Challenges, Approach, Projects and Tools
Fish and Watershed Program

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Presentation Outline

1. CONSERVATION CHALLENGES
2. PROGRAM APPROACH
3. PROJECTS
4. CURRENTLY AVAILABLE TOOLS

I. Aquatic Ecosystem Conservation Challenges

Continental scale for all stakeholders
(Jelks et al. 2008) :

1. Migration barriers
2. Habitat loss
3. Flow modification
4. Exotic species
5. Sedimentation
6. Over-exploitation

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Regional scale for FRI land managers :

1. Removing migration barriers
2. Reducing sedimentation
3. Preventing habitat loss

"Maintain and restore natural processes"
(Roni et al. 2002)

I. In addition to public perception and legislative compliance, what is the relevance for land managers?

Native fish conservation (Jelks et al. 2008) **:**

1. Migration barriers →
2. Sedimentation →

Other water-related values:

1. Infrastructure reliability
2. Water quality

Our program is fish-centric and we have almost no domestic water use from streams. However, the knowledge and tools from our program our widely applicable.

I. A Vision to Address our Aquatic Ecosystem Conservation Challenges:

Maintain and restore ecological processes, including disturbance, in consideration of the natural range of variation (Reeves et al. 1995).

I. A Vision to Address our Aquatic Ecosystem Conservation Challenges:

Key components:

