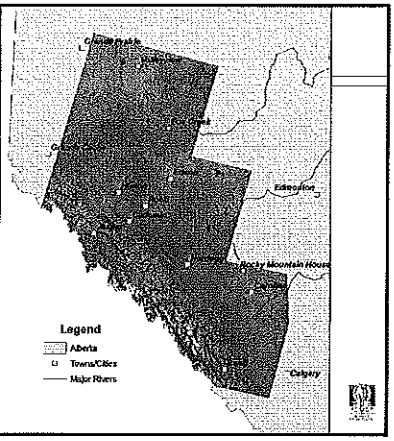
The Need for Accurate and Consistent Multi-Jurisdiction Information

- The Alberta Vegetation Inventory is the current standard of environmental information in the province's productive forested lands
  - Several different sources
  - Several different versions
  - Inconsistent quality
  - Incomplete coverage
  - Difficult to obtain!
- National Parks, First Nations reserves, private lands, and other protected areas not covered



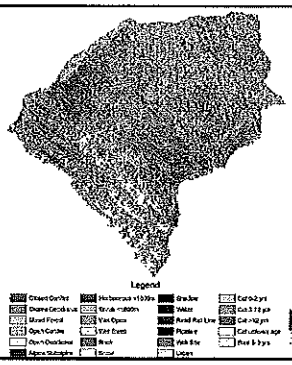
Mapping History and Expansion

2004
"100k Landscape"



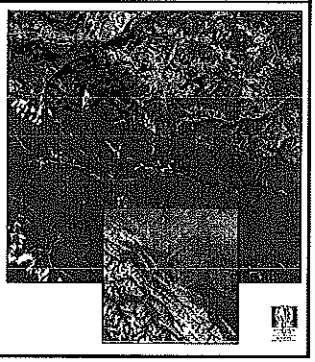
Evolution of the "Landcover Map"

- Lesson #1: Avoid expensive 'one-off' efforts that are inflexible and incapable of change
- Do not over-simplify a complex phenomenon



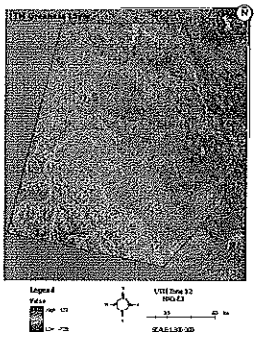
Evolution of the "Landcover Map"

- Lesson #2: Eliminate spatial inconsistencies that undermine the confidence of end users



Evolution of the "Landcover Map"

- Lesson #3: Reduce dependence on non-physical variables that may not be logical, consistent, or reproducible



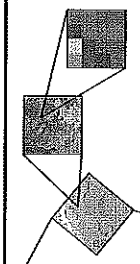
Mapping Objectives

- A series of physically-based products that do not over simplify a complex phenomenon
  - Landcover, vegetation structure, phenology, and change
- A flexible information source that is capable of addressing a variety of management objectives
  - Where possible, produce 'high-level' data products composed of continuous variables that can be recoded and combined to meet the individual manager's needs
- High-quality information that places a premium on consistency
  - Elimination of noise, seam lines, and other inconsistencies

"The map once constructed should be enduring"

John Wesley Powell

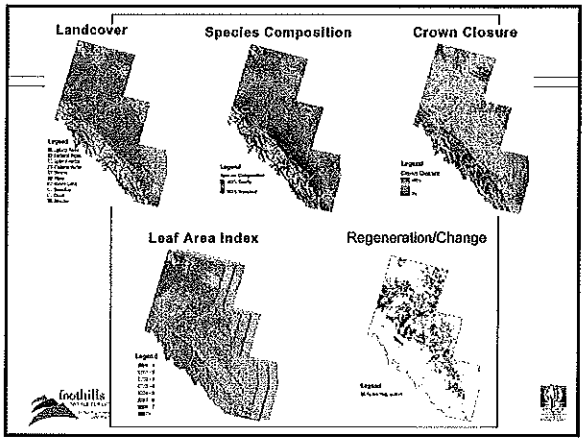
A Process-Based Approach to Mapping



Attribute	Data Source	Extraction Procedure
Crown Closure	Landsat	Statistical modelling
Species Composition	Landsat	Statistical modelling
LAI Phenology	Landsat/MODIS	Statistical modelling

