The Spatial extent of vegetative communities in the Aleza Lake Research Forest

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Abstracts

This project was designed to analyze the spatial extent of alder/willow swales within the Aleza Lake Research Forest. Alder/willow swales are habitat for many lichen species that support forest biodiversity. Analysis of alder/willow swales will provide information for forest licencee logging prescriptions so to maintain forest biodiversity.

Introduction

Recent attention has been given to old growth forests within British Columbia's (BC's) interior plateau, specifically the Aleza Lake Research Forest. Old growth forests appear to have characteristics which help to sustain biodiversity in BC's ecosystems. Two characteristics in particular, deciduous upland swales and willow/alder communities, act as key habitats that support regional flora and fauna. Swales are often located in the midst of commercial forests and are included in planned harvest areas. Species of lichens often act as biodiversity indicators within swales in old growth stands. Reducing the potential dispersal of lichens through logging practices may inhibit biodiversity. There is a need to gather information that would support forest licencees developing prescriptions to maintain old growth habitats such as swales and willow/alder communities.

This project aims to record information about the spatial extent of alder/willow swales in the Aleza Lake landscape so to analyze the extent of lichen habitat. A series of landscape metrics is used in FRAGSTATS to analyze the vegetation polygons.

Study Area and Data Source

The Aleza Lake Research Forest is approximately 9000 hectares in size and is located 60 kilometres east of Prince George. The area includes traditional territories of both Lheidli T'enneh and Tsek'ehne (McLeod Lake) First Nations. Previous GIS studies have been undertaken at the research forest by members of the University of Northern British Columbia; data was supplied to me by the class instructor. Specifically, a shape file that distinguishes between the different vegetation types within the Aleza Lake Research Forest.

Data Manipulation

The vegetation map I obtained classified the polygons by site series. For my data analysis I was interested in 3 polygons 1) upland forest alder-ladyfern seepage site complex 2) lowland wet forest alder-ladyfern seepage site complex and 3) wetlands alder-ladyfern seepage site complex. By using a hard copy of a map that classified polygons by vegetation I reclassified the polygons in my ArcMap layer to the ones of interest. I then performed the following steps:

- selected by attributes each of the three polygon patch layers of interest.
- exported the selected attributes as shapefiles.
- note: I had four shapefiles to work with, each of the above patch types and one shapefile that consisted of the total of all the patches.
- in ArcCatalog I then converted the shapefiles to raster grid files (appropriate for Fragstats input).
- I also loaded all shapefiles into ArcMap and created vegetative maps and labeled the polygons by numbers which correspond to the data tables.
- metadata has been added to N:\hirshfif\geog413\finalproject\fragstats_input\shape_raster_for_conversion\total_alder_ladyfern.shp

Fragstats

The landscape metrics of interest for this project are:

- total area, core area and perimeter/area ratio of each vegetation patch in the landscape.
- mean and median area of each patch type.
- mean and median distance through the longest and shortest axis of each patch type.
- the total linear distance through each patch.
- the proximity of each patch to the remainder of the landscape.

