Grizzly Bears and GIS

Introduction:

The conservation of grizzly bears and their habitat was recognized as an important land use objective in the Robson Valley LRMP. The LRMP recommended retention of unharvested reserves along avalanche chutes that provided good grizzly habitat, but did not define what constituted good avalanche chutes. Also, there was very little information on grizzly bear habitat use in the Robson Valley to guide habitat management practices in other habitat types.

fig.1 GPS collar.

The recent development of GPS radio-collars allows wildlife to be monitored without the need for frequent monitoring flights (fig.1). The collars automatically record and store the animal's location which, can be downloaded from the collar at a later date. Four adult female grizzly bears were captured and fitted with GPS radio-collars in May of 2001. The bears were captured by darting with them with immobilizing drugs from a helicopter. Two collared bears are in the Morkill River area, and the other two are in the Goat River area. The GPS radio-collars are programmed to record their location six times a day until early December. At that time, the collars will shut off during hibernation, and turn on again in the spring to record locations until December of 2002. The collars are programmed to download their data in August and November of each year. At the pre-programmed time, the collars begin to transmit the location data and it is necessary that the researchers are overhead in a helicopter at that precise time to receive the data transmission.

The bear location data we used for this project was provided by Mr. Dale Seip, the wildlife ecologist who is heading the grizzly bear research in the Robson Valley. The first data download provided hundreds of locations for each bear between May and August. Each bear had ranged over about 150 square km during that time period. By plotting these locations on a variety of map bases and joining certain attribute tables, we can determine the types of habitats that the bears were using. Most locations were at mid to upper elevations, with little use of valley bottoms.

After more data becomes available they will be analysed to determine patterns of habitat selection, including characteristics of good avalanche chutes, and selection for forest type and forest age class. That information will be used to identify which avalanche chutes should have unharvested reserves, and to develop habitat management objectives for the remainder of the forest land base.

Input:

The first part of the project was mainly concerned with finding the necessary data for our analysis and importing it into Arc coverages. The Trim data we used was obtained from the UNBC GIS lab directory: /home/data/griddata/trim. The DEM used was also obtained from a UNBC GIS lab directory. The Trim data's original file formats were ".e00", but by using the ArcInfo command *import*, the data was quickly formatted into Arc coverages. This Trim data provided us with such layers as, roads, trails, rivers, lakes, and marshes.

The Bio-geo-climatic Ecosystem Classification (BEC) coverage and the forest coverage were taken from disks which were provided for us from the current senior lab instructor, Mike Wolowicz. These BEC and forest coverages are more for Mr. Seip's analysis, and will not be used in the analysis section of this project.

The telemetry locations we used were given to us by Mr. Seip who is the coordinator and head of the current grizzly bear habitat project, which the data generated by this project will be used for. The attribute data was provided for us in form of a Microsoft Access table.

All of our telemetry locations fell within the 93h map sheet, and initially we only imported the Trim, DEM, and forest cover data for the map sheet 93h. Once the telemetry locations were overlaid onto these base coverages however, we discovered that some of the bear locations were very close to the border of the 93h and 83e map sheets. We then decided to import all the available information for the 83e map sheet, and include parts of it into our clip-coverage, in order to generate images which gave a more informative idea of where the bears were currently, and where they were heading.

Processing:

The processing portion of our project consisted of four main sections: projecting, appending, clipping, and overlaying. The projecting section of our project was necessary because of all the different projections our imported data came in. All of the Trim layers were originally in geographic, while the DEM, BEC and forest coverages were in Albers. Finally, the actual telemetry locations came in UTM, which is what all the other data projections were converted to and is the final projection used in our project. To perform all of these projection conversions, we used the Arc command *project.*

Next we joined all of the 93h layers with the 83e layers using the *append* command in ArcInfo. Before we could join all the layers however, we first needed to clean and build all of them after they were re-projected using the ArcInfo commands *clean* and *build*. During this step it was important to realize what type of layer we were cleaning and building, as the polygon default value would have been incorrect for such arc coverages as rivers, trails, and roads, and point coverages like the bear locations.