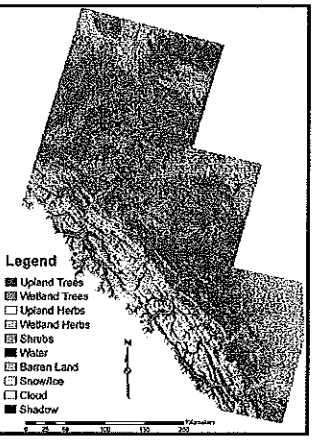
Attribute	Data Source	Extraction Procedure
Land Cover	Landsat	Classification

Attribute	Data Source	Extraction Procedure
Natural subregion	MODIS	Classification



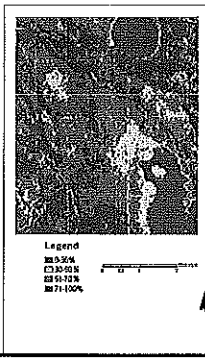
Land Cover

- Categorical classification of broad 'stand-level' information classes
- Overall accuracy 92%



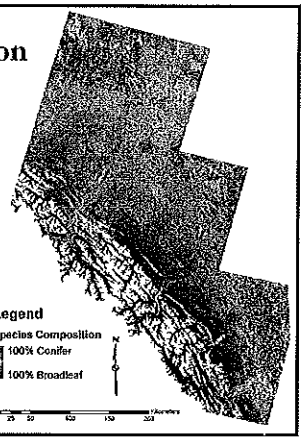
Crown Closure

- Continuous variable model of the percentage of ground covered by tree crowns
- Configurable to user-specified categories
- Accuracy decreases with higher detail
  - Two class: 91%
  - Three class: 62%
  - Four class: 52%



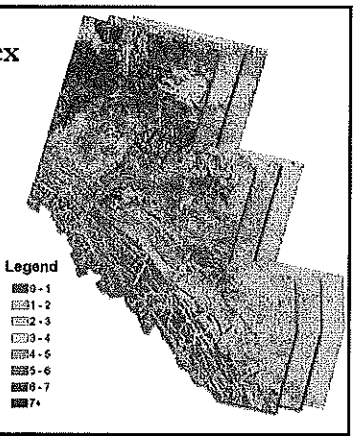
Species Composition

- Continuous variable model describing the proportion of coniferous trees in a 30m Landsat pixel
- Configurable to user-specified categories
- Accuracy decreases with higher detail
  - Two class: 93%
  - Three class: 71%
  - Four class: 69%

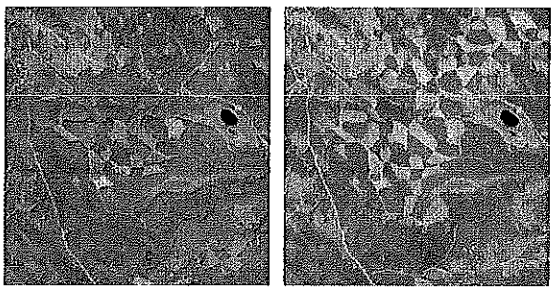


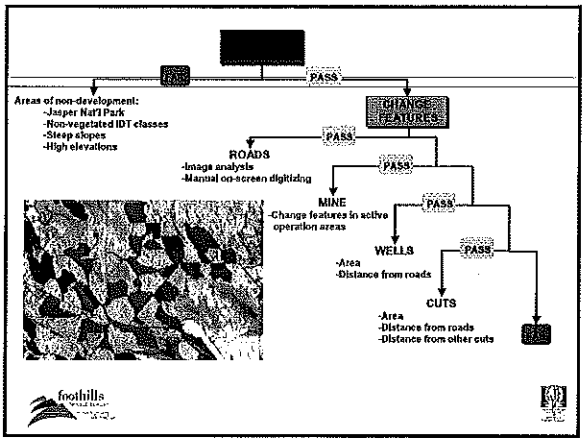
Leaf Area Index

- Continuous variable model describing the total one-sided leaf area per unit ground area
- Three products: early summer, late summer, leaf off



