



Managing Grizzly Bear Data

ESRI 2009 International User Conference, San Diego, California

Presented by: Julie Duval, July 15, 2009



Agenda

- 1) Overview of the Foothills Research Institute
- 2) Grizzly Bear Program Overview
- 3) Data Management
 - Database design changes
 - Including genetic data
- 4) Handling Telemetry Data
 - Transition from AML to python

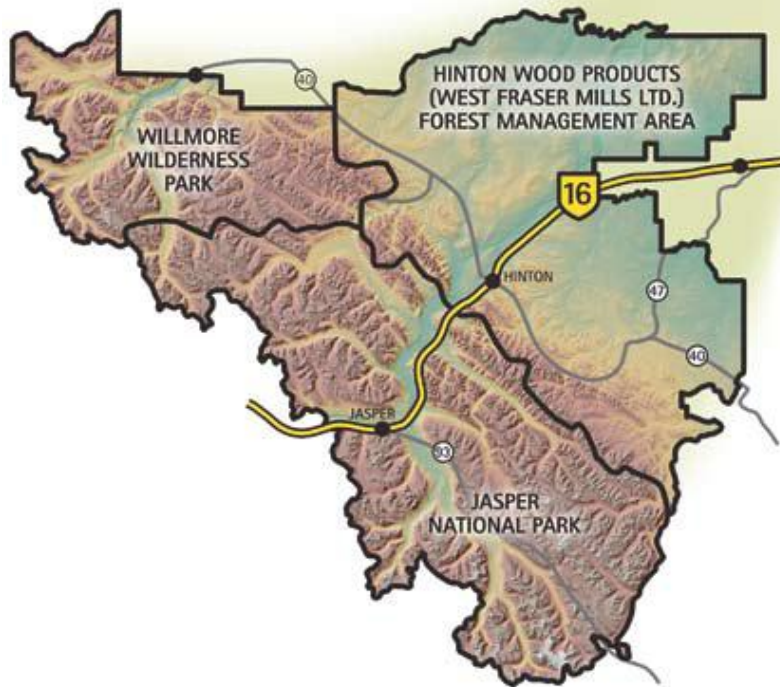


Our Mission:

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.



Foothills Research Institute Landbase



What We Do...

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



Research Programs



Grizzly Bear

Natural Disturbance

Fish & Watershed

Aboriginal Involvement

Social Sciences

Adaptive Forest

Management

Mountain Pine Beetle

Ecology

Foothills Stream Crossing

Local Level Indicators

Grizzly Bear Program

Overview



Foothills Research Institute



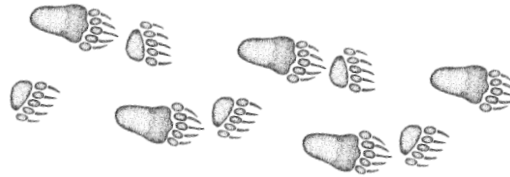
Grizzly Bear Program



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.



Grizzly Bear Program - Research Areas

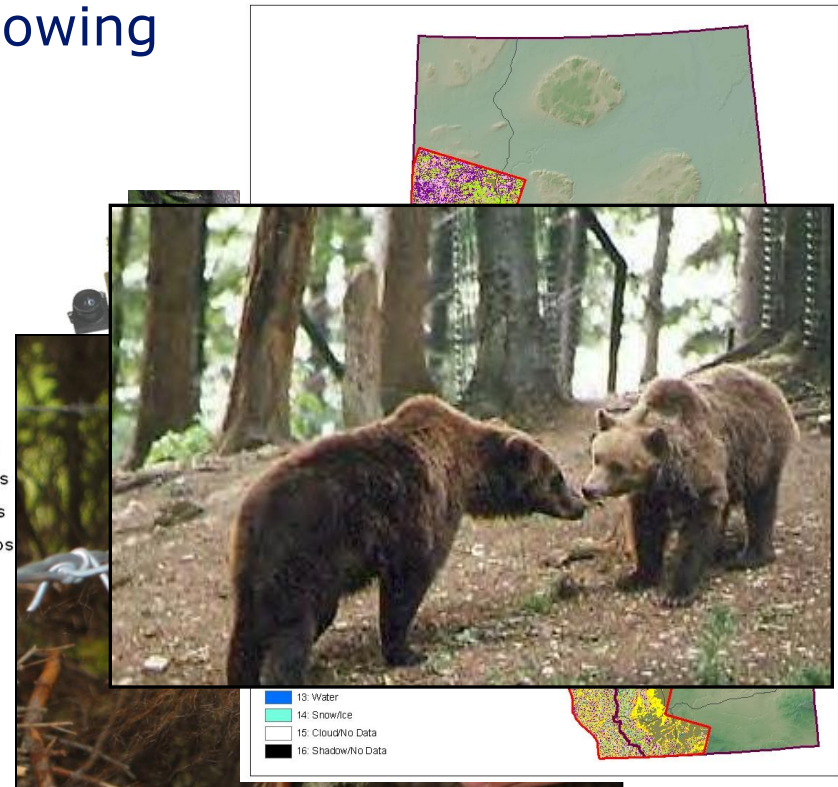
Research for the GBP is the work of a multidisciplinary team in the following areas:

- ◆ 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

Legend

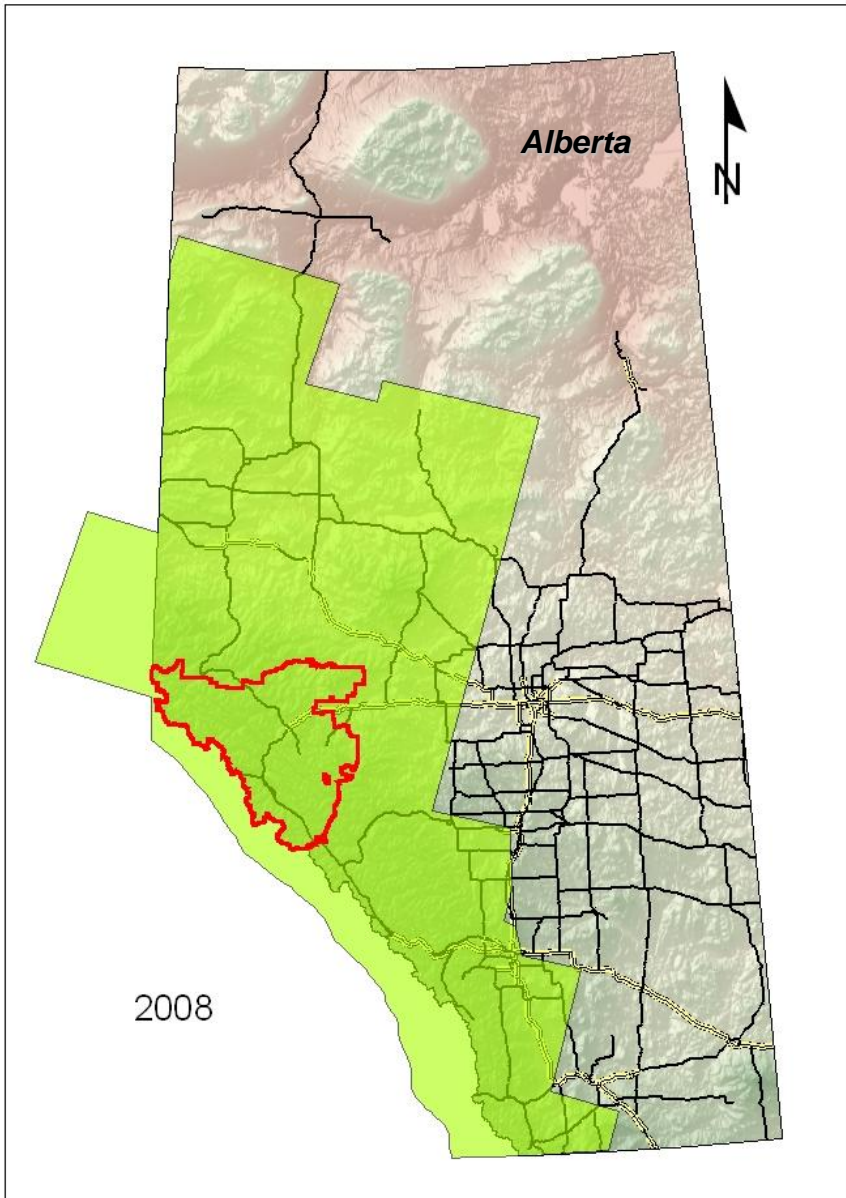
- 1: Upland trees
- 2: Wetland trees
- 3: Upland herbs
- 4: Wetland herbs
- 5: Shrubs
- 6: Water
- 7: Barren land
- 8: snow/ice
- 9: cloud
- 10: shadow