1. **Concentration versus dispersion of disturbance.**

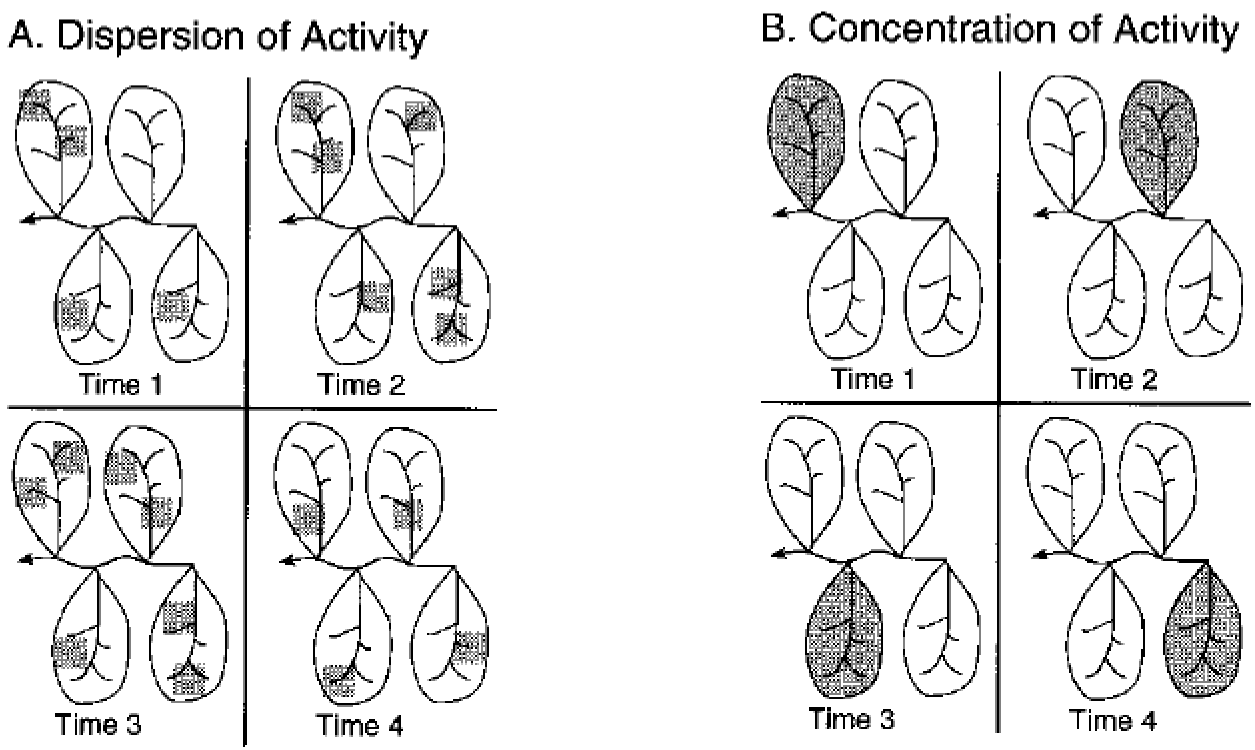


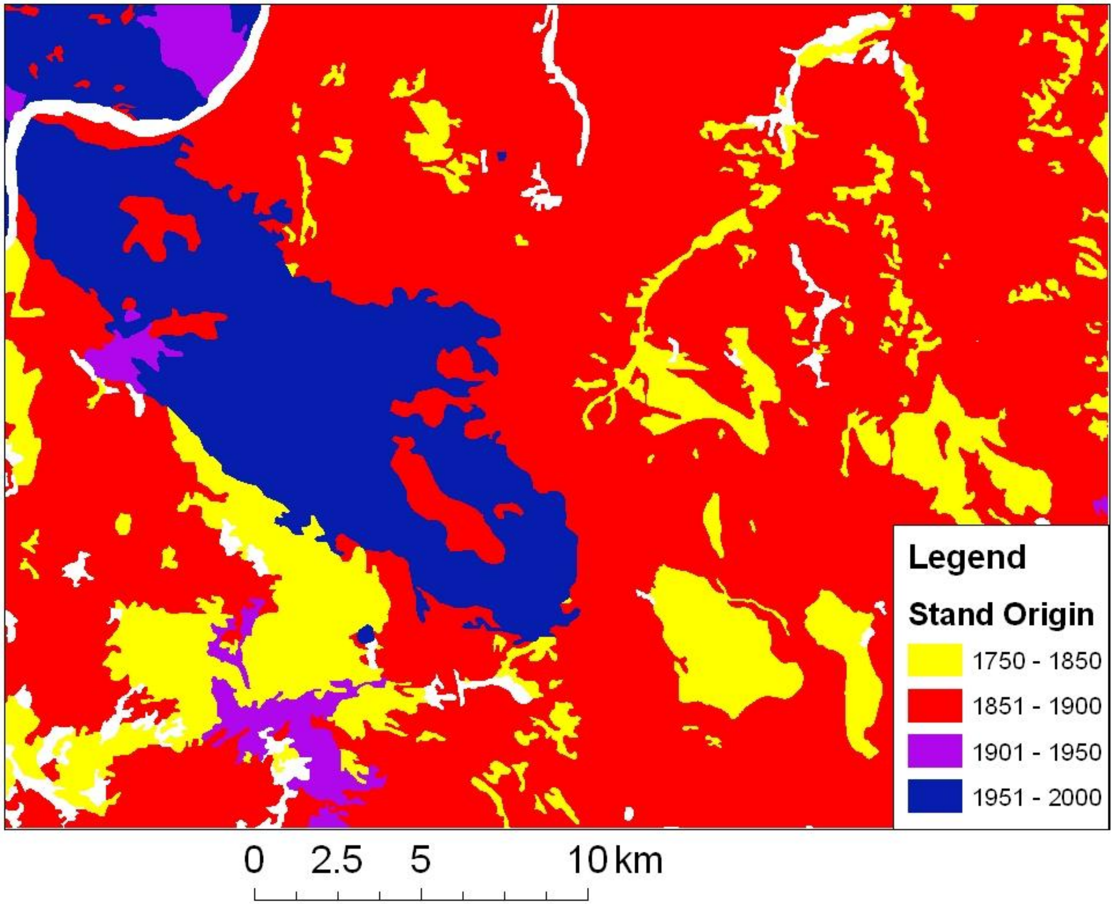
Figure 6. Examples of patterns resulting from (**A**) dispersing and (**B**) concentrating land management activities in a watershed over time (modified from Grant 1990).

from Reeves et al. 1995

I. A Vision to Address our Aquatic Ecosystem Conservation Challenges:

Key components:

2. **Landscape mosaic with large patches of forest representing natural range of age-classes.**



I. A Vision to Address our Aquatic Ecosystem Conservation Challenges:

Key components:

3. **Maintain site-scale processes (within NRV) including inputs of water, organic matter and sediment from adjacent hillslopes into streams.**

I. A Vision to Address our Aquatic Ecosystem Conservation Challenges:

Key components:

4. **Maintain connectivity for fish migration at watershed-scale.**

I. Our vision for addressing these challenges:

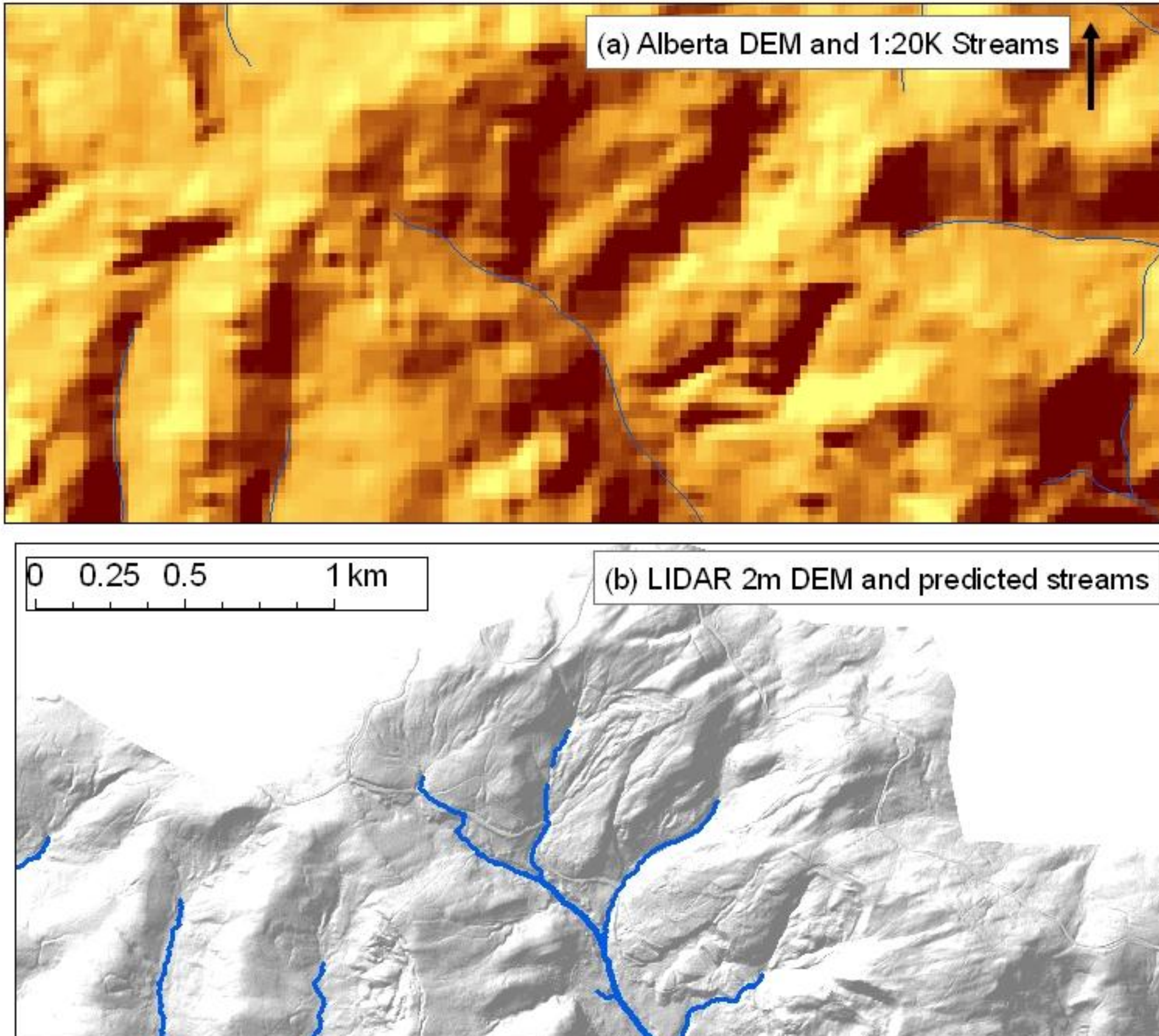
Related key future endeavors:

1. Help to set realistic public expectations and attainable management options.

2. Identify and communicate risks to high water quality and reliable water supplies over the long-term.

II. General Approach

1. Develop partnerships.
2. Utilize existing knowledge.
3. Utilize existing data (e.g., LIDAR).
4. Use peer review and publication process to address knowledge gaps.
5. Use extension to inform researchers and managers.
6. Produce tools, with an emphasis on map products (ultimate streams layer) that can be used to support ILM.


(a) Alberta DEM and 1:20K Streams
0 0.25 0.5 1 km
(b) LIDAR 2m DEM and predicted streams

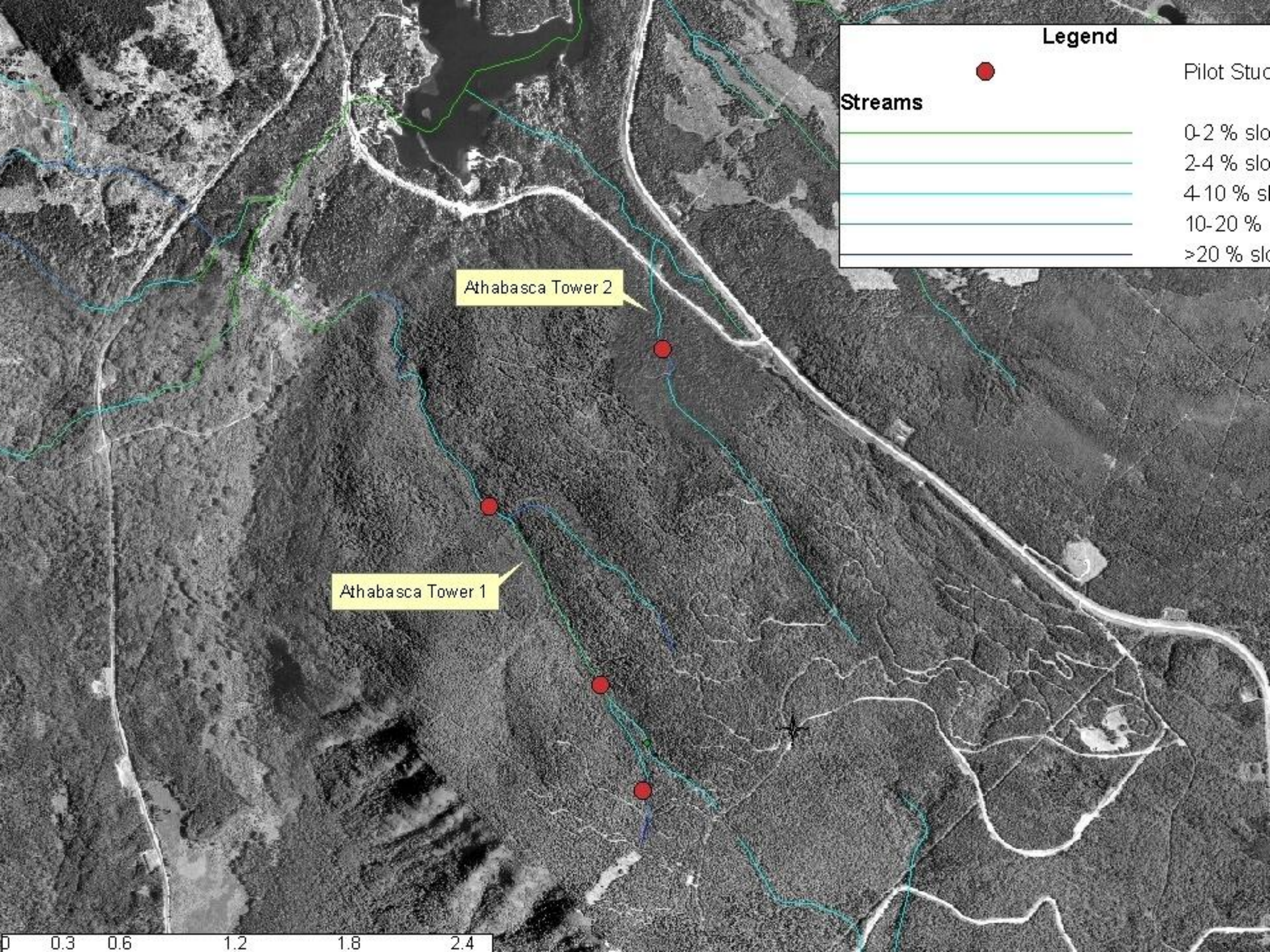
III. Current Projects

1. Headwater channel processes and mapping.
2. Watershed similarity analysis.
3. Hardisty Creek post-restoration monitoring.