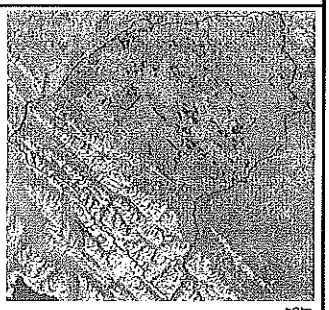
Change Detection: 1999 – 2001

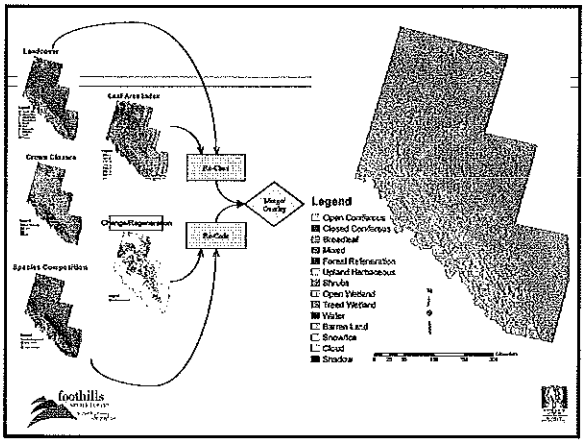




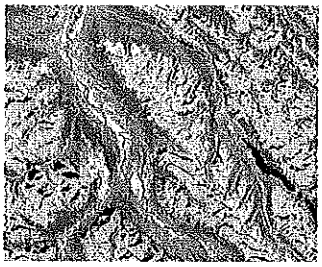
1999-2001 Change Features

- 284km roads
- 297ha mines
- 128 well sites
- 6012ha cut blocks



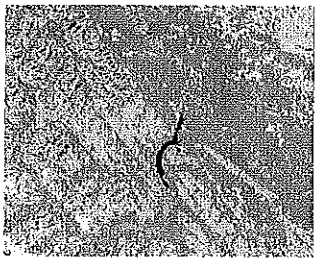


Reconfiguration: Structural Complexity



Open Coniferous
Moderate Coniferous
Dense Coniferous
Broadleaf Forest
Mixed Forest
Forest Regeneration
Upland Herbaceous
Shrubs
Open Wetland
Treed Wetland
Water
Barren Land
Snow/Ice
Cloud
Shadow

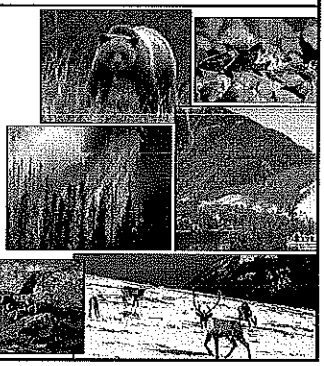
Reconfiguration: Structure Versus Phenology



LAI Senescence
LAI No Growth
LAI Moderate Growth
LAI Substantial Growth
Water
Barren Land
Snow/Ice
Cloud
Shadow

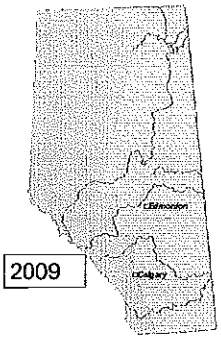
A Flexible Information Source

- Currently focussed on grizzly bears, but designed to support a broad range of resource management applications
  - Woodland Caribou
  - Mountain pine beetle
  - Native trout and fishes
  - Forest fire fuels
  - Biodiversity conservation
  - Kyoto protocol



Remote Sensing Team Responsibilities Mapping Expansion – 2004-2009

- Goal: All the grizzly bear range in Alberta mapped by 2009



Current Research Activities

- Efficient methods for change detection/map product updates
- Remote sensing/modelling methods for determining forest and cutover age
- Assessing new products and technology