Grizzly Map



<http://foothillsresearchinstitute.ca>







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Grizzly Bear Program

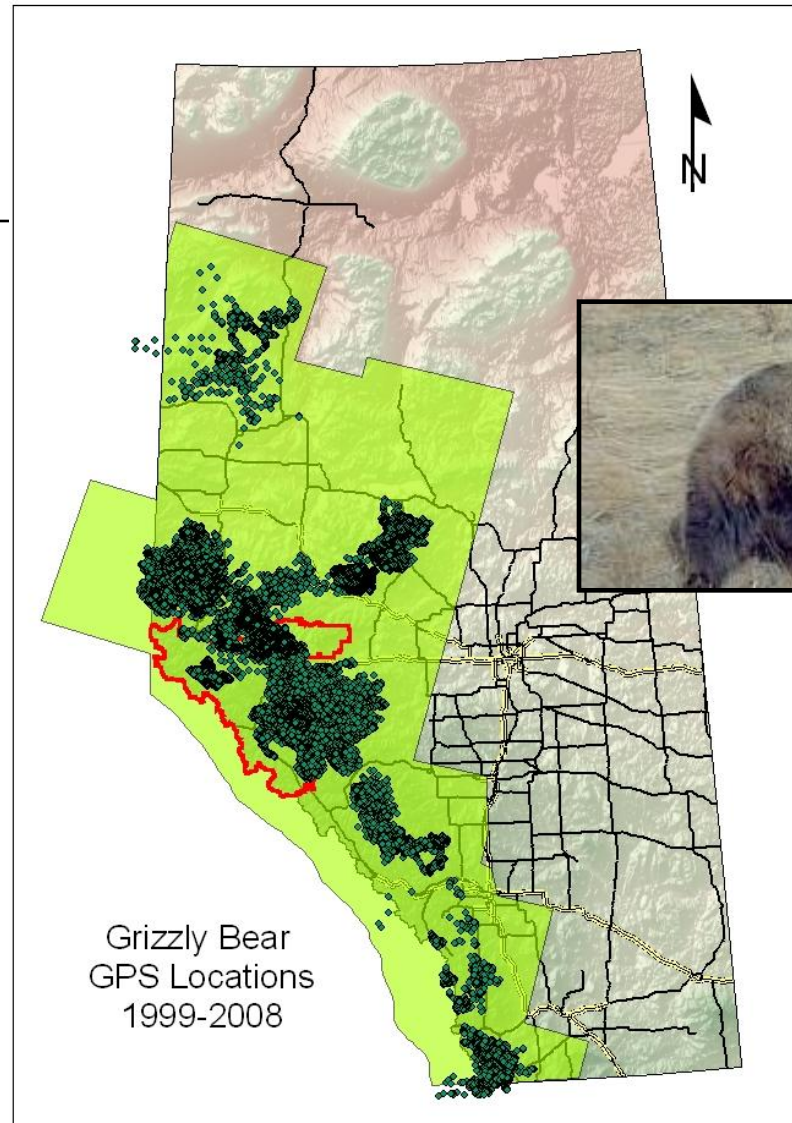
Legend

 FRI Boundary

 Research Boundaries

GPS Locations

Year	Number of GPS Locations
1999	6121
2000	9015
2001	11860
2002	9198
2003	11812
2004	11523
2005	57609
2006	39019
2007	19612
2008	29841



Grizzly Bear Program - Data Collection



Since 1999, 147 grizzly bears have been captured by the program's researchers and fitted with GPS collars (a few with cameras).



