Foothills Model Forest
Annual General Meeting
November 2006

FMF Grizzly Bear Research Program
Gordon Stenhouse
Long Term Program Goal

- To provide resource managers with the necessary knowledge and planning tools to ensure the long-term conservation of grizzly bears in Alberta.
Phase 3 Program Objectives

1. Continue the production of maps and models for grizzly bear habitat in Alberta.
2. Increase our knowledge and understanding of grizzly bear habitat use and populations.
3. Deliver new products and tools to program partners and aid in application of research results.
4. Provide training and outreach for program deliverables.
5. Maintain and expand program partner support.
Program Research Team

◆ Habitat Mapping and Landscape Change
  Dr. Steven Franklin (U of Saskatchewan)
  Dr. Greg McDermid (U of Calgary)
  Alysha Pape - MSc student
  Ame Wunderle - MSc student

◆ Resource Selection Modeling
  Dr. Mark Boyce (U of Alberta)
  Dr. Scott Nielsen – post doc
  Carrie Roever - MSc student

◆ Graph Theory Modeling
  Barb Schwab (Wilfred Laurier) - PhD student

◆ Camera Collars
  Dr. Naser El-Sheimy (U of Calgary)
  Andrew Hunter - PhD student

◆ DNA – Status and Trends
  Dr. David Paetkau
  Dr. Michael Proctor
  Dr. Curtis Strobeck (U of Alberta)
  Dr. Sam Wasser (U of Washington)
  Dr. John Boulanger (statistician)

◆ Animal Health and Physiology
  Dr. Marc Cattet (CCWHC)
  Dr. Nigel Caulkett (U of Saskatchewan)
  Dr. Matt Vijayan (U of Waterloo)
  Dr. Janice Barr (U of Illinois)
  Dr. David Janz (U of S)
  Ruth Carlson – PhD student

◆ GIS Applications - FMF
  Jerome Cranston
  Julie Duval
Phase 3 Program Objectives

1. Continue the production of maps and models for grizzly bear habitat in Alberta.
Our Approach –

How is this accomplished?
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

1999:

6051 locations
13 bears

Total: 6051
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2000:

8997 locations
20 bears

Total: 15,048
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2001:
11632 locations
20 bears

Total: 26,680
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2002:

8512 locations
23 bears

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Total: 35,192
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2003:
11,696 locations
32 bears

Total: 46,888
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2004:
11131 locations
30 bears

______________
Total: 58,019
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2005:
32279 locations
30 bears

Total: 90,298
Step 1: Grizzly Bear Habitat Use data

GPS locations collected:

2006:
20,872 locations
15 bears

Total: 124,171
The 124,171 GPS locations collected to date by the GBRP have been combined with location data from other research projects to form a comprehensive provincial database.

Step 1: Grizzly Bear Habitat Use data

- GBRP Bear Locations (GPS)
- Crowsnest
- ESGBP
- Kcountry
Remote sensing is the basis for grizzly bear habitat mapping. Landsat TM5 imagery is used to create classified landcover maps of all grizzly bear range in Alberta.
Step 2: Create a habitat base map

Remote sensing is the basis for grizzly bear habitat mapping. Landsat TM5 imagery is used to create classified landcover maps of all grizzly bear range in Alberta.

... is grouped into classes
Remote-sensing based mapping of all GB range in Alberta

The Remote Sensing landcover maps are also used to derive vegetation models: crown closure, Leaf Area Index, and conifer/deciduous composition.
Remote sensing is the basis for grizzly bear habitat mapping. Landsat TM5 imagery is used to create classified landcover maps of all grizzly bear range in Alberta.

The landcover maps have been combined with the GPS locations to create Resource Selection Function (RSF) models of grizzly bear distribution.

When GPS locations are overlaid with classified landcover maps,
Step 3: Produce RSF Maps

Remote sensing is the basis for grizzly bear habitat mapping. Landsat TM5 imagery is used to create classified landcover maps of all grizzly bear range in Alberta.

The landcover maps have been combined with the GPS locations to create Resource Selection Function (RSF) models of grizzly bear distribution.

