# Using GIS for Natural Resources Research

September 4, 2008 – ESRI Regional User Conference, Edmonton, AB

Presented by: Debbie Mucha, Julie Duval, Katie Yalte, Melissa Pattison

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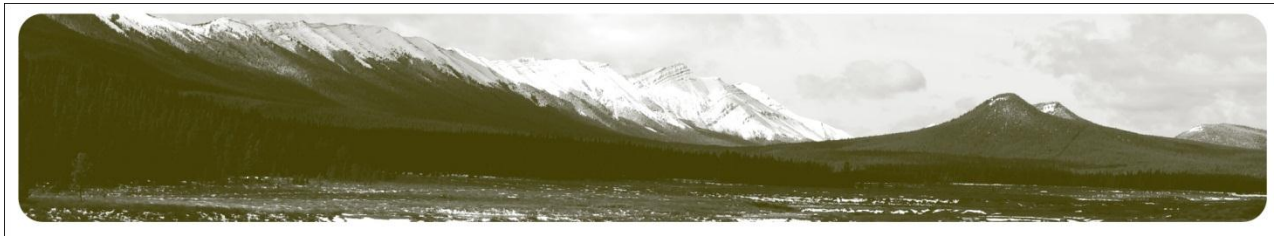
# Agenda

1) Overview of the Foothills Research Institute (FRI)
2) Aboriginal Involvement Program Referral Process
3) Spatial Data Cataloguing at the FRI
4) Grizzly Bear Program
5) Wrap-up



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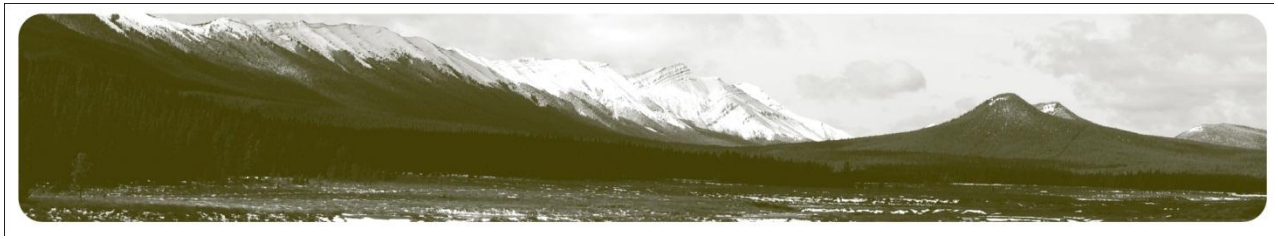
# Our Mission:

The Foothills Research Institute is a unique community of partners tied to the land and its people through a common concern for the welfare of the land and its resources.



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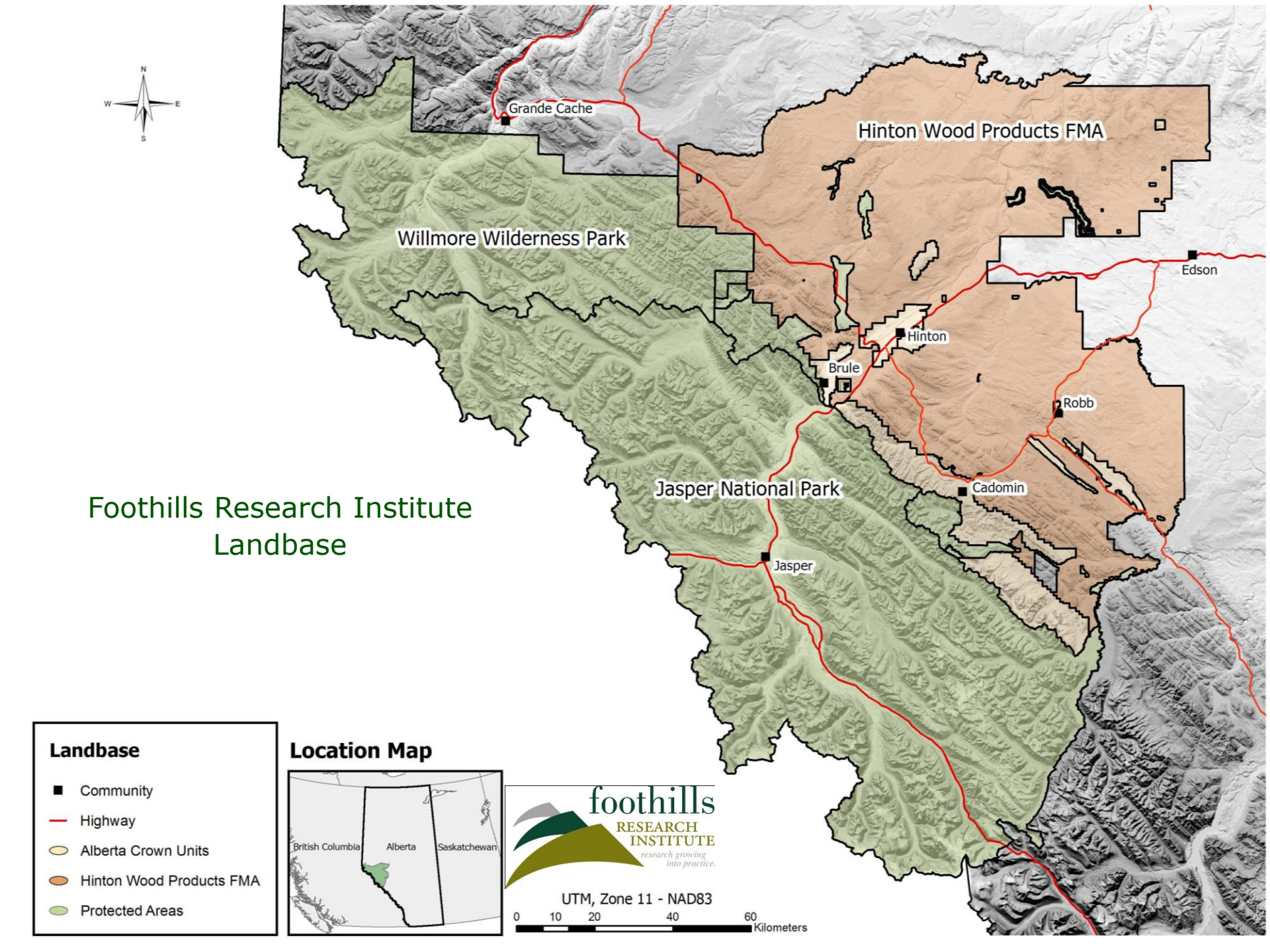
Grande Cache
Hinton Wood Products FMA
Willmore Wilderness Park
Edson
Hinton
Brule
Robb
Jasper National Park
Cadomin
Jasper
Foothills Research Institute
Landbase
Landbase
Community
Highway
Alberta Crown Units
Hinton Wood Products FMA
Protected Areas
Location Map
British Columbia
Alberta
Saskatchewan
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UTM, Zone 11 - NAD83
0
10
20
40
60
Kilometers

# Sponsoring Partners

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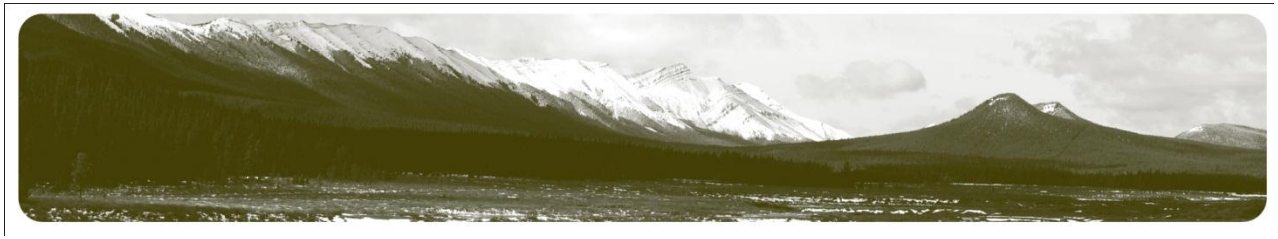

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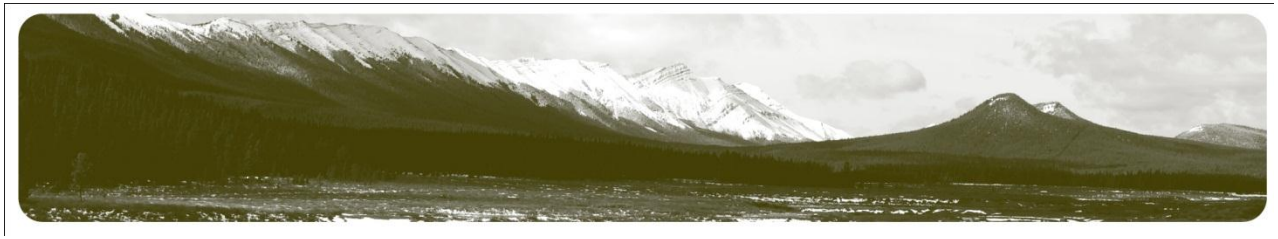
# What We Do…