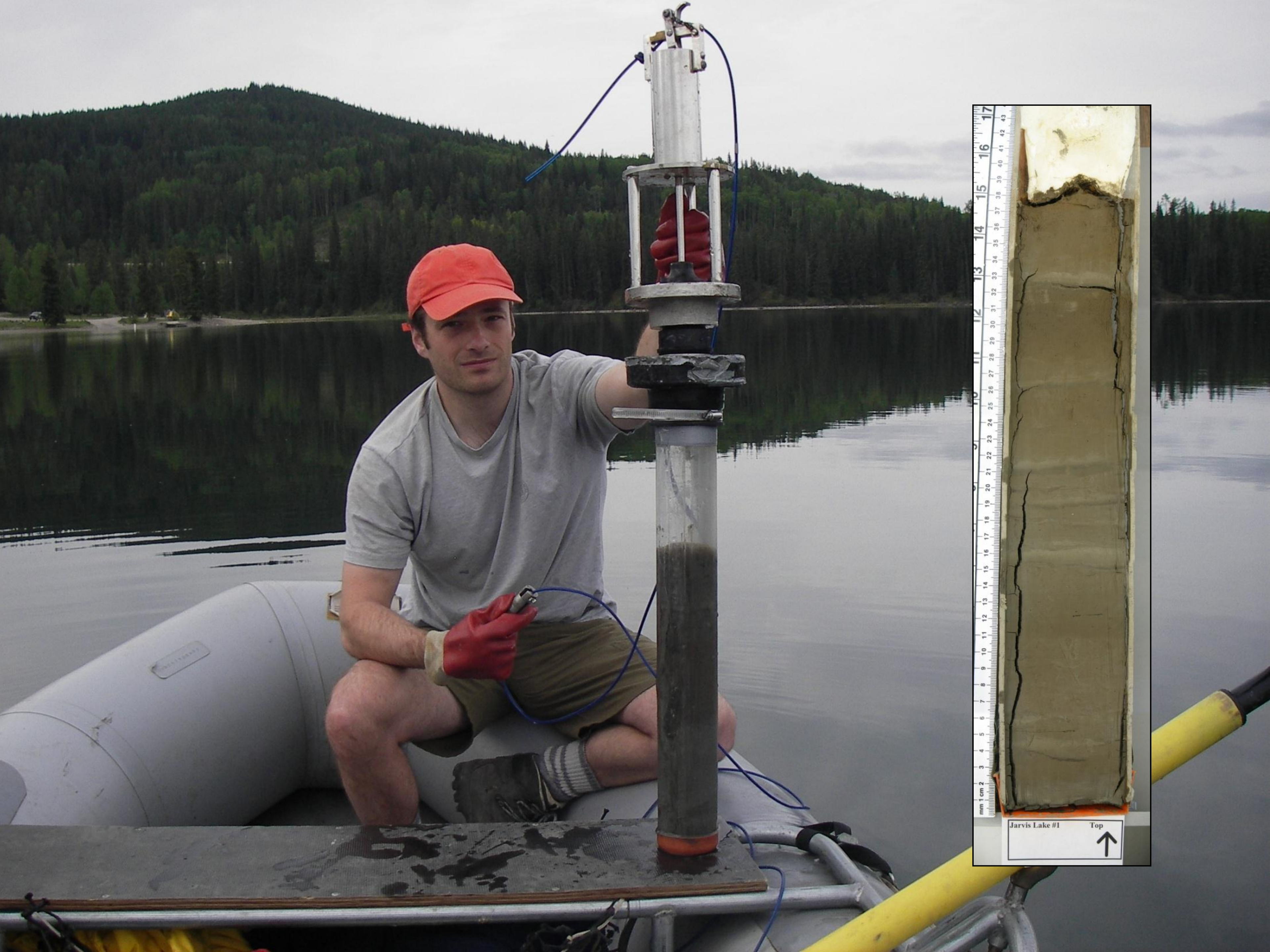
III. Current Projects

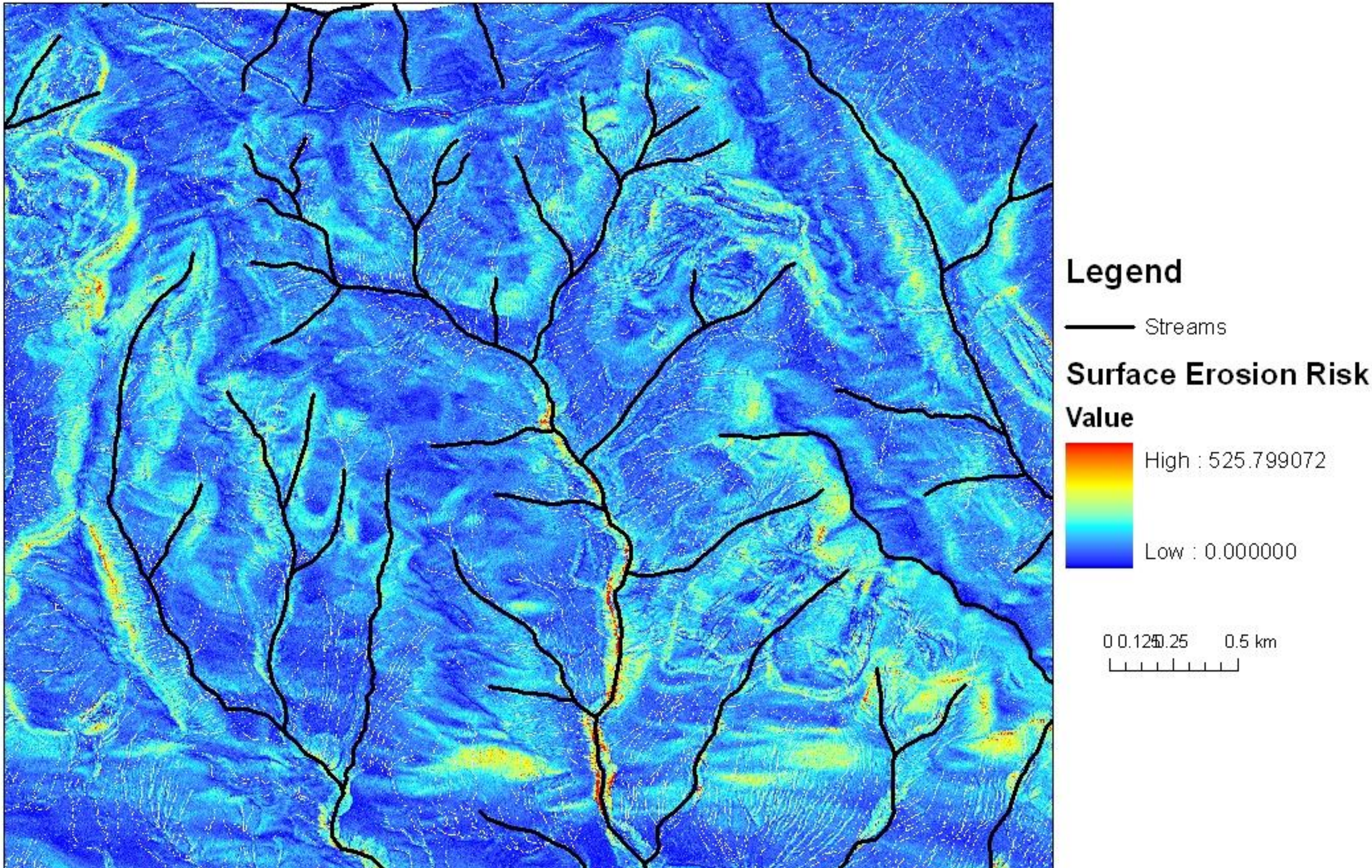
1. Headwater Channel Processes and

1. Focus is on **sediment** and **wood** processes.
2. Approach is to test and calibrate existing models that predict water quality and habitat structure from riparian management scenarios.