...and a map showing the probability of occurrence of grizzly bears can be created.
Phase 3 Program Objectives

2. Increase our knowledge and understanding of grizzly bear habitat use and populations.
Security and Road Densities

Survival rate vs. access density (km/km²)
Although bears use areas with high risk, use of these areas is considered risky business.

**Mortality risk**

**Defining mortality sites**

- Low risk
- Moderate risk
- High risk
- Very high risk

Human-caused mortality risk:

- Low
- Moderate
- High
- Very high
Safe Harbours for Grizzly Bears

Where are the areas of best habitat and lowest probability of mortality for grizzly bears on the landscape?

We have termed these areas - safe harbours.
A combination of high RSF and low mortality risk defines a safe harbour.
Grizzly Bear Movement Corridors

Where are they and how important are they?
Where are the travel corridors?

Graph Theory travel corridors connect areas of high-quality habitat. The darker and thicker the lines, the more likely they are to be used as travel routes.
But they’re just models..........how good are they really???????
The DNA surveys showed that grizzly bears were concentrated in the western portions of the sampled area. Sampling grid cells are outlined in white.

Surveyed 2004
Grid cell population: 42

Surveyed 2005
Grid cell population: 44

Height of blue lines is proportional to number of GB hits at DNA bait sites

DNA census hits, 2004-2005, looking west
The surveys also showed that the RSF surface, which was used in sampling site selection, was an excellent predictor of grizzly bear distribution.
Watersheds classified by mean RSF value were also useful coarse-level predictors of grizzly bear distribution.

Height of blue lines is proportional to number of GB hits at DNA bait sites

DNA census hits, 2004-2005, looking west
Relatively few bears were found in the heavily roaded eastern portion of the survey area.

Height of blue lines is proportional to number of GB hits at DNA bait sites.

DNA census hits, 2004-2005, looking west
Phase 3 Program Objectives

3. Deliver new products and tools to program partners and aid in application of research results.
What has been provided to date:

The models are GIS layers that can be overlaid with other feature layers, such as proposed developments, to determine their interaction.
All Partners have received:

1. Landcover mapping
2. RSF Mapping
3. Mortality Risk Model
4. Safe Harbour Mapping
5. Movement Corridors
Map Updated every 2 years

Grizzly Bear Project
Habitat Mapping Phases

Phase 7
Phase 6
Phase 5
Phase 4
Phase 3

Eastern Limit of Grizzly Bear Range

Map Updated every 2 years

Drawn By: J. Cranston
Date Drawn: Sep. 11, 2006
Phase 3 Program Objectives

4. Provide training and outreach for program deliverables.
Partnership with ENFORM

• Training program now being developed
• A two day course for end users
• Target for completion of program is spring 2007
• SRD staff, oil and gas, and forestry sectors can take this course together.
How do we use these products?

RSF Models – where is the best bear habitat found (by season), and where will these areas be in the future?

Where are the mortality risks now and in the future?

Where are the gb movement corridors, and where will they be?

Where are the safe harbour areas now and in the future?

What is the status of the grizzly bear in this population unit? (N)

How can development be planned to minimize impacts and/or what mitigation is possible?
GIS Applications

Geoprocessing scripts in the Python language have been written to incorporate proposed development features into the GIS model inputs, and regenerate the RSF and mortality risk models.
5. Maintain and expand program partner support.
Program Sponsors

- Ainsworth Lumber
- Alberta Conservation Association
- Alberta SRD
- Alberta Fish and Game
- Alberta Newsprint
- Anderson Exploration Ltd.
- Anderson Resources Ltd.
- AVID Canada
- BP Canada Energy Company
- Banff National Park
- BC Oil & Gas Commission
- Blue Ridge Lumber
- Buchanan Lumber
- Buchanan Resources Ltd.
- Canada Centre for Remote Sensing
- Canadian Hunter
- Canadian Wildlife Service
- Canfor
- Cardinal River Operations
- Canadian Forest Service
- Conoco Phillips Ltd.
- Conservation Biology Institute
- Devon Canada Corp.
- DMI
- Elk Valley Coal
- EnCana Corp.
- Environment Canada –HSP
- Foothills Model Forest
- Fording Coal
- FRIAA
- GeoAnalytic Ltd.
- Gregg River Resources
- Husky Energy
- Jasper National Park
- Komex International Ltd.
- Lehigh Inland Cement
- Luscar Ltd.
- Manning Forestry Research
- Millar Western Ltd.
- Mountain Equipment Co-op
- Nexen
- Nature Resources Service
- Northrock Resources Ltd.
- NSERC
- Petro Canada
- Peyto Exploration
- Precision Drilling Ltd.
- PTAC (CAPP)
- Rocky Mountain Elk Foundation
- Shell Canada
- Slave Lake Pulp
- Spray Lake Sawmills
- Suncor
- Sundance Forest Industries
- Sundre Forest Products
- Talisman Energy Ltd.
- Telemetry Solutions
- Trans Canada Pipelines
- University of Alberta
- University of Calgary
- University of Lethbridge
- University of Saskatchewan
- University of Washington
- Veritas
- Hinton Wood Products (West Fraser)
- Western College of Veterinary Medicine
- Weyerhaeuser Ltd.
- World Wildlife Fund
The Next Five Years