- Applied research
- Generate knowledge and develop management tools
- Communications and Extension



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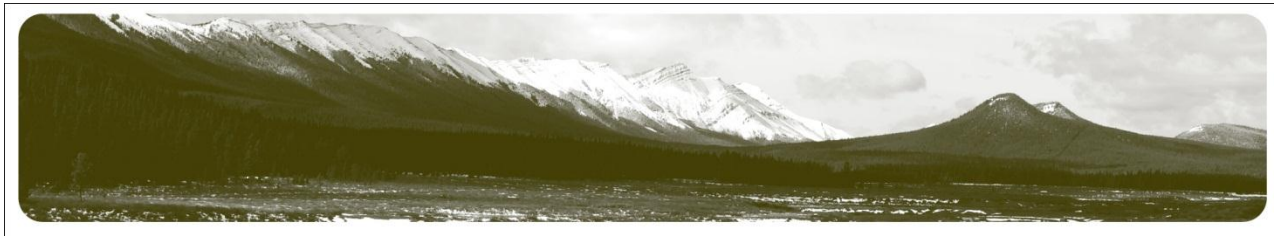
# How We Do It…

- Partnerships
- Relevant
- Sound Governance
- Efficiencies through strong administration



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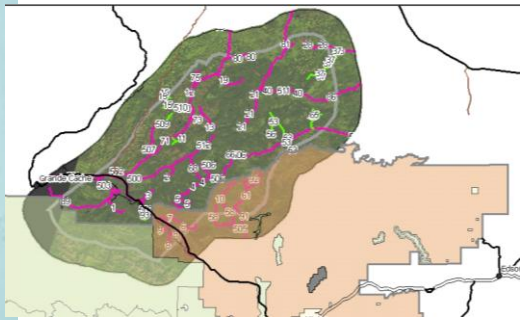
# Research Programs

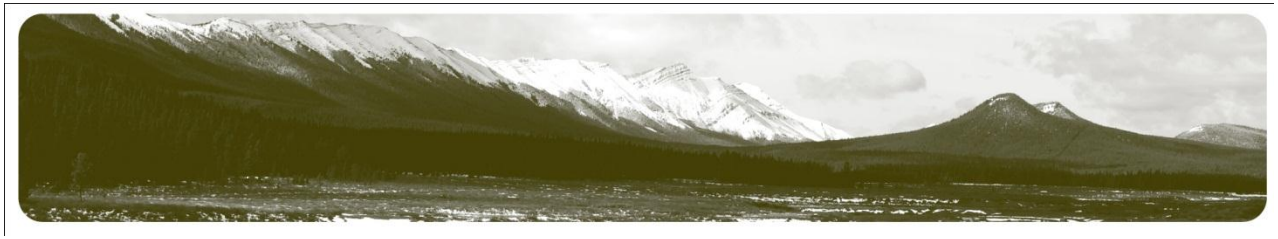
- Grizzly Bear
- Natural Disturbance
- Fish & Watershed
- Aboriginal Involvement
- Social Sciences
- Adaptive Forest Management
- Mountain Pine Beetle Ecology Program

# Associations to Minimize Impacts





- Foothills Stream Crossing Association
- Foothills Landscape Management Forum



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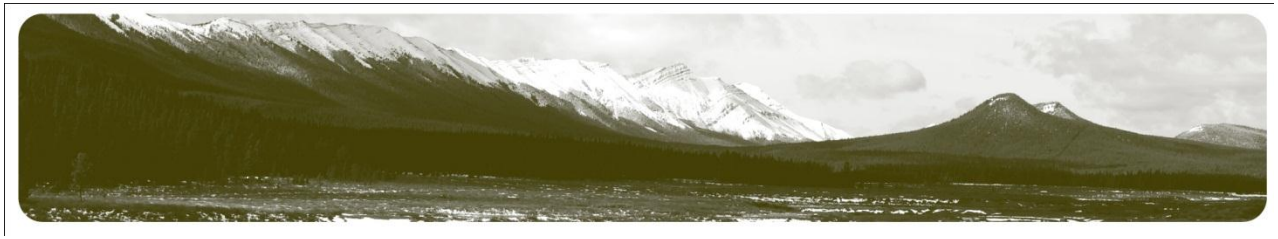
# New Programs

- Water
- Climate Change
- Forest Community
- Circumboreal Initiative
- Yellowhead Ecosystem Management Group



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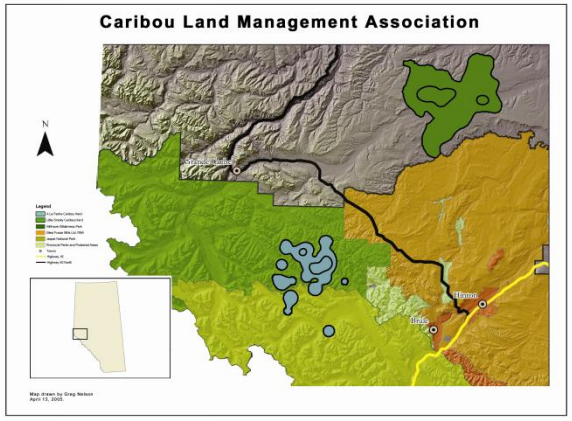
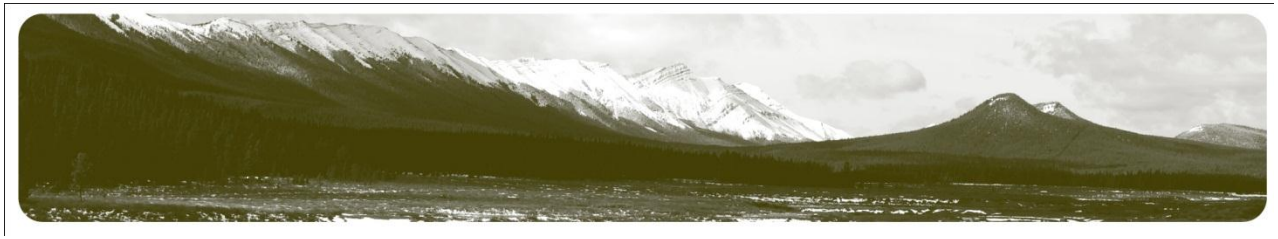
# Support Programs




- Communications & Extension
- Geographic Information Systems (GIS)



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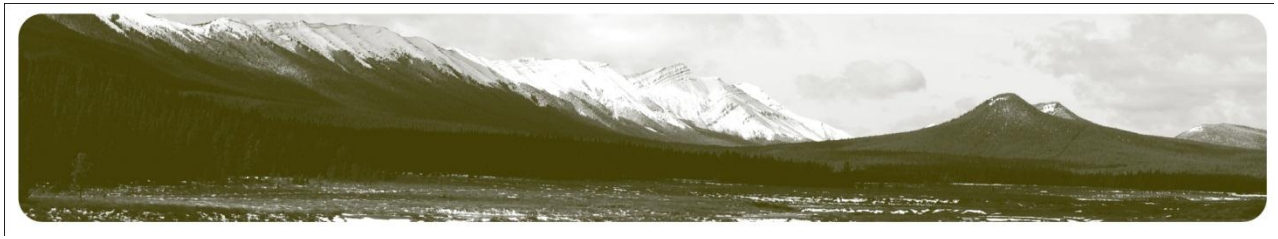
# GIS at the FRI

**STAFF**

- 3 full-time GIS Staff - GIS Program
- 1 full-time GIS Staff - Aboriginal Involvement Program
- Work also with GIS contractors/researchers/students

- Approximately 7 regular GIS users on staff (we have a total of 11 FT staff and 3 PT staff on site)
- ~6 program leads offsite