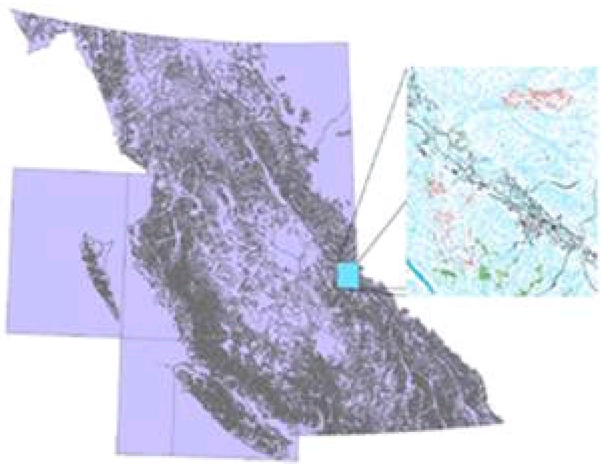


fig.2 Study area, when compared to the rest of BC.

Clipping the appended layers into smaller and more manageable sizes, was the second last major section of our data processing (fig.2). To do this we first determined a suitable size for our study area. We did this by drawing a polygon over the telemetry locations in ArcView, with enough of an area around the outer most points (about 6km), which became our clip-coverage. After creating this clip-coverage, we simply needed to use the ArcInfo command *clip*; entering the input coverage, the clip-coverage, and the output coverage, to create our final base coverages that would be used in our project.

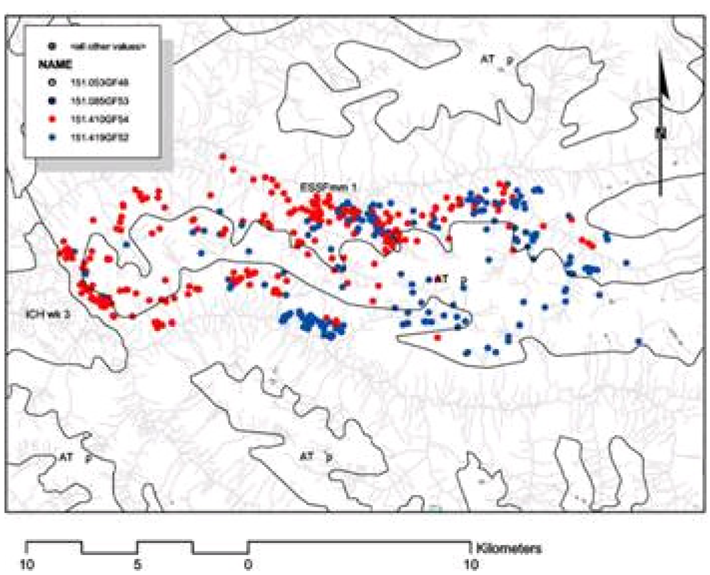
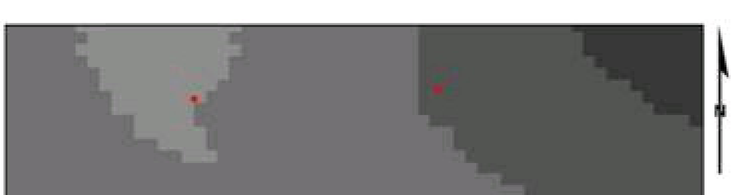


Fig.3 Identity between GPS telemetry locations and BEC polygons.

The final major section of our data processing was to overlay all of the meaningful base layers (i.e. forest cover, BEC cover, and DEM), with the telemetry locations. To do this we used the ArcInfo commands *identity* and *latticespot* . *Identity* was used to overlay the telemetry locations onto any of the polygon coverages (fig.3), while the *latticespot* command was needed to overlay the telemetry locations onto the DEM (fig.4), because it is a grid and not a polygon coverage. By doing this, we created



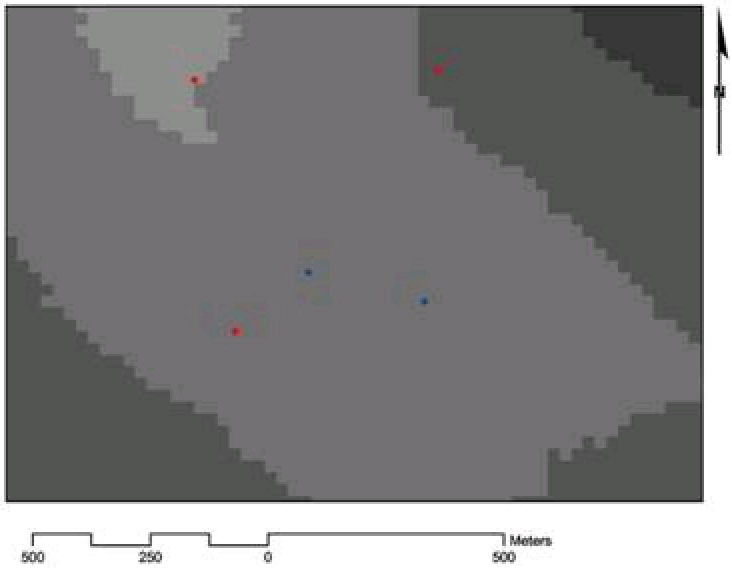


fig.4 Lattice spot between GPS telemetry locations and elevation DEM.

new attribute tables which contained the attributes of the telemetry locations and only the habitat attributes on which the telemetry locations were located.