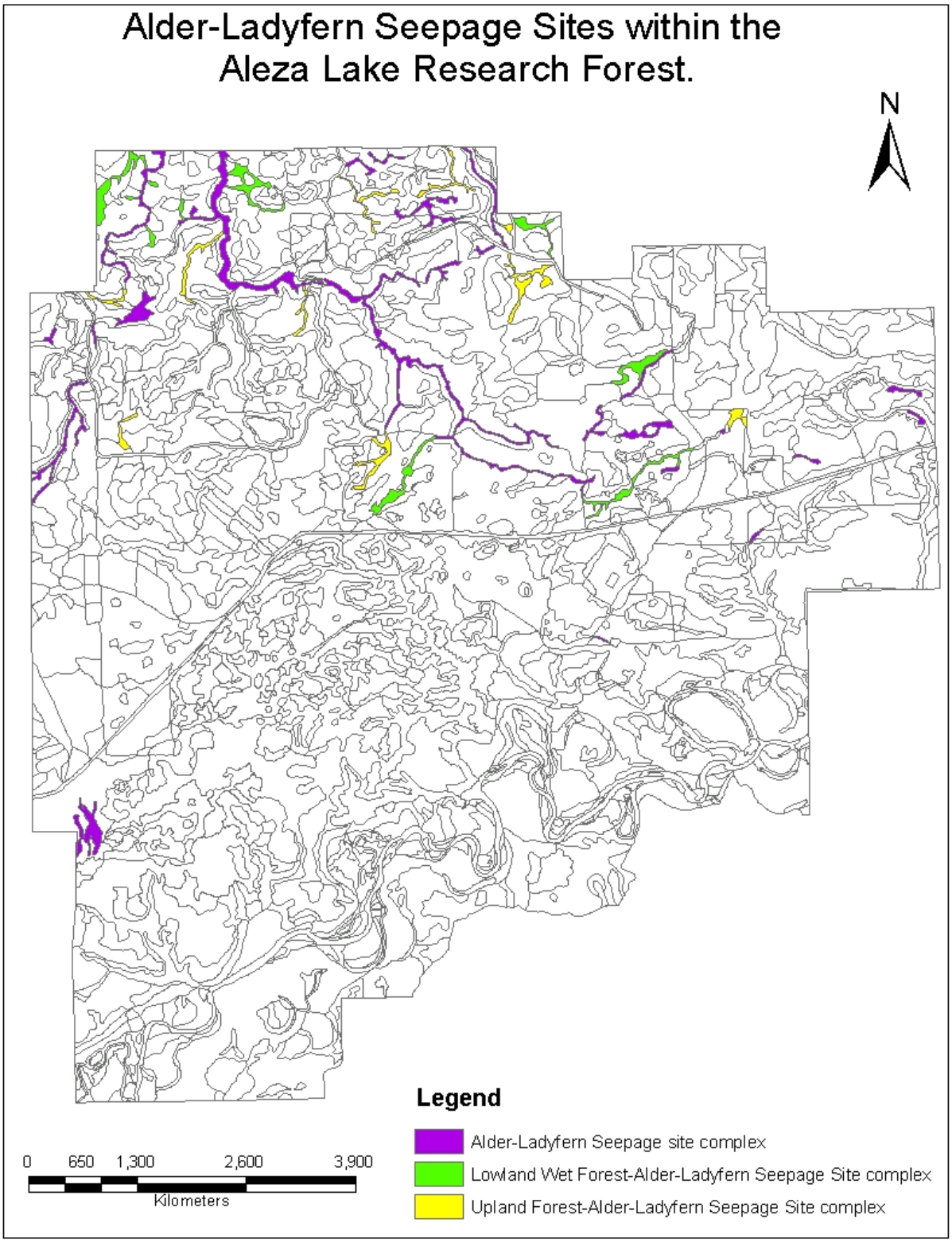
Manual steps:

- load raster grid file into fragstats and set the output location.
- select output statistics as patch metrics; input file type as landscape; patch neighbours as 8 cell rule and analysis type as standard.
- select the patch metrics for analysis (ie. area, perimeter to area ratio).
- execute the run and browse the results.