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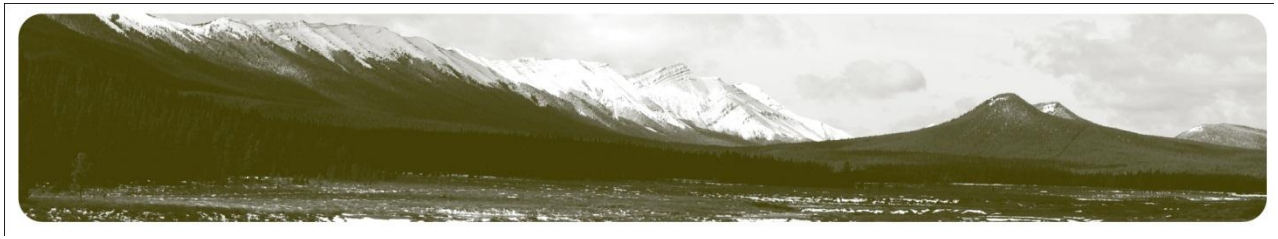
# GIS at the FRI

**SOFTWARE/HARDWARE**

- ARCGIS 9.2 SP 6
- 4 Arcinfo licenses, 3 Arcview, 2 grid, 1 tin
- ArcIMS 9.1
- World Construction Set/Visual Nature Studio
- Microsoft Access (also have SQL Server Std. edition)
- ~ 1TB of data on server (imagery/orthophotos)
- Strong I.T. support role



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# Aboriginal Involvement Program Referral Process

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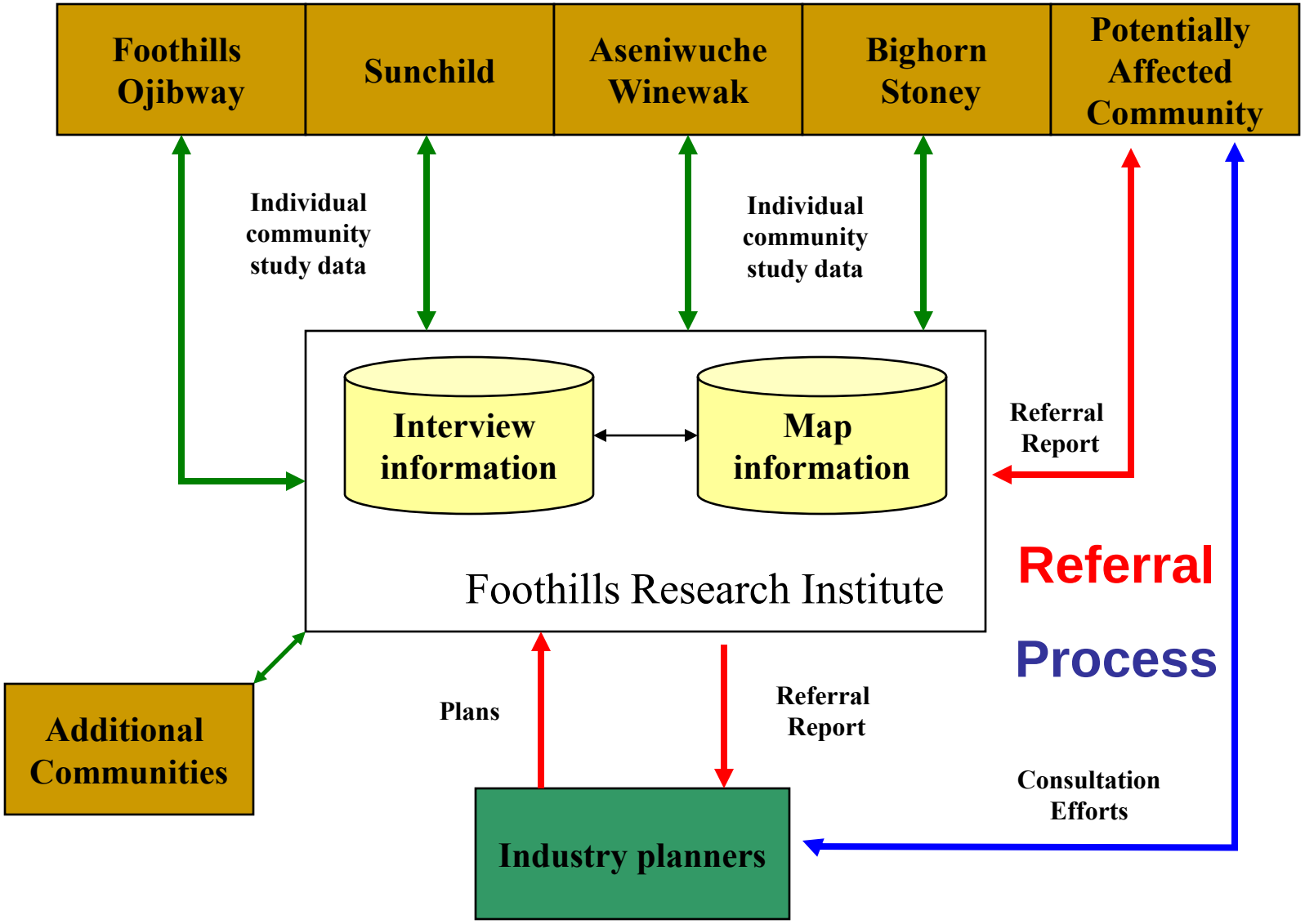
# Multi-community Traditional Cultural Study



# How We Do It

- Train community members in the use of GPS units and field sheets
- Import GPS data into a spatial PGDB, input field sheet data into a non-spatial DB (MS Access)
- Accept proposed development locations from industry in both spatial and non-spatial formats
- Run a process recently automated by Sir Sandford Fleming GIS Applications Specialist co-op students to determine areas of conflict
- Distribute results to industry and community representatives via Referral Reports

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# Data Management & The Process

- Originally used a “point & click” method with past versions of ArcGIS 9.x that required an ArcInfo license and a third party ArcMap extension
- Automated process in summer of 2008 and now use ArcView 9.2

**Benefits:**

- No longer require an ArcInfo license and third party extension to run the process, ArcView 9.2 license is sufficient
- The Referral Process can now be run by just about anyone

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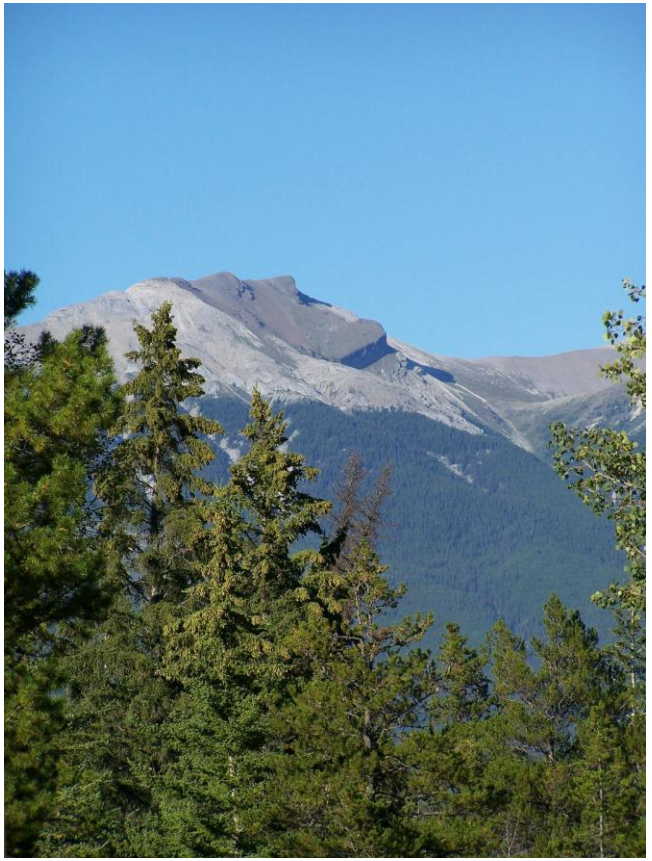
# Aboriginal Involvement Program Referral Process