We also used the GRID commands *slope* and *aspect* on our clipped DEM to create two new DEM layers. One showing the slope, and the other showing the aspect of the areas in which the bears were located.

Database:

The data base aspect of this project was mainly performed in Microsoft Access. The attribute tables created by overlaying the telemetry locations onto the habitat layers in the processing section of this project were exported into ".dbf" files using the ArcInfo command *export*. These ".dbf" files were then imported into Microsoft access and converted into ".mdb" files.

Once in Microsoft Access, the ".mdb" files were then queried and joined together into one main table, using primary keys such as "BearName", "BEC_tag", and "fc_tag" (fig.5). This final table was then exported to Microsoft Excel, where the unnecessary fields, such as "Mapsheet_ID", could be deleted more easily.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	NAME	EASTING	NORTHING	MONTH_	DAY_	YEAR_	HOUR_	MIN_	SEC	ELEVATION	ASPECT	SLOPE	BECLABEL
2	151.410GF54	678242.7	5958954	6	26	2001	17	0	36	1141.08	36.6455	2.3346	ESSFmm 1
3	151.410GF54	676716.6	5958346	6	26	2001	13	1	36	1197.47	117.151	13.2858	ESSFmm 1
4	151.410GF54	680166.4	5958806	6	25	2001	21	0	36	1194.38	9.3553	19.6362	ESSFmm 1
5	151.410GF54	680471.1	5957899	6	25	2001	17	1	36	1205.88	347.404	17.5062	ESSFmm 1
6	151.410GF54	679616.5	5957897	6	26	2001	1	0	36	1213.44	277.348	17.478	ESSFmm 1
7	151.419GF52	691040.6	5957716	7	4	2001	5	0	36	1382.96	350.037	5.1452	ESSFmm 1
8	151.410GF54	690669.9	5957709	7	12	2001	13	1	36	1371.48	166.676	7.34656	ESSFmm 1
9	151.410GF54	680678.7	5957629	6	25	2001	9	1	8	1261.84	61.9689	24.7028	ESSFmm 1
10	151.410GF54	690928.2	5957592	7	12	2001	9	0	56	1403.4	268.305	9.43547	ESSFmm 1
11	151.419GF52	692426.6	5957479	6	29	2001	17	1	0	1433.16	337.85	5.67806	ESSFmm 1
12	151.410GF54	674294.3	5957451	7	16	2001	21	0	56	1409.69	86.2813	4.70207	ESSFmm 1
13	151.419GF52	690056.1	5957438	7	13	2001	13	0	56	1405.78	306.579	7.197	ESSFmm 1
14	151.419GF52	692245.3	5957432	6	30	2001	13	1	8	1427.35	279.605	6.78775	ESSFmm 1
15	151.419GF52	692246	5957417	6	30	2001	9	2	8	1427.43	279.678	6.94965	ESSFmm 1
16	151.419GF52	691466.2	5957416	7	4	2001	1	0	44	1407.9	21.9293	3.68779	ESSFmm 1
17	151.419GF52	692514.9	5957388	6	29	2001	5	1	44	1448.07	292.795	9.74538	ESSFmm 1
18	151.410GF54	675367.9	5957387	7	23	2001	21	2	32	1531.28	337.604	7.48954	ESSFmm 1
19	151.410GF54	680450.8	5957327	6	25	2001	5	1	0	1338.84	88.472	4.10026	ESSFmm 1
20	151.410GF54	690855.4	5957304	7	12	2001	5	0	36	1440.27	345.31	12.7126	ESSFmm 1
21	151.410GF54	680992.6	5957285	6	20	2001	21	1	8	1266.47	23.2279	18.5817	ESSFmm 1
22	151.410GF54	674517.1	5957269	6	27	2001	13	0	36	1462.86	305.402	15.9395	ESSFmm 1
23	151.419GF52	689391.3	5957269	7	13	2001	1	0	36	1399.19	250.456	10.8542	ESSFmm 1
24	151.410GF54	674518.3	5957237	6	27	2001	9	2	0	1468.5	311.793	17.0591	ESSFmm 1
25	151.410GF54	677698.7	5957206	7	25	2001	1	0	56	1551.05	233.369	26.6916	ESSFmm 1
26	151.410GF54	682476.2	5957176	6	19	2001	5	0	36	1237.87	333.544	11.9004	ESSFmm 1
27	151.410GF54	674520.7	5957174	6	27	2001	17	1	0	1482.93	314.375	16.9209	ESSFmm 1
28	151.410GF54	683035.5	5957166	6	19	2001	1	1	0	1254.18	296.919	10.4727	ESSFmm 1
29	151.419GF52	691632	5957154	6	26	2001	1	0	36	1421.19	11.6177	7.72047	ESSFmm 1
30	151.410GF54	689712.2	5957115	7	29	2001	5	0	36	1436.05	29.1483	14.368	ESSFmm 1