Grizzly Bear Program - Data Capture Costs

Since spring of 1999:

334 grizzly bear capture events
@ \$6,000 per capture

131 collars have been used
@ \$4,000 (avg) per collar
(96 collars available for use --> ~25 currently on bears)

\$75,000 to \$90,000 per year spent on flying
(for capture efforts, tracking and telemetry 'uploads')

Program Total:
\$14 Million (2008)

Compare to
\$60/location in the
early 1980s

On 210,000 valid GPS locations:

~ \$16 per location



Grizzly Bear Program

Data Management



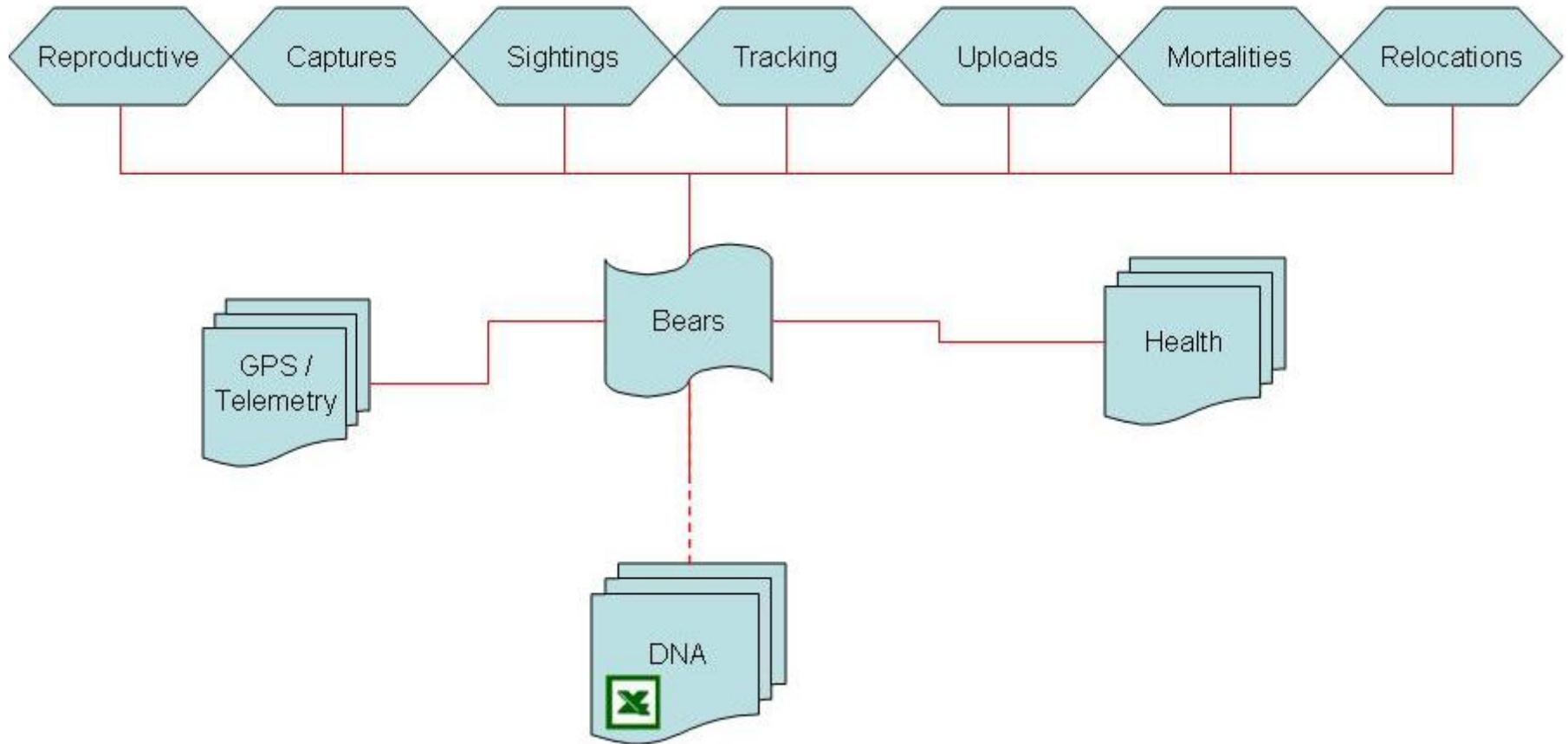
Foothills Research Institute



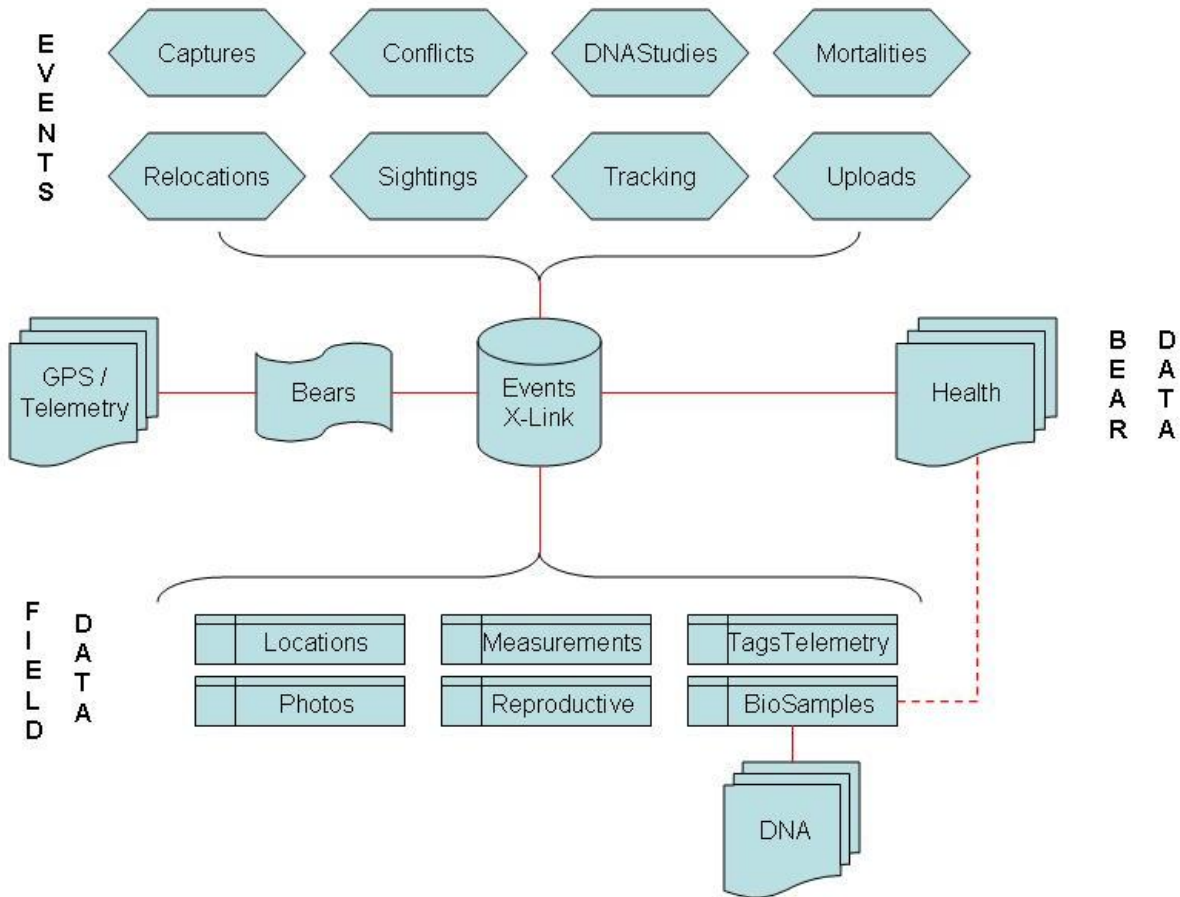
Grizzly Bear Program



Old Database Structure



New Database Structure



Database Switchboard





Foothills Research Institute Grizzly Bear Program

Grizzly Bear Research Database

Done

Today's Date: 6/26/2009 2:00:32 PM

Bear: G020

Date (>=): 01-Jan-99

Apply Filter

Event Type:

Date (<=): 26-Jun-2009

Remove Filter

Events

event ID	46	Bear	G020	Primary Event	Capture	Open Event 1
Date	13-Jun-99	Alias	Mary	Secondary Event	na	Open Event 2
Time	11:14 AM	Bear ID	21203	Tertiary Event	na	Open Event 3
Occurrence #	-999	Other ID				
Entered By	JDuval	Sex	F			
Date Entered	23-Jan-09	Birth Date	01-Feb-95			
Comments	Loading of Existing Data	Age	4	View Location Data View Temperature Data Track Modifications		

event ID	1354	Bear	G020	Primary Event	Tracking	Open Event 1
Date	14-Jun-99	Alias	Mary	Secondary Event	na	Open Event 2
Time		Bear ID	21203	Tertiary Event	na	Open Event 3
Occurrence #	-999	Other ID				
Entered By	JDuval	Sex	F			
Date Entered	23-Jan-09	Birth Date	01-Feb-95			
Comments	Loading of Existing Data in GB_Tracking	Age	4	View Location Data View Temperature Data Track Modifications		

event ID	1364	Bear	G020	Primary Event	Tracking	Open Event 1
Date	28-Jun-99	Alias	Mary	Secondary Event	na	Open Event 2
Time	10:50 AM	Bear ID	21203	Tertiary Event	na	Open Event 3
Occurrence #	-999	Other ID				
Entered By	JDuval	Sex	F			
Date Entered	23-Jan-09	Birth Date	01-Feb-95			
Comments	Loading of Existing Data in GB_Tracking	Age	4	View Location Data View Temperature Data Track Modifications		



Foothills Research Institute Grizzly Bear Program

Capture Events

Bear: **G020** Date: **20-Oct-00** Time: **10:19 AM**

Relocations	Modifications	Sightings	Conflicts	Mortalities	
Capture Data	Location Details	Tags and Telemetry	Measurements	Bio Samples	Reproductive Info

CAPTURE INFORMATION

Standard Arrival	Drugged	Reversed	Departure	Capture Team	Stenhouse/Goski/Munro/Bell
? Times		10:19 AM			
Capture Method	heli dart	Snare Site		<input type="checkbox"/> Trap Monitor	Time Sprung
Delivery System	pneu dart rifle	Limb Caught	na	<input type="checkbox"/> Trap Alarm	
Dart System	n/a	Restraint Time	9999 hrs	<input type="checkbox"/> Trap Video	

ANIMAL DATA:

Age:	Estimated	5	<input type="button" value="Calculate"/>	Recapture?	yes
	Actual	5		<input type="button" value="Review Capture History"/>	
	Age Class	adult			

ADDITIONAL INFORMATION:

Injury/Abnormality	<input type="text"/>
Pre- Dart Behaviour	<input type="text"/>
Injury Category	9999
Comments	<input type="text"/>

Locations

Bear ID	Name	LOC no	UTM Easting	UTM Northing	Date	Time	Year	Month	Day
21203	G020	1	468317.625029544	5886547.60651785	6/13/1999	10:06:00 PM	1999	6	13
21203	G020	2	468836.190744241	5887263.98015201	6/14/1999	6:01:00 AM	1999	6	14
21203	G020	3	468970.500109958	5887444.44256971	6/14/1999	2:01:00 PM	1999	6	14
21203	G020	4	469449.58923074	5887979.80335498	6/14/1999	6:02:00 PM	1999	6	14
21203	G020	5	466794.409712023	5890662.99494111	6/14/1999	10:01:00 PM	1999	6	14
21203	G020	6	465762.995556427	5890037.25411859	6/15/1999	6:02:00 AM	1999	6	15
21203	G020	7	465693.65114625	5890251.3490958	6/15/1999	10:01:00 AM	1999	6	15
21203	G020	8	465759.453055474	5890196.36581148	6/15/1999	2:02:00 PM	1999	6	15
21203	G020	9	465662.914217738	5889974.55892822	6/15/1999	6:02:00 PM	1999	6	15
21203	G020	10	465835.555731124	5890179.13464516	6/15/1999	10:02:00 PM	1999	6	15
21203	G020	11	466318.137636545	5889107.72440879	6/16/1999	10:01:00 AM	1999	6	16
21203	G020	12	466524.529011462	5888782.5430454	6/16/1999	6:02:00 PM	1999	6	16
21203	G020	13	467568.322940737	5888348.16617956	6/16/1999	10:02:00 PM	1999	6	16
21203	G020	14	466858.881641512	5886161.42855152	6/17/1999	10:02:00 AM	1999	6	17
21203	G020	15	466613.487830333	5886479.07689963	6/17/1999	2:02:00 PM	1999	6	17
21203	G020	16	468246.655704718	5886642.63700949	6/17/1999	6:02:00 PM	1999	6	17
21203	G020	17	467587.425599711	5886227.64509964	6/18/1999	10:02:00 AM	1999	6	18
21203	G020	18	467596.635974972	5886204.22072612	6/18/1999	2:02:00 PM	1999	6	18