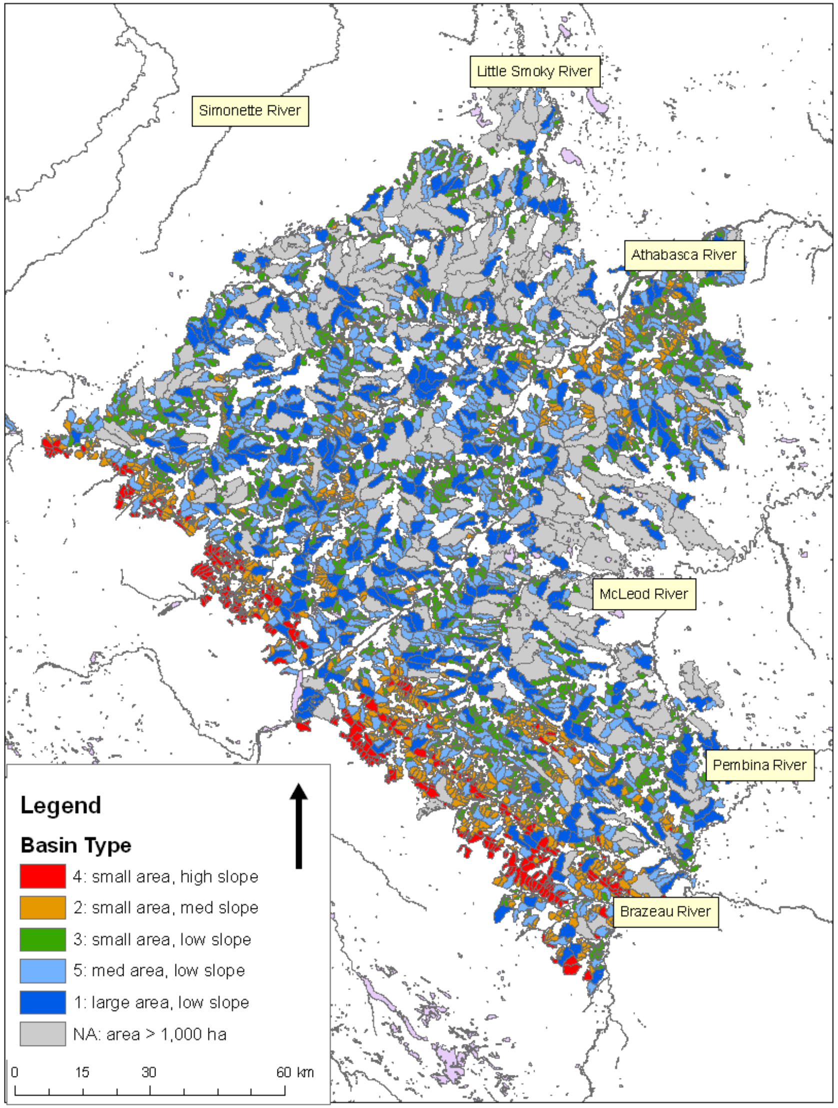
Legend
Pilot Stuc
Streams
0-2 % slo
2-4 % slo
4-10 % sl
10-20 %
>20 % slo
Athabasca Tower 2
Athabasca Tower 1
0 0.3 0.6 1.2 1.8 2.4


Jarvis Lake #1
Top



Outcome will highlight portions of the watershed that are most sensitive to land-use activities.