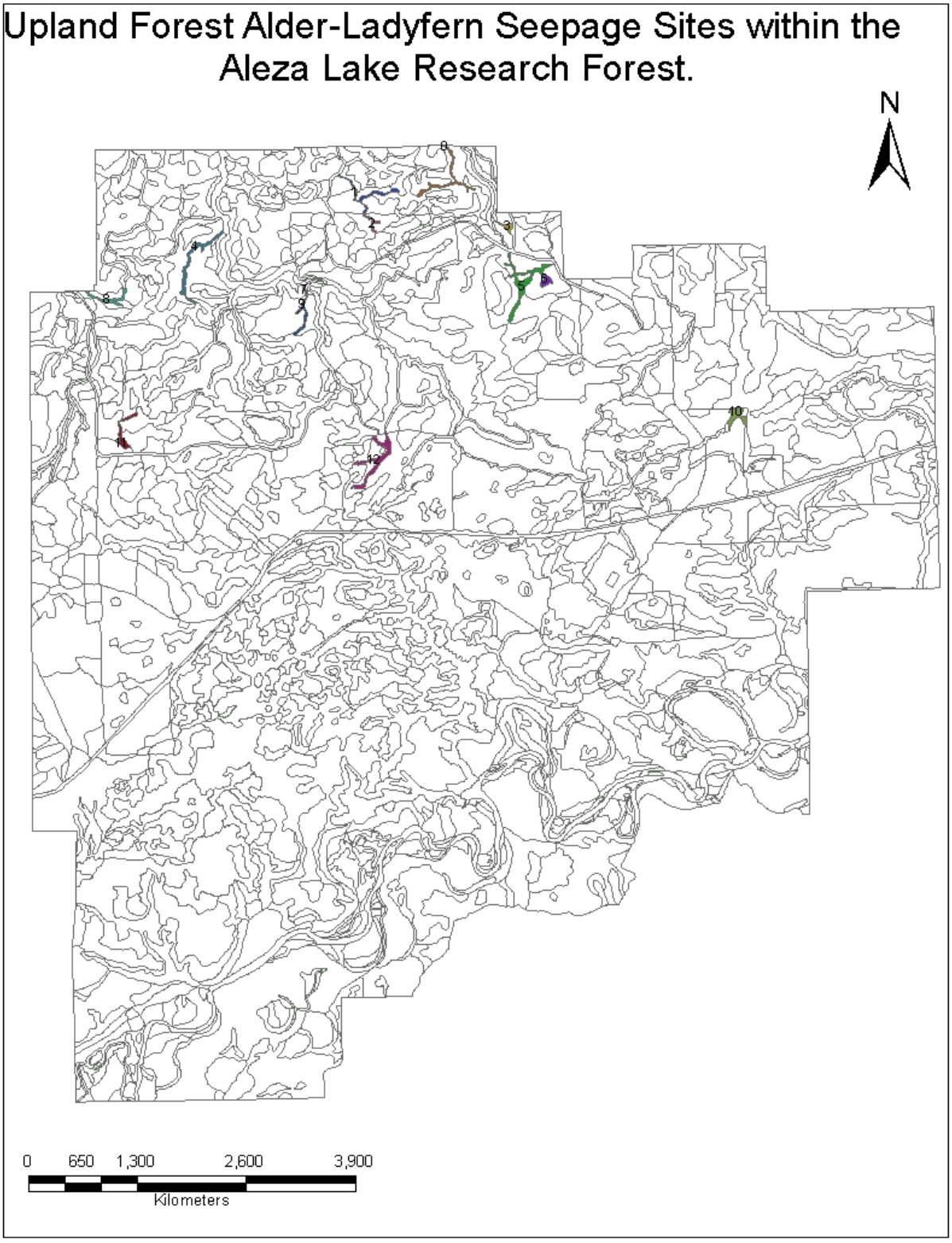
- results are exported in two file types, excel and text file.
- open text file in excel and calculate mean, median, standard deviation, sum, min and max.
- note: the only metrics that I was able to analyze using fragstats were: area, core area and perimeter to area ratio; the remainder of the metrics I had to manually measure in ArcMap and record the data for analysis in excel. The proximity metric I was unable to analyze as the remainder of the landscape needed to be classified by vegetative polygon type and I did not aquire the appropriate data.

Analysis Results

Below is a map all three patch types in the Aleza Lake Research Forest.



Below is a map of the upland forest alder-ladyfern seepage site complex and the related data table.