N

Years into the future

0

100

?
Grizzly bears in the more southern area around Banff were in poorer body condition than our study animals. This difference was most pronounced in adult male bears.

<table>
<thead>
<tr>
<th>Sex (Age Class)</th>
<th>Body Condition IndexA (mean ± SE; [n])</th>
<th>Statistical SignificanceB (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ESGBP</td>
<td>FMFGBP</td>
</tr>
<tr>
<td>Female (all ages)</td>
<td>-0.43 ± 0.13 [22]</td>
<td>-0.13 ± 0.13 [37]</td>
</tr>
<tr>
<td>- subadult (&lt; 5 yrs)</td>
<td>-0.59 ± 0.38 [6]</td>
<td>-0.25 ± 0.25 [16]</td>
</tr>
<tr>
<td>- adult (≥ 5 yrs)</td>
<td>-0.37 ± 0.11 [16]</td>
<td>-0.04 ± 0.13 [21]</td>
</tr>
<tr>
<td>Male (all ages)</td>
<td>-0.16 ± 0.23 [21]</td>
<td>+1.00 ± 0.22 [23]</td>
</tr>
<tr>
<td>- subadult (&lt; 5 yrs)</td>
<td>-0.45 ± 0.35 [9]</td>
<td>0.47 ± 0.29 [10]</td>
</tr>
<tr>
<td>- adult (≥ 5 yrs)</td>
<td>+0.05 ± 0.31 [12]</td>
<td>+1.41 ± 0.29 [13]</td>
</tr>
</tbody>
</table>
Reproductive Hormones

- Although a number of differences were found between these 2 populations the LH value differences were significantly different in males.

<table>
<thead>
<tr>
<th>Hormone (Units)</th>
<th>Serum ConcentrationA (mean ± SE)</th>
<th>Statistical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ESGBP (n = 16)</td>
<td>FMFGBP (n = 17)</td>
</tr>
<tr>
<td>Luteinizing hormone (ng/ml)</td>
<td>0.07 ± 0.04</td>
<td>0.33 ± 0.09</td>
</tr>
<tr>
<td>Testosterone (ng/ml)</td>
<td>0.85 ± 0.26</td>
<td>0.91 ± 0.22</td>
</tr>
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</table>
Long-term Stress Detection
- stress-induced genes (U of W)
- stress-activated proteins (U of S)

Health Assessment
- Growth (CCWHC), reproduction (U of I), activity (FMF), disease (CCWHC), & survival (FMF)

Environment Assessment
- Human activity (U of S)
- Landscape change (U of S)

Environmental Health
Why is long-term stress detrimental?

Short-term stress

Energy allocation by individual animal

+ + + + = total energy budget

Health Functions

stress response growth reproduction activity immune function
Because other health functions are compromised.
A Two-Fold Approach (2006-2010)

Animal Health
1. Develop stress biomarkers.
2. Expand health measures.
3. Link stress with other health measures.

Landscape Structure
1. Enhance geospatial tools to:
   a) Increase structural resolution.
   b) Detect human-caused change.

Establish linkages between health and landscape structure and change.
How are bears using the landscape?
Current Path from GPS alone
Camera/Pedometer Development - 2006
ANTICIPATED PATH FROM GPS + SENSORS
Grizzly Bear Response to Mountain Pine Beetles and new harvesting strategies
Questions