fig.5 A section of the main table created in Microsoft Access

Analysis:

The final analysis of the main table created in the database section of our project was done solely for our own interest, and is not required by Mr. Seip for his own analysis. To analyse the table we used the query builder in ArcView. We performed two queries; one was the slope of the land the telemetry locations were on and the second was the movement of each bear over time. We then created two maps of our query findings, which can be seen in the output section of our project (fig.6 and 7).

Output:

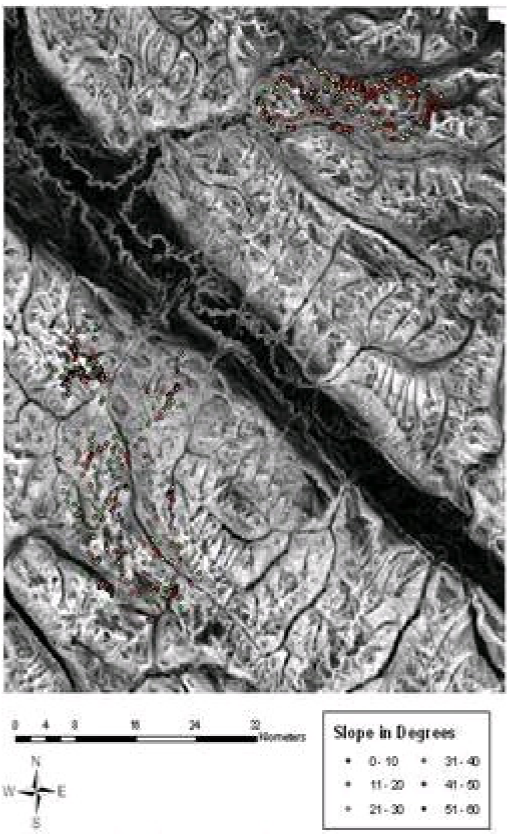


fig.7 All of the Bear locations displaying the slope of the area in which they are standng.

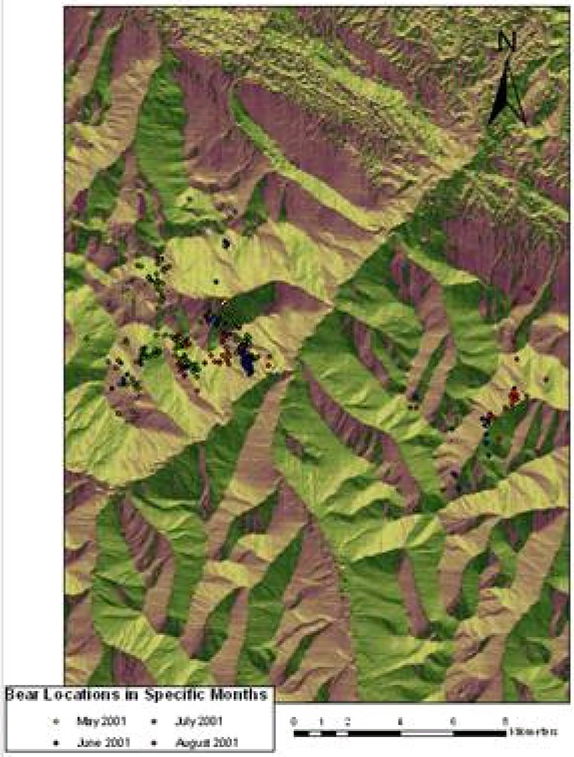


fig.6 The location of one bear, as it moves from month to month.