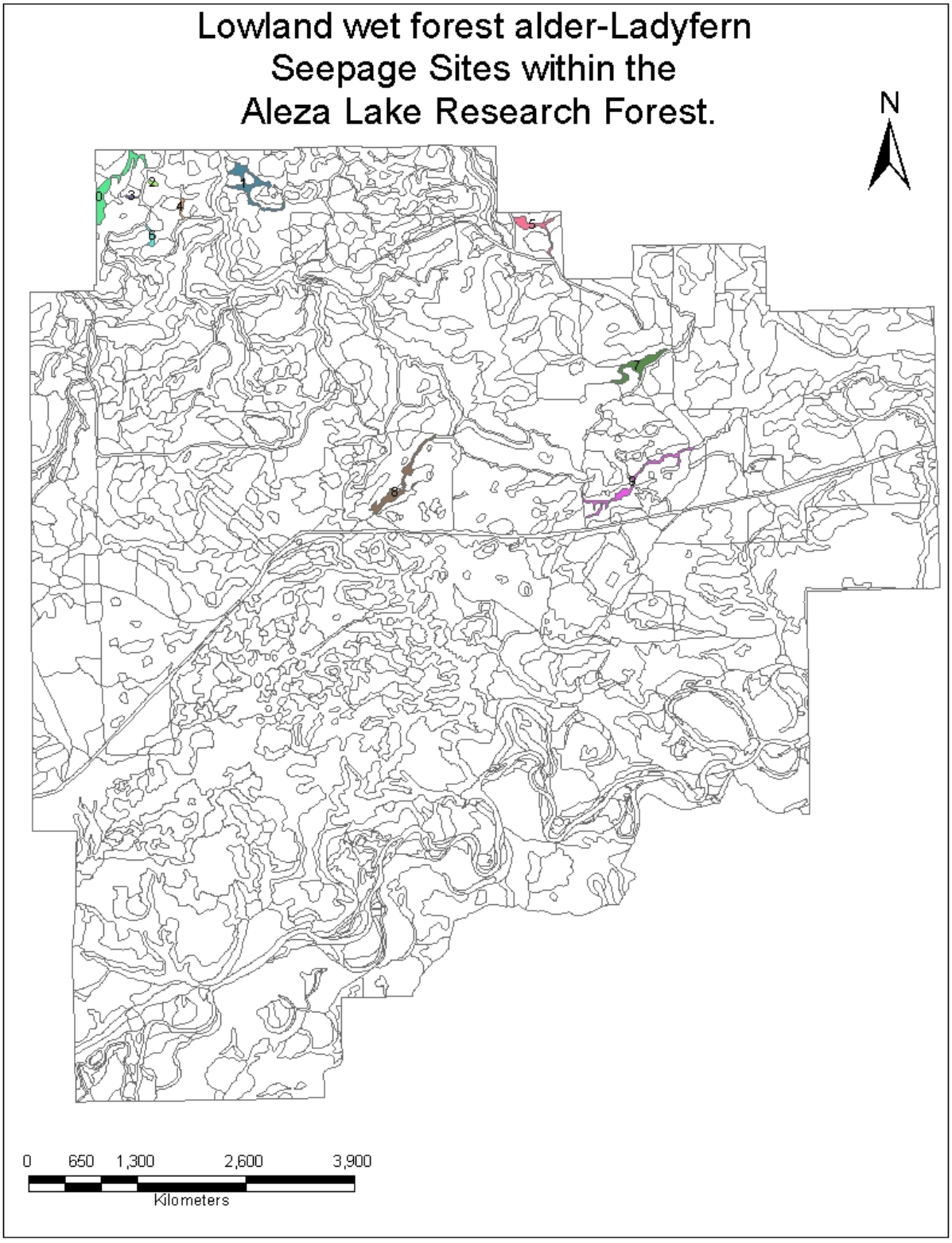


Upland forest alder-ladyfern seepage site complex

TYPE	AREA (m^2)		TYPE	Shortest Axis (m)		TYPE	Longest Axis (m)	
0	3.51	Sum	0	12.86	Sum	0	372.62	Sum
1	2.92	34.71	1	10.15	228.22	1	295.67	4289.98
2	0.84	mean	2	20.94	mean	2	203.76	mean
3	0.92	2.67	3	14.73	17.56	3	203.44	330.00
4	4.15	Median	4	26.23	Median	4	362.36	Median
5	6.53	2.25	5	17.74	17.74	5	694.40	298.48
6	1.36	Min	6	19.41	Min	6	177.52	Min
7	0.38	0.38	7	12.14	10.15	7	143.01	143.01
8	1.92	Max	8	19.11	Max	8	426.60	Max

9	1.72	6.53		9	13.18	31.68		9	280.82	694.40	
10	2.82	SD		10	31.68	SD		10	298.48	SD	
11	2.25	1.83		11	17.99	6.16		11	329.94	149.75	
12	5.40			12	12.06			12	501.36		
TYPE	Linear Distance (m)			TYPE	Perimeter-Area Ratio			TYPE	Core-Area		
0	1035.23	Sum		0	1030.12	Sum		0	3.32	Sum	
1	978.19	8002.69		1	1084.21	11003.71		1	2.85	34.56	
2	303.77	mean		2	1106.15	mean		2	0.90	mean	
3	203.79	615.59		3	817.68	846.44		3	0.91	2.66	
4	1222.94	Median		4	805.69	Median		4	4.22	Median	
5	928.54	591.71		5	649.03	817.68		5	6.43	2.33	
6	144.97	Min		6	515.89	Min		6	1.34	Min	
7	161.44	144.97		7	1142.86	487.11		7	0.42	0.42	
8	608.39	Max		8	985.51	Max		8	1.90	Max	
9	512.81	1222.94		9	959.52	1142.86		9	1.67	6.43	
10	351.94	SD		10	487.11	SD		10	2.81	SD	
11	591.71	372.78		11	745.98	223.12		11	2.33	1.82	
12	958.97			12	673.97			12	5.48		