Date (>=): **Filter by Date** **Clear Date Filter** **Done**

Date (<=):

Record: of 2195 (Filtered)

Fix	DOP	Collar	Data Status	Full Date	Locations_ID	Reloc?	Denning?	Time of Day	Data Ownership
3	3	TEL	FINAL	6/13/1999 10:06:00 PM	5309	No	No	NightTime	FRI
2	2	TEL	FINAL	6/14/1999 6:01:00 AM	5310	No	No	DayTime	FRI
2	2	TEL	FINAL	6/14/1999 2:01:00 PM	5311	No	No	DayTime	FRI
2	7	TEL	FINAL	6/14/1999 6:02:00 PM	5312	No	No	DayTime	FRI
2	2	TEL	FINAL	6/14/1999 10:01:00 PM	5313	No	No	NightTime	FRI
2	3	TEL	FINAL	6/15/1999 6:02:00 AM	5314	No	No	DayTime	FRI
3	3	TEL	FINAL	6/15/1999 10:01:00 AM	5315	No	No	DayTime	FRI
2	2	TEL	FINAL	6/15/1999 2:02:00 PM	5316	No	No	DayTime	FRI
3	4	TEL	FINAL	6/15/1999 6:02:00 PM	5317	No	No	DayTime	FRI
3	4	TEL	FINAL	6/15/1999 10:02:00 PM	5318	No	No	NightTime	FRI
2	6	TEL	FINAL	6/16/1999 10:01:00 AM	5319	No	No	DayTime	FRI
2	2	TEL	FINAL	6/16/1999 6:02:00 PM	5320	No	No	DayTime	FRI
2	2	TEL	FINAL	6/16/1999 10:02:00 PM	5321	No	No	NightTime	FRI
2	2	TEL	FINAL	6/17/1999 10:02:00 AM	5322	No	No	DayTime	FRI
2	3	TEL	FINAL	6/17/1999 2:02:00 PM	5323	No	No	DayTime	FRI
3	5	TEL	FINAL	6/17/1999 6:02:00 PM	5324	No	No	DayTime	FRI
2	2	TEL	FINAL	6/18/1999 10:02:00 AM	5325	No	No	DayTime	FRI
2	2	TEL	FINAL	6/18/1999 2:02:00 PM	5326	No	No	DayTime	FRI