III. Current Projects
2. Basin Similarity Analysis



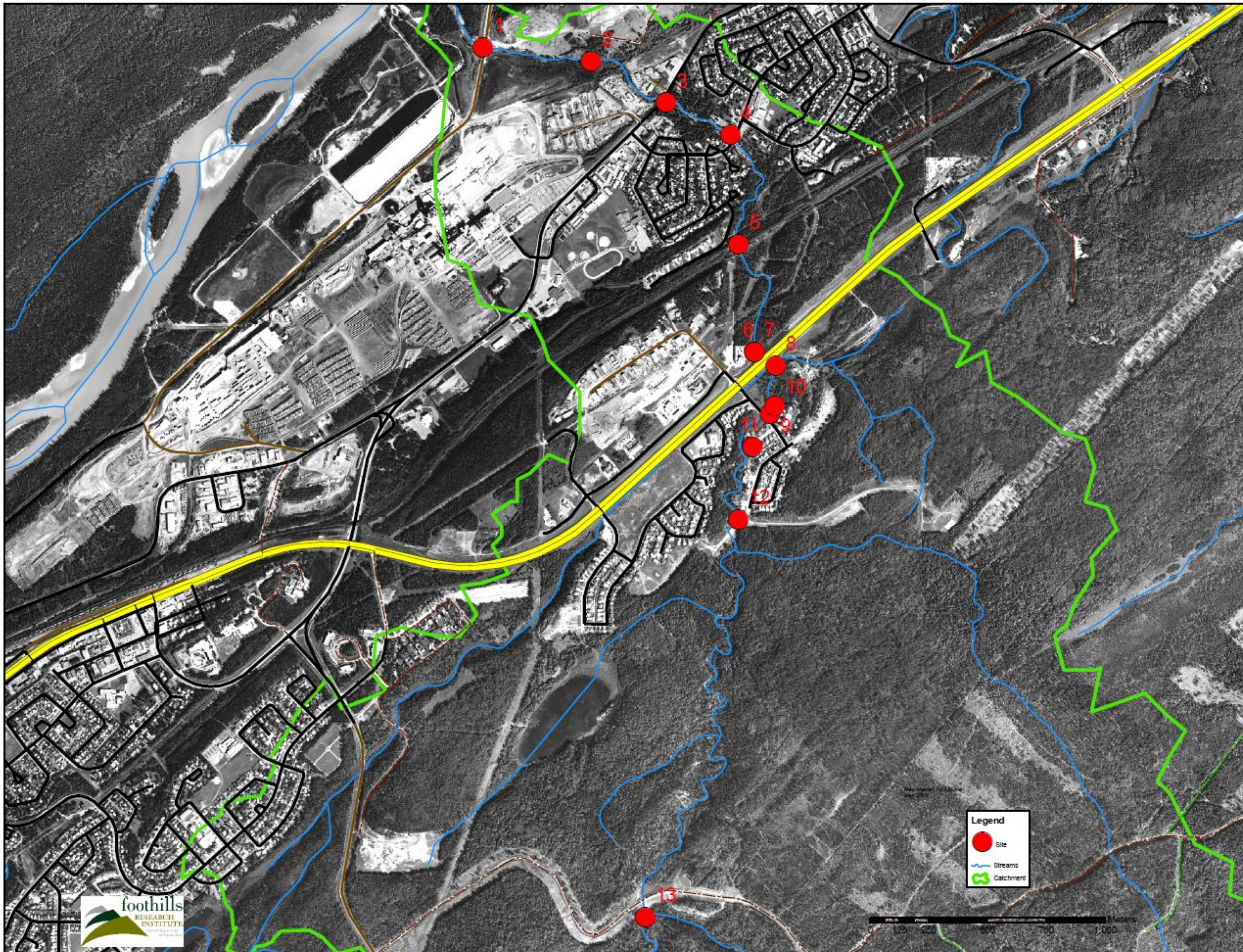
Preliminary classification based on sediment production potential.