Below is a map of the lowland wet forest alder-ladyfern seepage site complex and the related data table.



Lowland wet forest alder-ladyfern seepage site complex

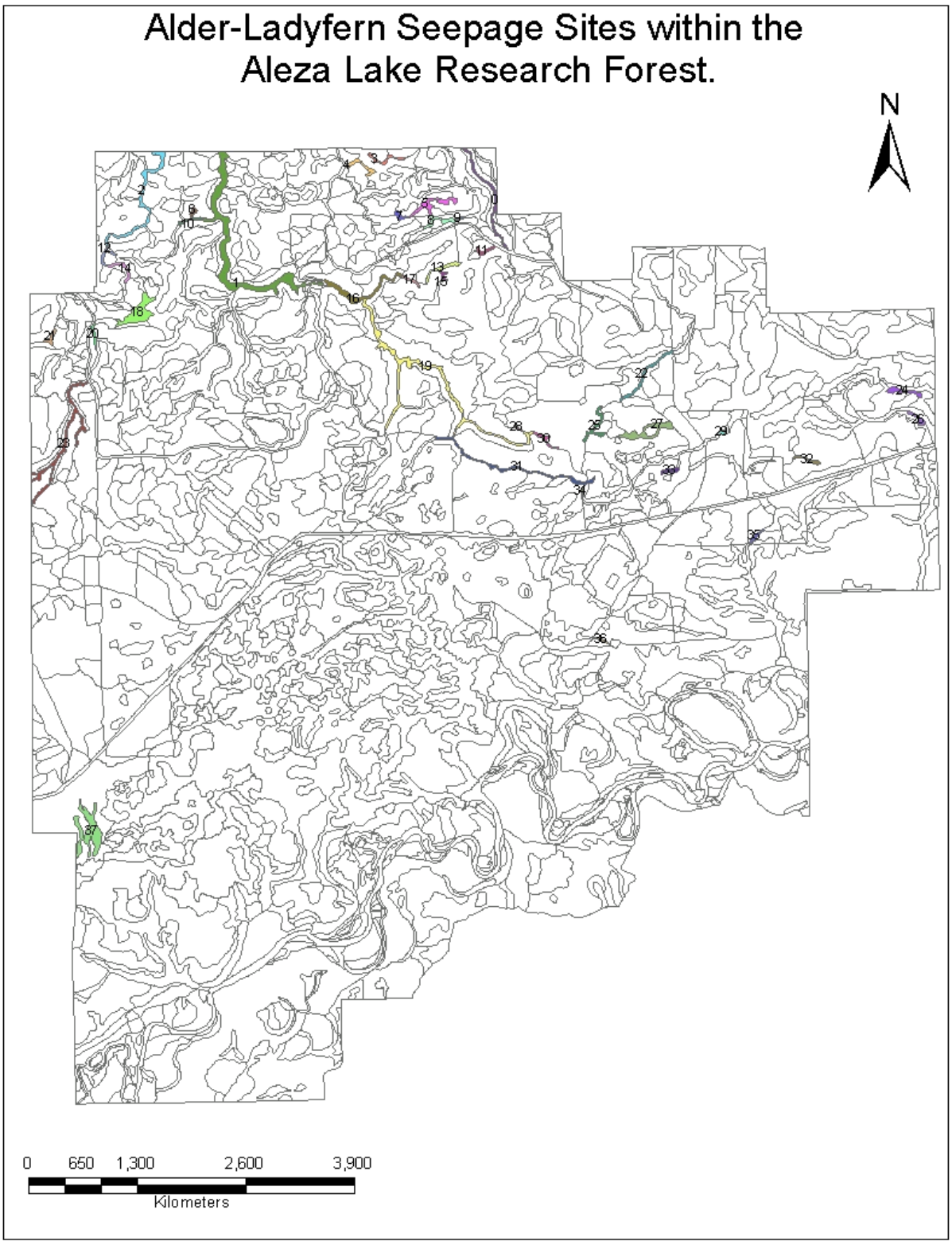
TYPE	AREA (m^2)		TYPE	Shortest Axis (m)		TYPE	Longest Axis (m)	
0	8.71	Sum	0	20.37	Sum	0	553.99	Sum
1	8.04	44.15	1	15.98	209.45	1	547.58	3629.52
2	0.50	mean	2	21.49	mean	2	135.56	mean
3	0.43	4.41	3	15.95	20.95	3	166.55	362.95
4	1.01	Median	4	23.45	Median	4	239.93	Median
5	3.90	5.11	5	20.37	20.93	5	373.37	377.86
6	1.34	Min	6	30.36	Min	6	266.77	Min
7	6.33	0.43	7	25.36	10.34	7	471.86	135.56