***What We've Accomplished:***

**Multi-community Traditional Cultural Study**

1)Documented and stored over 2300 TLU sites from 5 communities

2)Trained over 25 community technicians



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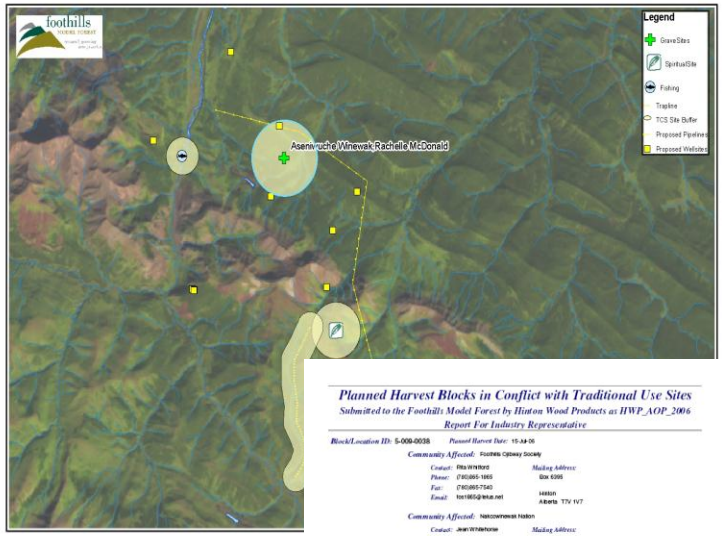
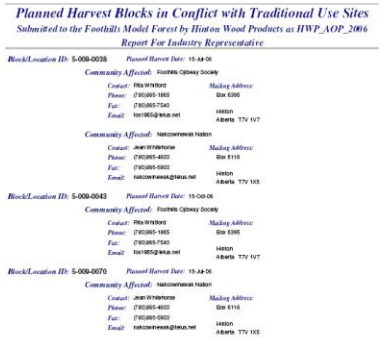
# Aboriginal Involvement Program
# Referral Process

## *What We've Accomplished:*

### Referral Process

1) 1 pilot from Government (Alberta TPRC)
2) 9 pilot referral runs by 4 companies (Shell, Suncor, West Fraser, Coal Valley Resources)
3) Protection of 91 cultural sites from potential disturbances
4) Savings to companies of $10-30k per day of planning time by using process





Planned Harvest Blocks in Conflict with Traditional Use Sites
Submitted to the Foothills Model Forest by Hinton Wood Products as HWP_AOP_2006
Report For Industry Representative


Pilot Study
Draft

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# Aboriginal Involvement Program
# Referral Process

## Bragging Rights:

1) We have the highest density of traditional data documented in the nation
2) We are the first operational 'Alternative Regional Consultation Notification and Support Model' in the nation
3) We have a regional co-ordination table for access and communication with communities for land use
4) To date, we have had no major political blow ups or blockades

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# Spatial Data Cataloging

Outline

1. Goal
2. Inventory
3. Editor
4. Distribution/Use

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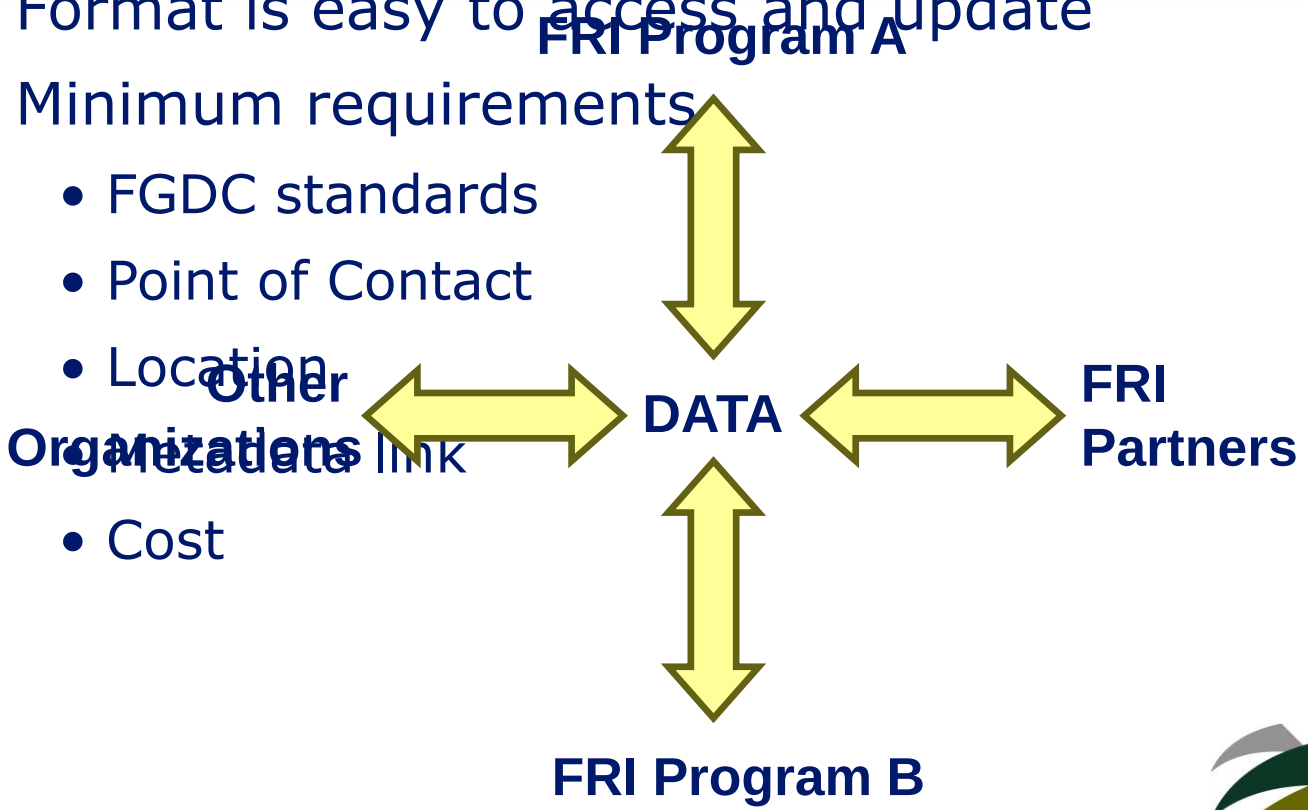
# 1. Goal

- Role of GIS Program
  - Support GIS and data management
    - Format is easy to access and update
    - Minimum requirements
      - FGDC standards
      - Point of Contact
      - Location
      - Metadata link
      - Cost

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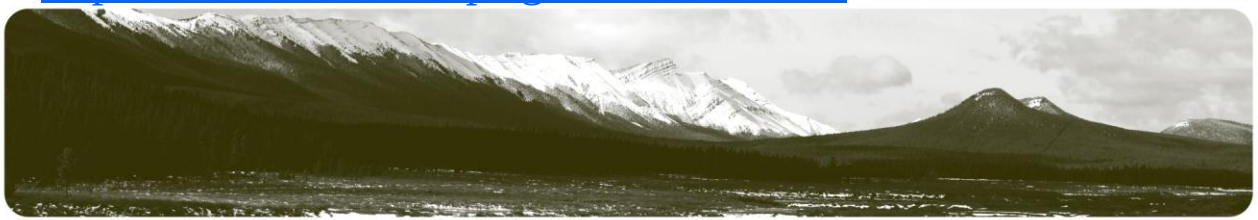
# 2. Inventory

- Software
  - ArcCatalog 9.2


  - NPS Metadata Tools


http://science.nature.nps.gov/nrdata/tools/

| Tool/Feature |
| --- |
| Create metadata for non-spatial datasets |
| Import ITIS (Biological Profile) metadata |
| Parse with MetaParser |
| Upload XML metadata to the NPS Data Store |
| Update metadata with XML templates |
| Edit XML metadata using stylesheets (including NPS-specific elements) |
| Export metadata in multiple formats |
| Create an MSAccess metadata catalog database |
| Search metadata records |
| Import *.e00 and *.shp metadata |
| Edit XML metadata using a text editor |
| Spellcheck metadata records |
| Search and replace text in a metadata record |
| Create XML metadata templates |
| Harvest entity and attribute information for geospatial data |



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# 2. Inventory

- Issues
  - Time consuming
  - Over-achieves on export
  - Under-achieves on import

- Resolutions
  - Data management
  - Manual refinement

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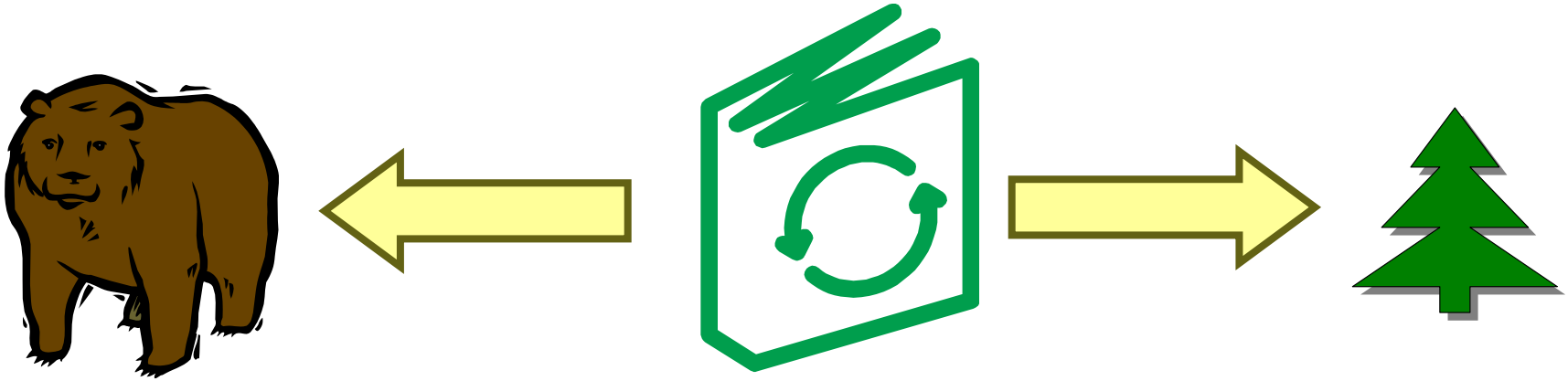
# 2. Inventory