III. Current Projects

3. Hardisty Creek Monitoring (Fish Populations)

III. Current Projects

3. Hardisty Creek Monitoring (Storm Water)



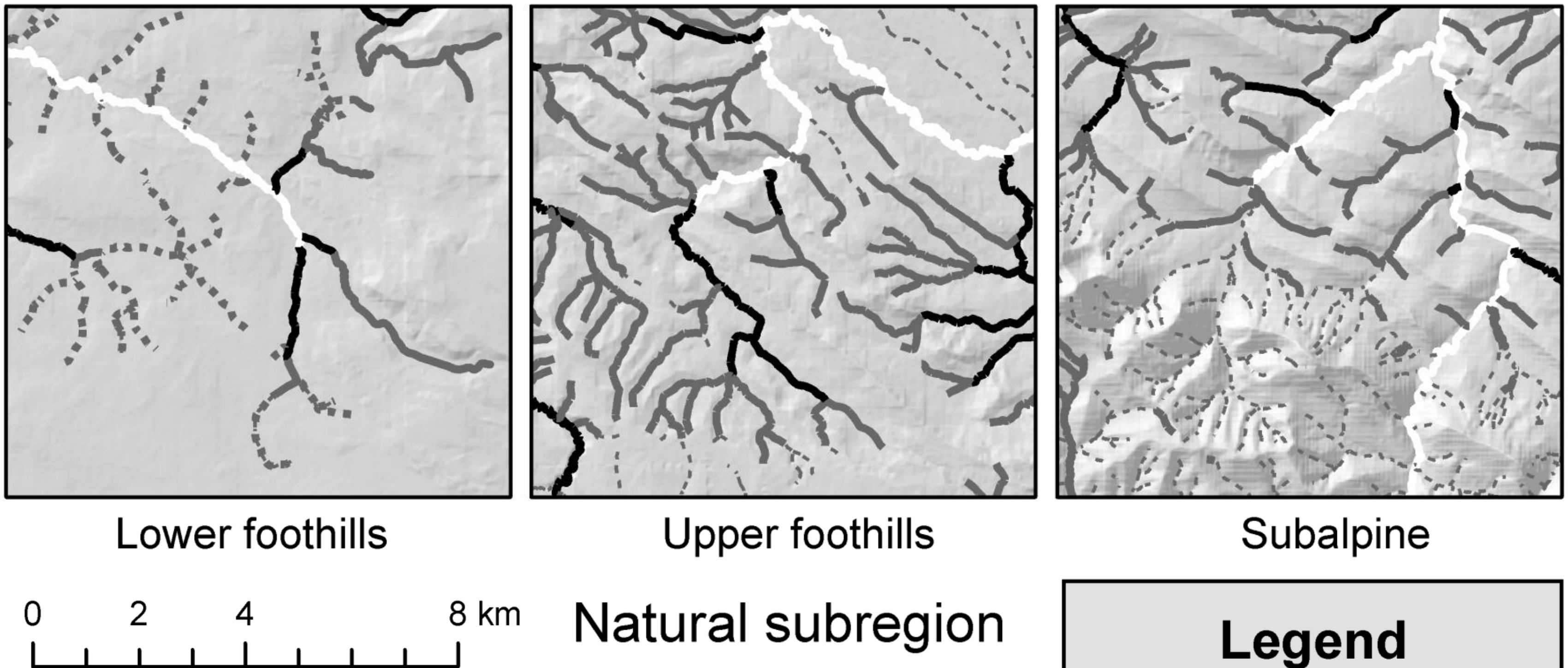
III. Current Projects

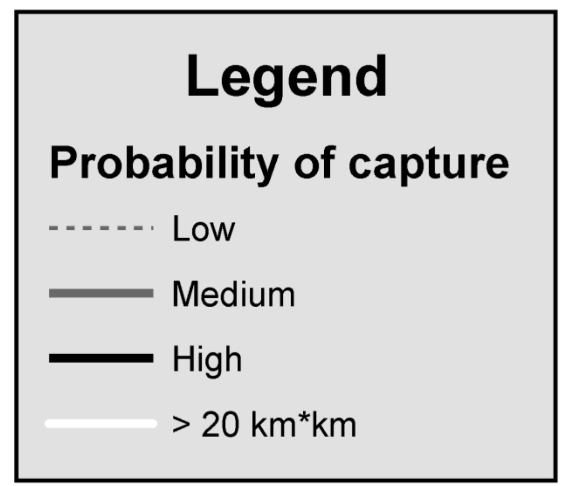
3. Hardisty Creek Storm Water Monitoring

- **Some industrial properties within Town of Hinton are sediment source areas.**
- **Town of Hinton reviewing policy and standards for erosion control plans in existing and new developments.**

IV. Currently Available Tools

1. Fish occurrence probability maps (stream reach)





Upstream fish habitat tool for HWP

Predictive modeling and spatial mapping of fish distributions in small streams of the Canadian Rocky Mountain foothills

Richard J. McCleary and Marwan A. Hassan

Abstract: We developed an automated procedure for modeling spatial distribution of fish occurrence using logistic regression models and geographic information system (GIS) tools. Predictors were measured from a digital elevation model (DEM) and stream layers. We evaluated the accuracy of GIS measures of reach slope through a comparison with field measures. Resource selection function models were used to explain presence–absence of bull trout (*Salvelinus confluentus*), rainbow trout, (*Oncorhynchus mykiss*), nonnative brook trout (*Salvelinus fontinalis*), and all fishes. Our models were extrapolated based on low, medium, and high levels of probability to produce reach-scale maps across 12 000 km^2. We attempted to improve models by adding land-use variables; however, the terrain best suited to road building and harvest also contained the habitat selected by rainbow trout, whereas bull trout generally selected terrain too steep for land use. These confounding factors emphasize the need for process-based investigations in addition to correlative approaches to identify habitat requirements. This automated method provides a rapid evaluation of fish habitat across remote areas useful for salmonid conservation and research planning.

Résumé : Nous avons mis au point une procédure automatisée pour modéliser la répartition spatiale de l'occurrence des poissons à l'aide de modèles de régression logistique et d'outils du système d'information géographique (GIS). Les valeurs prédictives ont été mesurées d'après un modèle digital d'altitude (DEM) et la couche des cours d'eau. Nous avons évalué la précision des mesures GIS des pentes des sections par comparaison avec des mesures de terrain. Des modèles de fonction de sélection des ressources ont servi à expliquer la présence–absence de l'ombre à tête plate (*Salvelinus confluentus*), de la truite arc-en-ciel (*Oncorhynchus mykiss*), de l'omble de fontaine (*Salvelinus fontinalis*) non indigène et de l'ensemble des poissons. Nous avons extrapolé nos modèles à des niveaux bas, moyens et élevés de probabilité pour produire des cartes à l'échelle des sections sur 12 000 km^2. Nous avons essayé d'améliorer les modèles en ajoutant des variables d'utilisation des terres; cependant, les surfaces les plus appropriées pour la construction de routes et pour les récoltes contiennent aussi les habitats sélectionnés par la truite arc-en-ciel, alors que l'ombre à tête plate choisit généralement des terrains trop escarpés pour utilisation humaine. Ces facteurs confondants soulignent la nécessité de faire des investigations reliées aux processus en plus d'utiliser les méthodes de corrélation pour identifier les besoins en habitats. Notre méthode automatisée fournit une évaluation rapide des habitats des poissons dans des régions éloignées qui est appropriée pour la conservation des salmonidés et elle permet une planification de la recherche.

[Traduit par la Rédaction]

Introduction

Quantifying fish distributions in streams and extrapolating these occurrence patterns beyond sampled areas can provide knowledge to support fish conservation planning and guide detailed experimental investigations (Rosenfeld 2003). Impediments to extrapolation of occurrence patterns include identifying key parameters that can be accurately measured with remote methods and addressing scaling issues related to the hierarchical nature of stream systems.

Approaches to modeling fish distributions differ between regions and land-use types. Differences in terrain limit model transferability. Models of fish occurrence used in headwater streams of the mountainous regions of western North America include descriptors of stream size, reach slope, and disruptions in stream connectivity created by obstructions to fish migration (Fransen et al. 2006). Geomorphic characteristics that dictate thermal regime also influence habitat selection by salmonids (Baxter and Hauer 2000). Fish habitat and distribution in the Great Plains of