8	7.13	Max		8	25.78	Max		8	491.57	Max	
9	6.78		8.71	9	10.34		30.36	9	382.34		553.99
		SD				SD				SD	
			3.35				5.78				154.25

TYPE	Linear Distance (m)			TYPE	Core Area			TYPE	Per-Area Ratio		
0	1304.98	Sum		0	8.71	Sum		0	444.44	Sum	
1	1030.59		7943.87	1	8.04		44.15	1	555.97		6890.99
2	137.91	mean		2	0.50	mean		2	824.12	mean	
3	164.22		794.39	3	0.43		4.41	3	1052.63		689.10
4	268.97	Median		4	1.01	Median		4	851.49	Median	
5	842.04		905.57	5	3.90		5.11	5	662.39		660.78
6	286.16	Min		6	1.34	Min		6	659.18	Min	
7	969.10		137.91	7	6.33		0.43	7	452.17		444.44
8	1251.98	Max		8	7.13	Max		8	560.00	Max	
9	1687.92		1687.92	9	6.78		8.71	9	828.60		1052.63
		SD				SD				SD	
			549.70				3.35				196.70

Below is a map of the wetlands alder-ladyfern seepage site complex and the related data table.

Alder-Ladyfern Seepage Sites within the Aleza Lake Research Forest.



Alder-ladyfern seepage site complex

TYPE	AREA (m^2)		TYPE	Longest Axis (m)		TYPE	Shortest Axis (m)		TYPE	Linear Distance (m)		TYPE	Area-Perm Ratio		TYPE	Core-Area	
0	4.0975	SD	0	374.8	SD	0	12.55	SD	0	1499.53	SD	0	959.1214	SD	0	4.0975	SD
1	21.4125	4.327838	1	527.13	132.312086	1	12.03	6.320062	12	3002.48	786.3801	257	1	412.843	259.88	1	21.4125	4.3278377
2	6.0125	Min	2	460.35	Min	2	16.57	Min	2	1735.53	Min	2	793.3472	Min	2	6.0125	Min	
3	1.41	0.235	3	224.7	105.92	3	17.79	1.4	3	528.14	105.92	3	1014.184	331.2977	3	1.41	0.235	
4	1.675	Max	4	285.31	Max	4	20.75	Max	4	425.43	Max	4	829.8507	Max	4	1.675	Max	
5	3.2875	21.4125	5	352.18	582.33	5	17.7	38.57	5	676.59	3163.39	5	733.0798	1454.546	5	3.2875	21.4125	
6	0.685	Sum	6	144.92	Sum	6	38.57	Sum	6	144.92	Sum	6	700.7299	Sum	6	0.685	Sum	
7	0.8375	117.3925	7	174.8	11471.06	7	23.13	734.1	7	219.21	26752.36	7	752.2388	33956.88	7	0.8375	117.3925	