- Benefits
  - Low cost and simple
  - Overview of metadata
  - meets FGDC standards
  - Outputs a Queriable Spatial Data Catalog



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# 3. Editor

- Software
  - ArcCatalog 9.2


  - EME (**E**nvironmental Protection Agency **M**etadata **E**ditor)



http://innovateteam.com/projects/epa-metadata-editor/

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# 3. Metadata Editor

- Issues
  - EPA specific
  - Lacking batching capabilities of other editors
    - NPS & MeauxData
- Resolutions
  - Limited customization for Foothills Research Institute
  - EPA(ver3) or ESRI(9.3) develop batch editor ?

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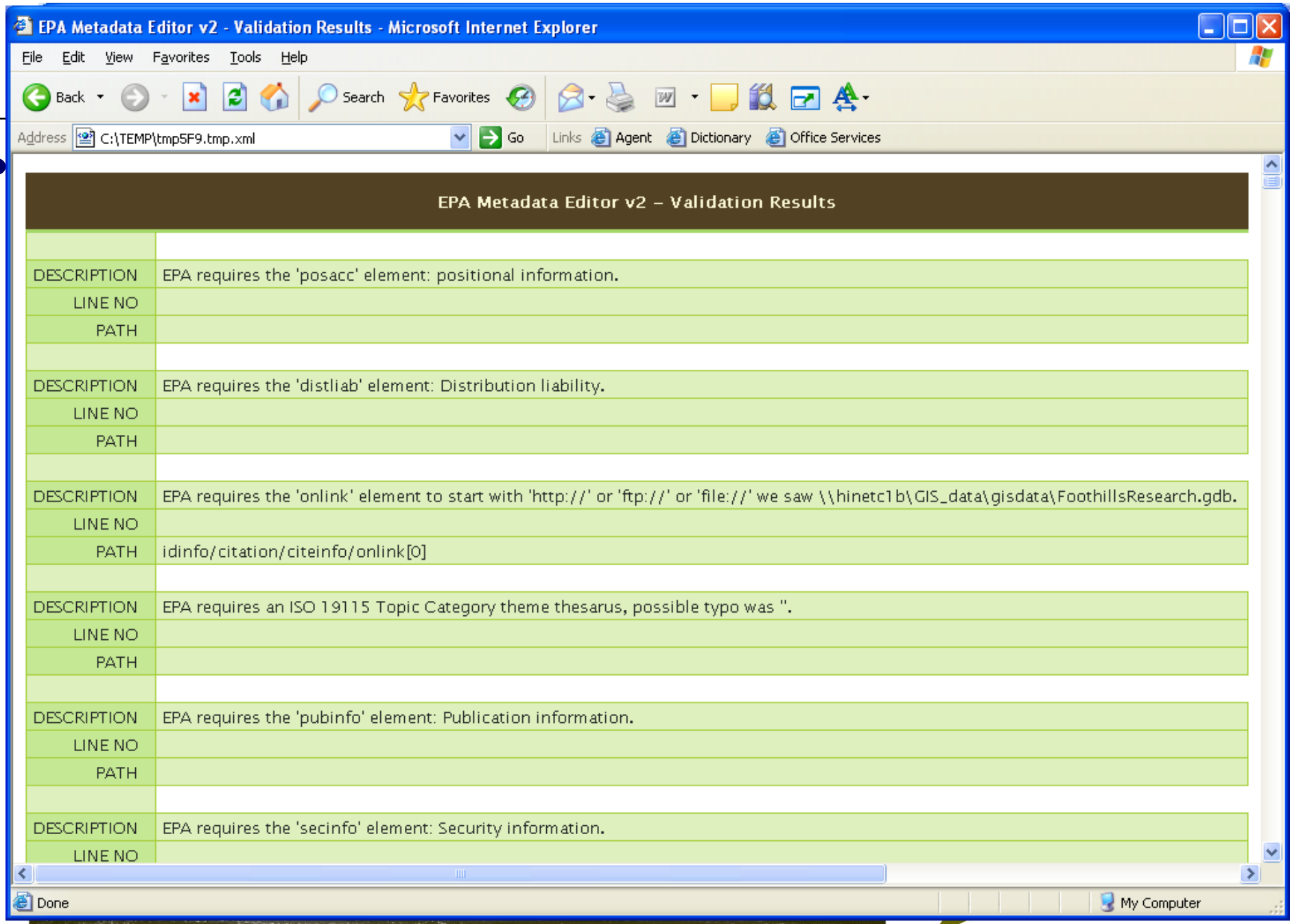
EPA Metadata Editor v2 - Validation Results - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address C:\TEMP\tmp5F9.tmp.xml
Go
Links Agent Dictionary Office Services
EPA Metadata Editor v2 – Validation Results
DESCRIPTION EPA requires the 'posacc' element: positional information.
LINE NO
PATH
DESCRIPTION EPA requires the 'distliab' element: Distribution liability.
LINE NO
PATH
DESCRIPTION EPA requires the 'onlink' element to start with 'http://' or 'ftp://' or 'file://' we saw \\hinetc1b\GIS_data\gisdata\FoothillsResearch.gdb.
LINE NO
PATH idinfo/citation/citeinfo/onlink[0]
DESCRIPTION EPA requires an ISO 19115 Topic Category theme thesarus, possible typo was ''.
LINE NO
PATH
DESCRIPTION EPA requires the 'pubinfo' element: Publication information.
LINE NO
PATH
DESCRIPTION EPA requires the 'secinfo' element: Security information.
LINE NO
Done
My Computer

# 4. Distribution

Options

- Website Catalog
- Web Accessible Folder
- Metadata Services
  - Z39.50 Client
- Data Portal

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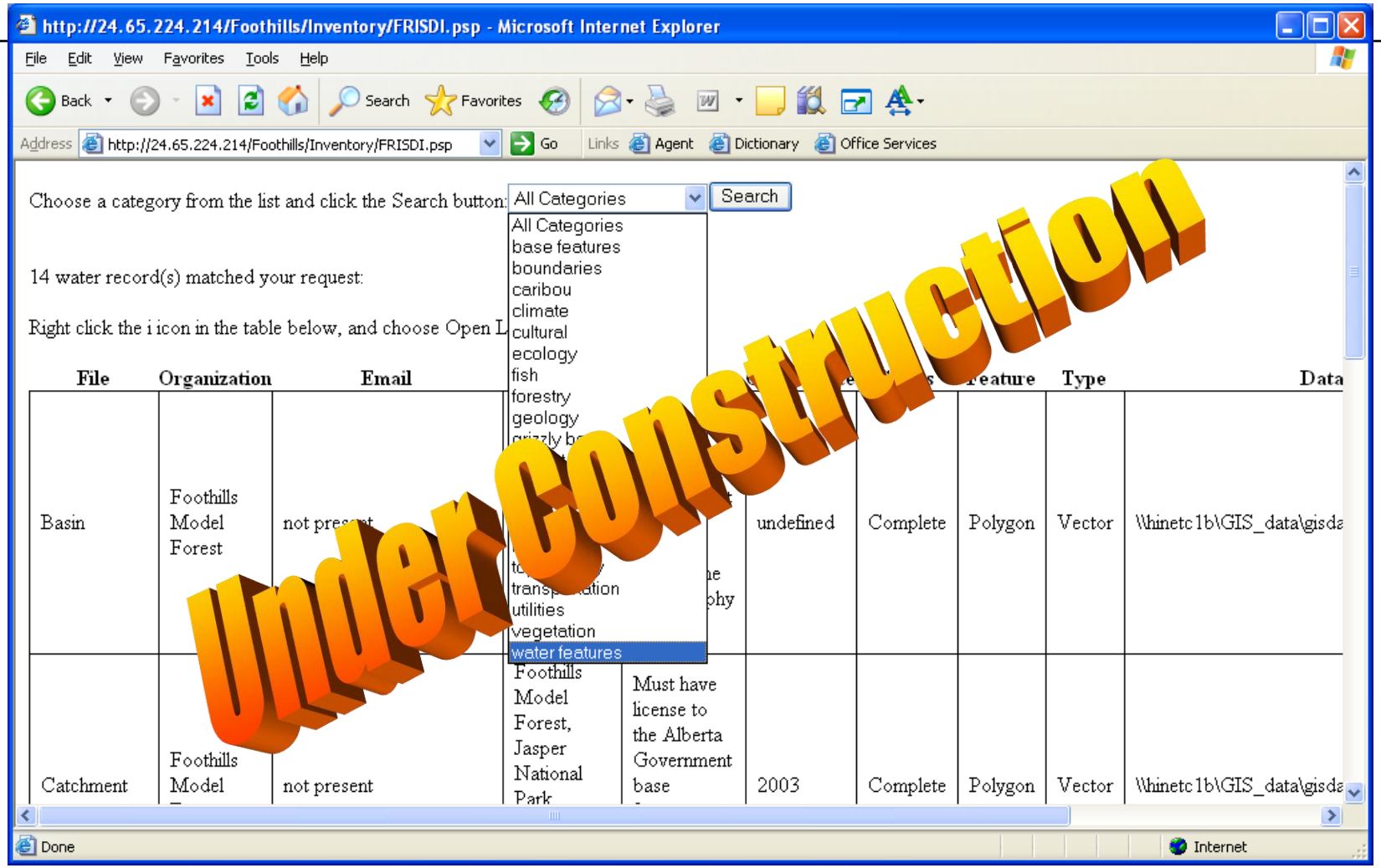
# 4. Distribution