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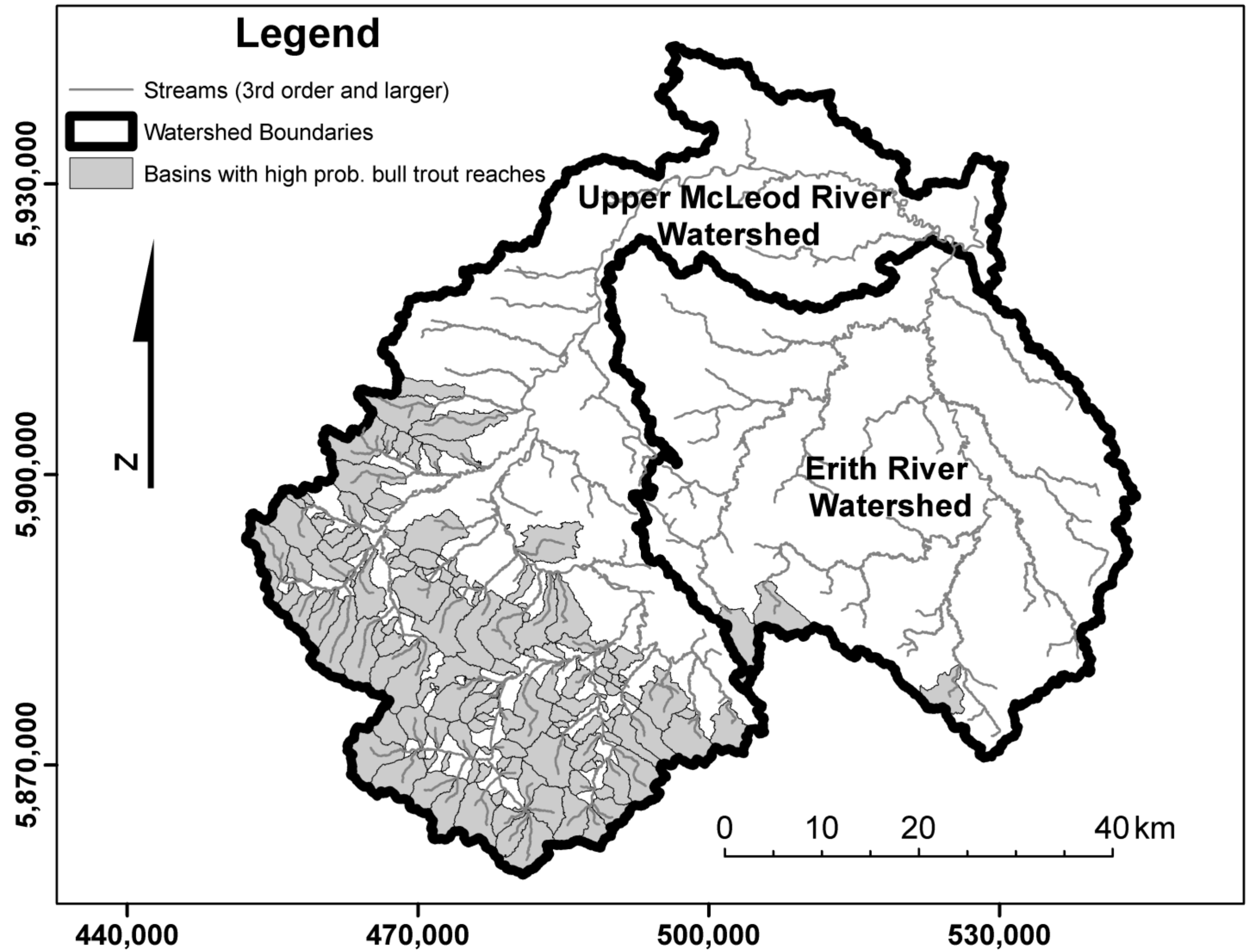
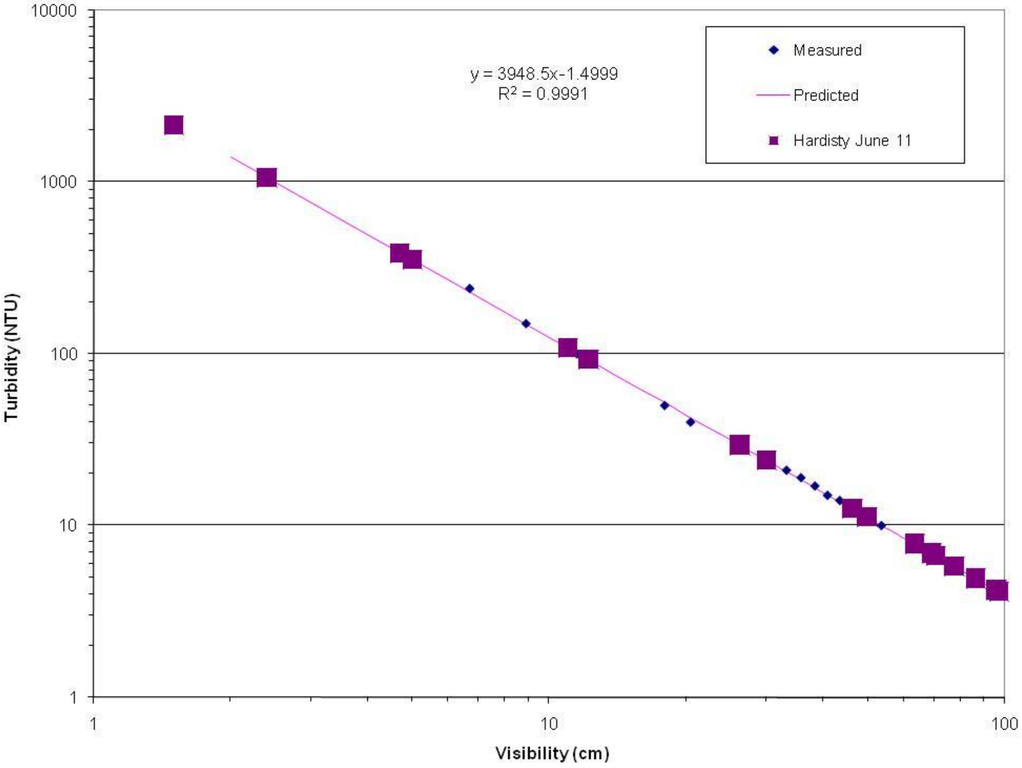
IV. Currently Available Tools

2. Bull trout occurrence probability by watershed



IV. Currently Available Tools
3. Storm water monitoring



IV. Currently Available Tools

Demonstration sites

Summary

- Program role is to support ILM through development of user-friendly databases and tools.
- Tools are developed in close consultation with land managers to meet their needs and focus on key issues.
- Science behind tools is rigorous with publication as target.
- Tools are available for your use.

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CAPP

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NSERC

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Sundre Forest Products

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Questions??