8	1.6775	mean		8	308.19	mean		8	20.6	mean		8	445.96	mean		8	792.8465	mean		8	1.6775	mean	
9	0.235	3.089276		9	105.92	301.87		9	15.71	19.31842105		9	105.92	704.0094737		9	1404.255	893.602		9	0.235	3.0892763	
10	0.905	Median		10	295.11	Median		10	18.59	Median		10	300.1	Median		10	917.1271	Median		10	0.905	Median	
11	0.9675	1.215		11	214.05	289.915		11	27.67	18.665		11	282.14	395.175		11	909.5607	913.3439		11	0.9675	1.215	
12	1.015			12	226			12	13.81			12	281.51			12	1034.483			12	1.015		
13	1.63			13	400.1			13	16.53			13	513.31			13	865.0307			13	1.63		
14	1.3175			14	207.02			14	18.11			14	456.76			14	918.4061			14	1.3175		
15	0.5425			15	145.87			15	18.12			15	171.05			15	1087.558			15	0.5425		
16	4.9225			16	497.17			16	16.75			16	1184.16			16	678.517			16	4.9225		
17	0.67			17	217.4			17	20.13			17	264.58			17	1149.254			17	0.67		
18	6.55			18	582.33			18	25.83			18	583.22			18	331.2977			18	6.55		
19	14.655			19	438.16			19	18.74			19	3163.39			19	791.5387			19	14.655		
20	0.8525			20	313.35			20	15.66			20	372.74			20	1102.639			20	0.8525		
21	1.0275			21	184.59			21	29.07			21	184.59			21	720.1946			21	1.0275		
22	2.635			22	298.07			22	20.31			22	381.91			22	952.5617			22	2.635		
23	7.905			23	378.36			23	19.41			23	1800.38			23	917.141			23	7.905		
24	1.685			24	397.37			24	20.37			24	455.6			24	706.2315			24	1.685		
25	2.3			25	361.48			25	21.24			25	562.58			25	856.5217			25	2.3		
26	1.1125			26	269.94			26	30.94			26	268.43			26	737.0787			26	1.1125		
27	4.795			27	471.57			27	15.61			27	688.01			27	550.5735			27	4.795		
28	0.3125			28	138.01			28	18.44			28	137.39			28	1344			28	0.3125		
29	0.3325			29	107.97			29	1.4			29	107.97			29	962.406			29	0.3325		
30	1.0475			30	181.48			30	21.57			30	408.44			30	1088.306			30	1.0475		
31	5.645			31	565.88			31	16.61			31	2147.07			31	972.5421			31	5.645		
32	1.0025			32	294.52			32	18.97			32	377.63			32	967.581			32	1.0025		
33	0.945			33	221.79			33	27.4			33	222.04			33	656.0847			33	0.945		
34	0.33			34	143.6			34	9.27			34	189.7			34	1454.546			34	0.33		
35	0.75			35	260.15			35	20.36			35	260.15			35	986.6667			35	0.75		
36	0.45			36	226.88			36	14.53			36	232.57			36	1444.444			36	0.45		
37	9.76			37	474.54			37	23.26			37	1971.23			37	462.0902			37	9.76		

Conclusions

Overall the project was a success. The manual measuring of some of the landscape metrics was unfortunate; more time and research into how the fragstats program works would potentially overcome this problem. The alder-ladyfern seepage site complex was the most prominent polygon in the landscape. The alder-ladyfern seepage site class has the largest polygons with the greatest linear distance. The two other classes of comparison, lowland wet forest alder-ladyfern, and upland forest alder-ladyfern both had a small number of polygons and area in comparison. All polygons had a large perimeter to area ratio as the majority of the polygons were long and slender. Given the long slender shape of all the polygons the core-area measurments were relatively the same as the area measurements. When looking at the potential for lichen dispersal, the shortest axis values are of importance. This value could potentially represent the minimum distance for a lichen species to travel if the species were to spread. Since the alder-ladyfern class is most prominent throughout the landscape it should be recomended to licencees that alder-ladyfern vegetative sites should be maintained within the landscape.

Future Developments / works

Future research is being conducted in Northern BC on other areas of old growth forest. The same analysis will be conducted. Further reading into using the metrics for fragstats analysis would be of much help. This would cut down on the time for analysis. Also obaining a map layer that already classes the polygons by vegetation type would be helpful. Further research to see if shortest, longest and linear distance through each polygon would be of help. Since these metrics were manually measured there is a certain degree of error that is present.

References

All files pertaining to this project can be found under N:\hirshfif\geog413\finalproject. Fragstats help provided the information I needed to learn how to use the program.

TOP