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# Next Steps

- Train staff – metadata and editing
- Research & development for metadata distribution
- Provide a searchable spatial data catalog for FRI programs, partners and other organizations

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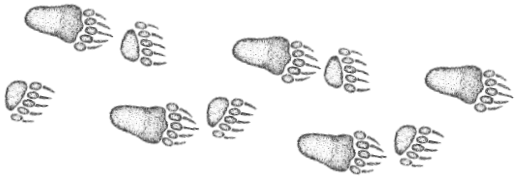
# Grizzly Bear Program (1998-today)

To provide resource managers with the necessary knowledge and planning tools to ensure the long-term conservation of grizzly bears in Alberta



The Grizzly Bear Program (GBP) was initiated in 1998 as an outcome of environmental hearings on the proposed Cheviot coal mine southwest of Hinton.

The GBP began tracking grizzly bears in 1999 using GPS radio-telemetry collars, to increase our understanding of how grizzly bears respond to human use on the landscape.

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# Grizzly Bear Program - Research Areas

Research for the GBP is the work of a multidisciplinary team in the following areas:

- Habitat Mapping and Landscape Change
- Graph Theory Modeling
- Statistical Analysis and Modeling
- Camera Collars
- Bear Capture/Ecology
- DNA – Status and Trends
- Wildlife Health
- GIS Applications

Grizzly Map


http://www.fmf.ab.ca/pa_GB.html

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# Grizzly Bear Program - Data Collection

Since 1999, 171 grizzly bears have been captured by the GBP, either by aerial darting or in leg-hold snares, and fitted with GPS collars (a few with cameras).

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# Grizzly Bear Program - Data Capture Costs

298 grizzly bear captures
@ $6,000 per capture = **$1,788,000**

126 collars have been used
@ $4,000 (avg) per collar = **$504,000**
(82 collars available for use –-> 28 currently on bears)

$75,000 to $90,000 per year spent on flying
(for capture efforts, tracking and telemetry 'uploads')
Over ten years: **$750,000 to $900,000**.

Total: **$3,100,000**

Program Total:
$14 Million

Compare to $60/location in the early 1980s

On 185,000 valid GPS locations:
**$16.75 per location**

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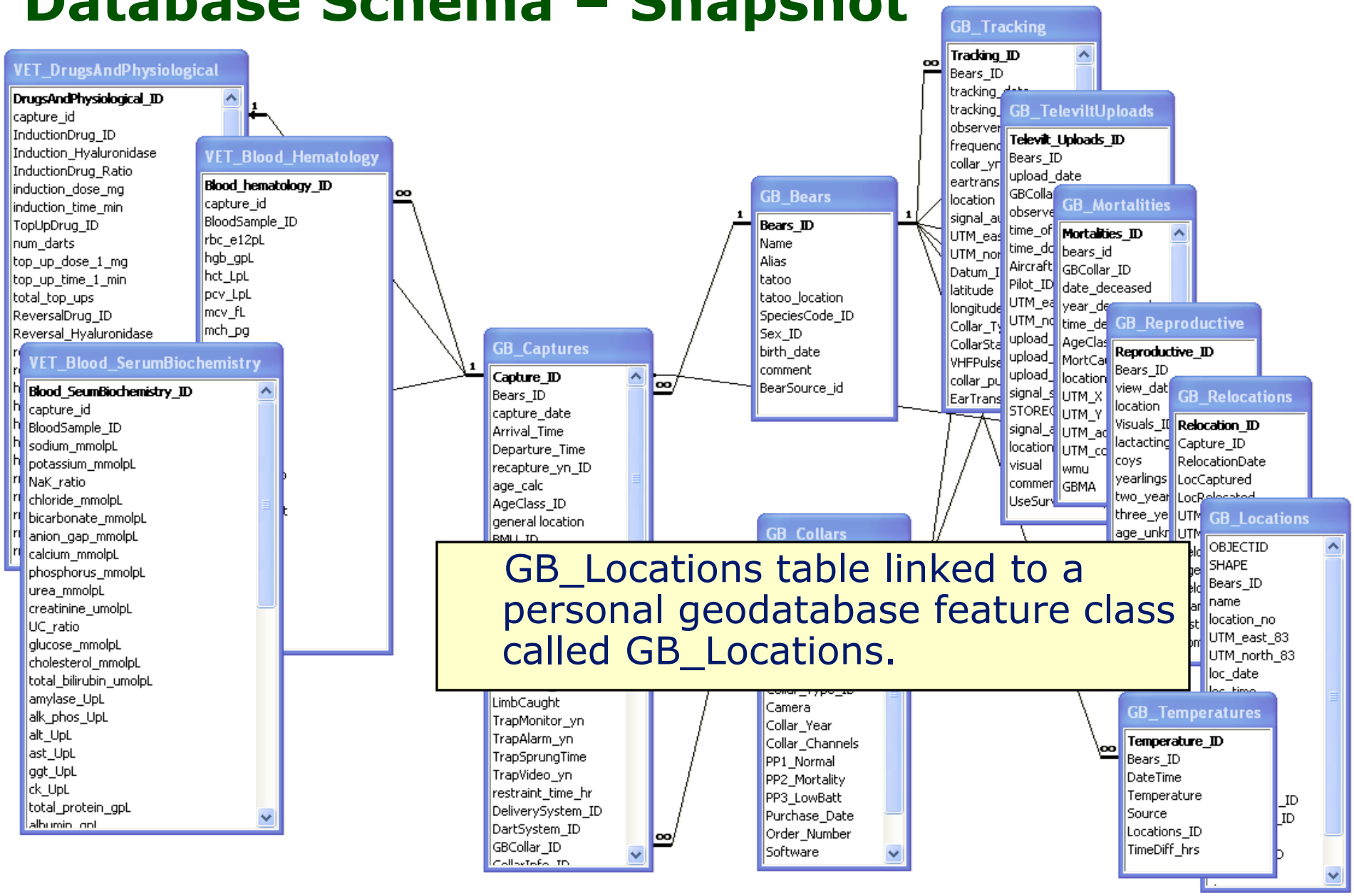
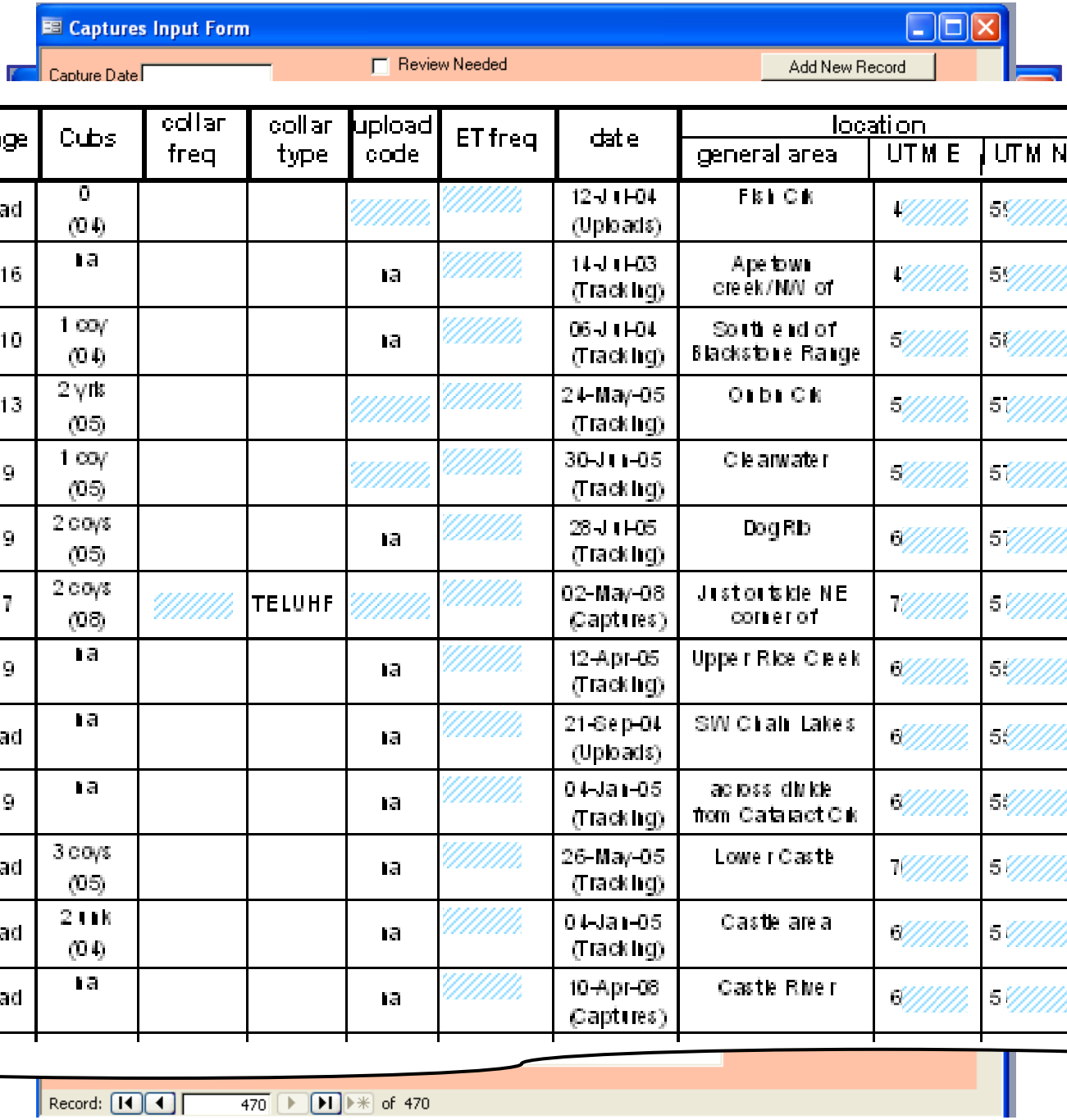
# Database Schema – Snapshot