Grizzly Bear Program

Handling Telemetry Data



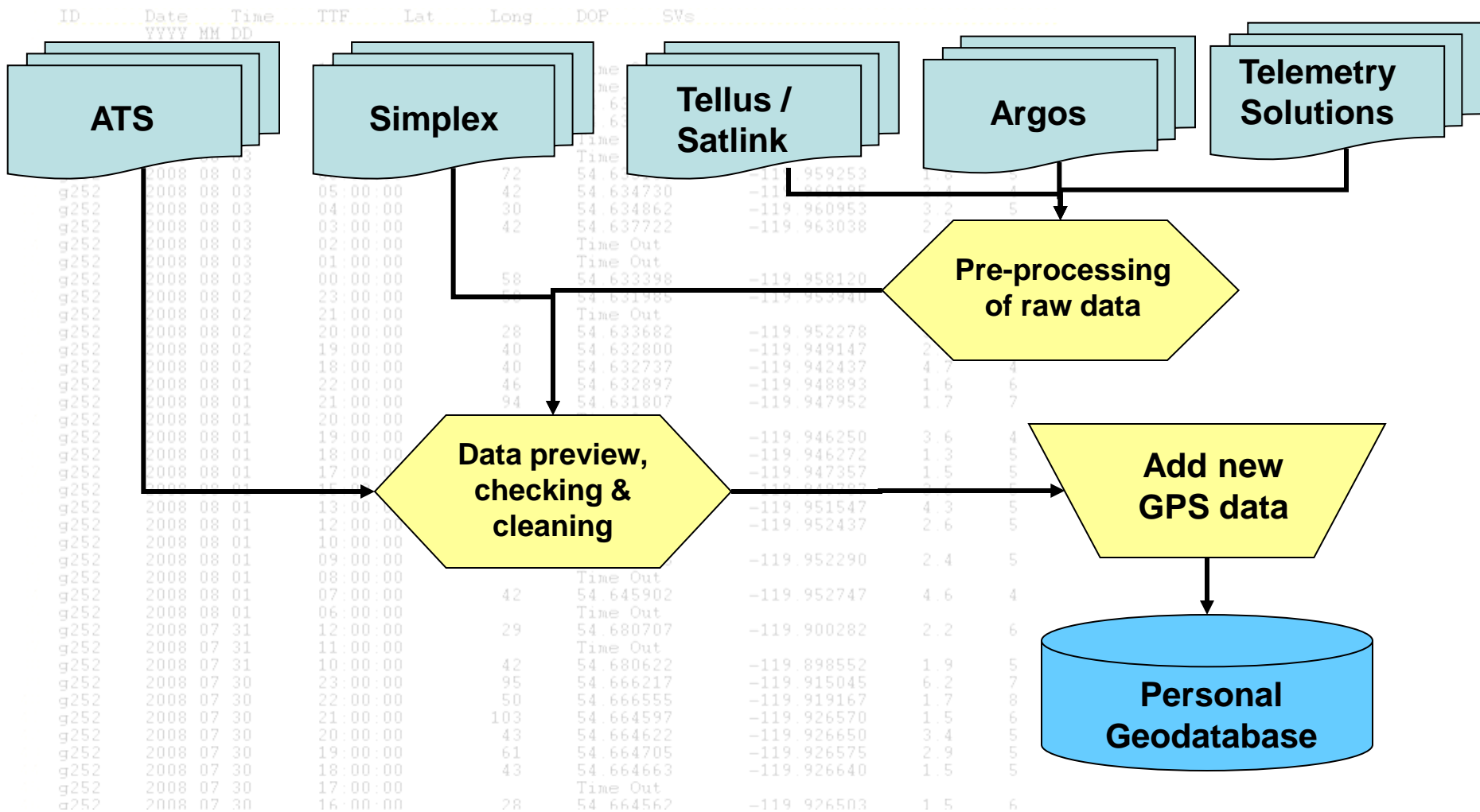
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Grizzly Bear Program



Raw GPS Data Processing



Processing Tools

- Collar Data Processing
 - 1. Pre-processing
 - a. Flip Data File
 - b. process Argos Direct Data
 - b. process Tellus Raw Data
 - c. process Tellus Temperatures
 - 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

b. add GPS Locations to GDB

Text file to process
test.txt

Year of data
2008

Collar Source
Tellus-2

Data Status
Final

Is this a Simplex collar with a camera attached?
 Is this a RC Simplex collar?

Data Ownership
FRI

OK Cancel Environments... Show Help >>

Check for Errors in GB_Locations

Output file name
C:\Workspace\ErrorCheckTest.txt

Enter minimum year criteria
2006

Enter maximum year criteria
2007

Criteria for Extreme movement rate (m/hr)
50000

Criteria for Very Fast movement rate (m/hr)
25000

Criteria for Fast movement rate (m/hr)
10000

Criteria for a bear in movement (m/hr)
8000

Small time interval, in minutes
10

OK Cancel Environments... Show Help >>



GPS Data Management

- Originally used aml code and menus to process the raw data. Data was appended to MS Access database using DBMSCursor.
- Converted aml code to python in summer 2007 and added as tools in the toolbox. Data is now appended to a Feature Class in a Personal Geodatabase.

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.



Summary

- As the Grizzly Bear Program continues to grow, spatial and non-spatial datasets are continually evolving to meet research requirements. These multi-user datasets are managed to be flexible and functional and to allow efficient GIS analysis.
- The database design changes will be beneficial in supporting multiple types of users, ensuring that everyone has the most recent information available.
- The tools for loading the raw GPS telemetry locations enable the researchers to process their own data and move on to their analyses quickly.





Thank You!