GB_Locations table linked to a personal geodatabase feature class called GB_Locations.




| bear id | sex | age | Cubs | collar freq | collar type | upload code | ET freq | date | location | | | General Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | general area | UTM E | UTM N | |
| G067 | F | ad | 0 (04) | | | | | 12-Jul-04 (Uploads) | Fish Clk | 4 | 5 | Grande Cache |
| G068 | M | 16 | na | | | na | | 14-Jul-03 (Tracking) | Apetown creek/NW of | 4 | 5 | Grande Cache |
| G070 | F | 10 | 1 coy (04) | | | na | | 06-Jul-04 (Tracking) | South end of Blackstone Range | 5 | 5 | FMF Core |
| G071 | F | 13 | 2 yrlg (05) | | | | | 24-May-05 (Tracking) | Orbit Clk | 5 | 5 | Clearwater |
| G073 | F | 9 | 1 coy (05) | | | | | 30-Jun-05 (Tracking) | Clearwater | 5 | 5 | Clearwater |
| G075F | F | 9 | 2 coys (05) | | | na | | 28-Jul-05 (Tracking) | Dog Rib | 6 | 5 | Clearwater |
| G077 | F | 7 | 2 coys (06) | | TELUHF | | | 02-May-06 (Captures) | Just outside NE corner of | 7 | 5 | Waterton |
| G078 | M | 9 | na | | | na | | 12-Apr-05 (Tracking) | Upper Rice Creek | 6 | 5 | Livingstone |
| G079 | M | ad | na | | | na | | 21-Sep-04 (Uploads) | SW Chain Lakes | 6 | 5 | Livingstone |
| G080 | M | 9 | na | | | na | | 04-Jan-05 (Tracking) | across divide from Cataract Clk | 6 | 5 | Livingstone |
| G081 | F | ad | 3 coys (05) | | | na | | 26-May-05 (Tracking) | Lower Castle | 7 | 5 | Waterton |
| G082 | F | ad | 2 unk (04) | | | na | | 04-Jan-05 (Tracking) | Castle area | 6 | 5 | Waterton |
| G083 | M | ad | na | | | na | | 10-Apr-06 (Captures) | Castle River | 6 | 5 | Waterton |

# GPS Data Management

- Originally used aml code and menus to process the raw data.
- Converted aml code to python in summer 2007 and added as tools in the toolbox

**Benefits:**

- No longer require ArcInfo license to process data, ArcView license is sufficient
- The task of processing incoming raw data is now done by the wildlife biologist

**Technical issues:**

- Not able to display output feature class in ArcMap – known issue

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# Raw GPS Data Processing

ATS

Simplex

Tellus / Satlink

Argos

Pre-processing of raw data

Data preview, checking & cleaning

Add new GPS data

Personal Geodatabase

- Collar Data Processing
  - 1. Pre-processing
    - a. Flip Data File
    - b. process Argos Direct Data
    - b. process Tellus Raw Data
  - 2. Preview data
    - preview ATS Data
    - preview Televilt/Argos Data
  - 3. Add to GeoDatabase
    - a. Delete Selected Features
    - b. add GPS Locations to GDB
    - b. add GPS Locations to GDB - ATS
    - c. Compact GeoDatabase
    - d. Make a COPY of GB_Locations
  - 4. Data Checking
    - Check for Errors in GB_Locations

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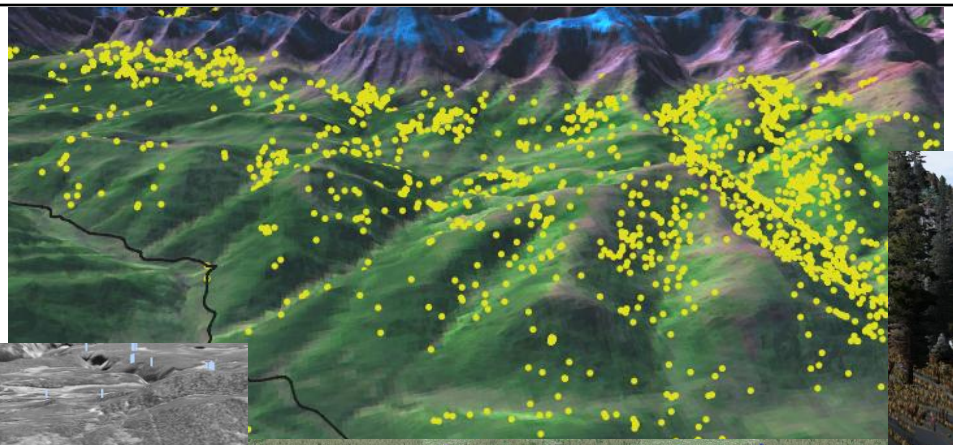
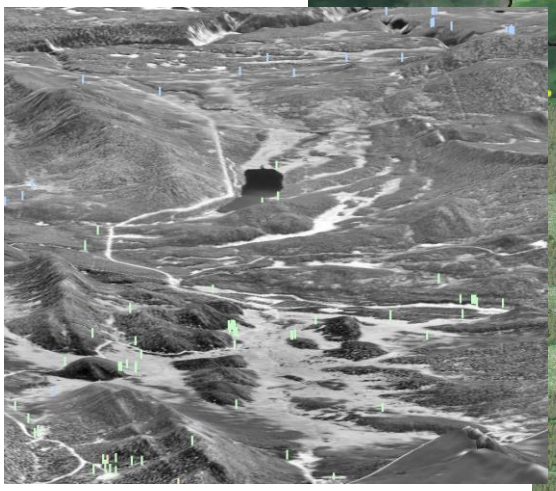
# Grizzly Bear Program - Visualization





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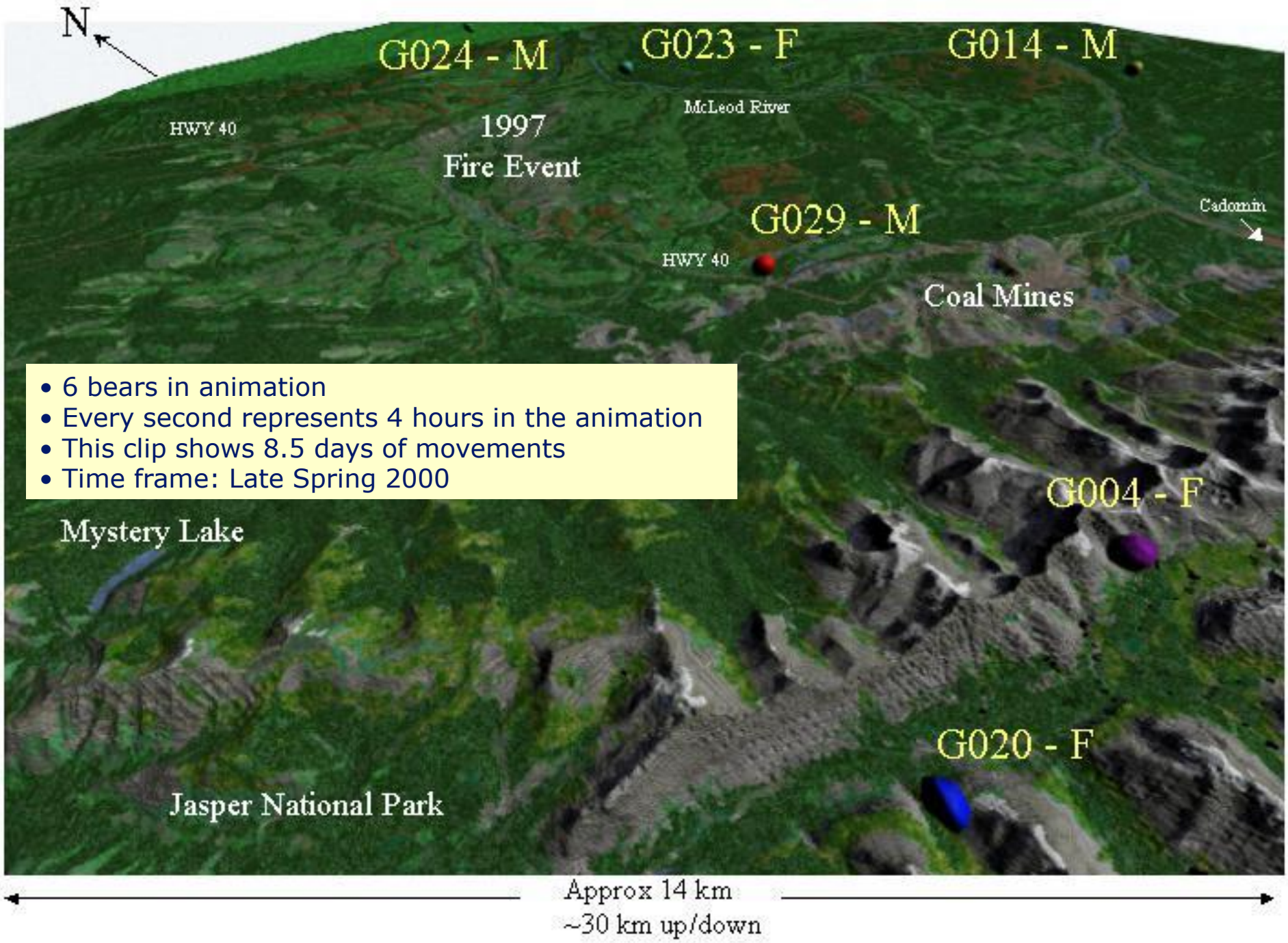
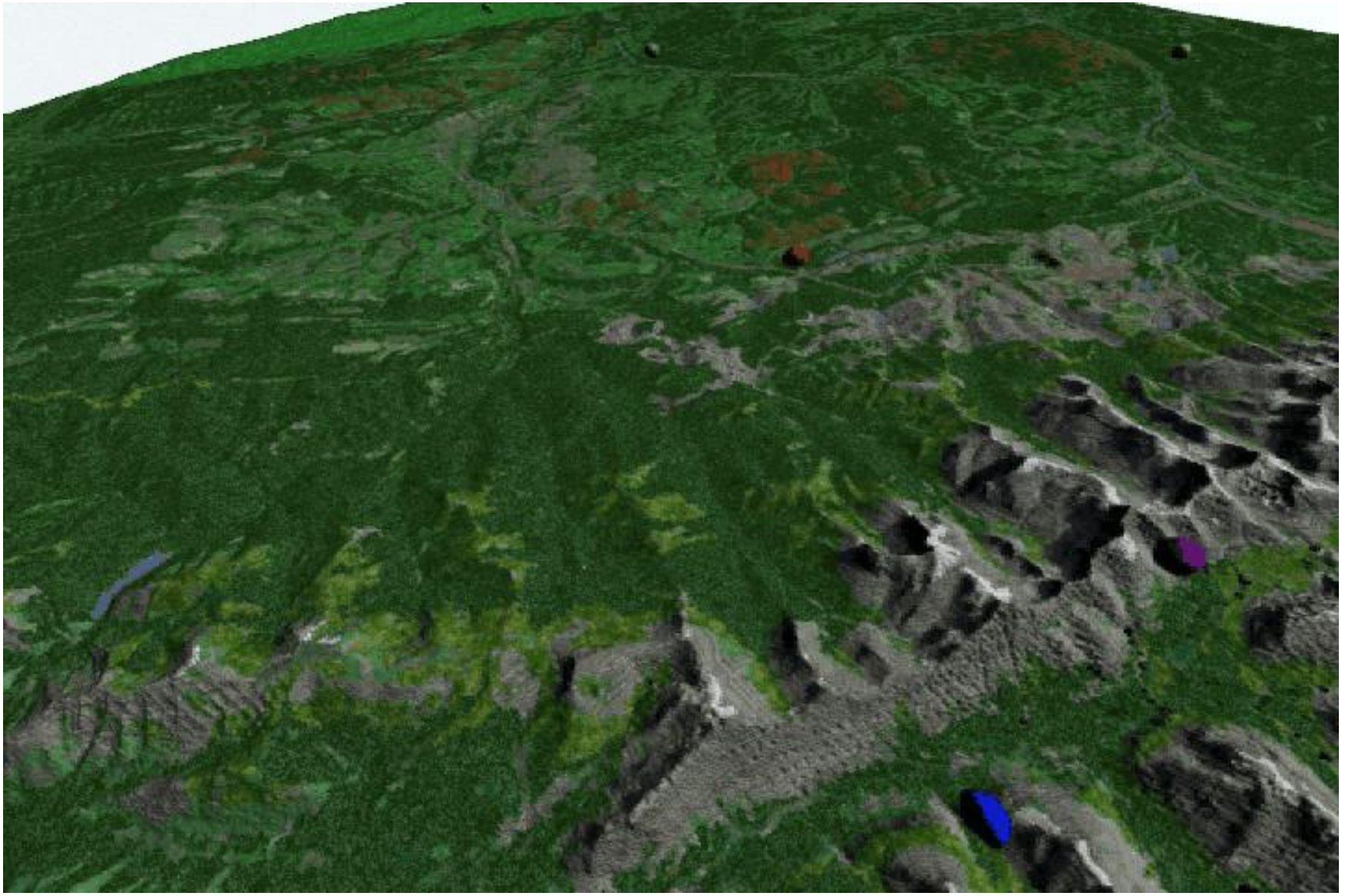

N
G024 - M
G023 - F
G014 - M
HWY 40
McLeod River
1997
Fire Event
G029 - M
HWY 40
Cadomin
Coal Mines
• 6 bears in animation
• Every second represents 4 hours in the animation
• This clip shows 8.5 days of movements
• Time frame: Late Spring 2000
G004 - F
Mystery Lake
G020 - F
Jasper National Park
Approx 14 km
~30 km up/down



# Conclusion

- Focus on reducing data duplication & redundancy and contributing to improved data sharing across the landbase
- Strength in partnerships and working together
- Remain a leader in providing world-class GIS and data management to programs and partners

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# A Partnership That Produces Results!

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