Evaluating Corridors

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Corridor Design

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Evaluating Corridors

Least cost methods always provide a “best” solution, even when the best is not very good.

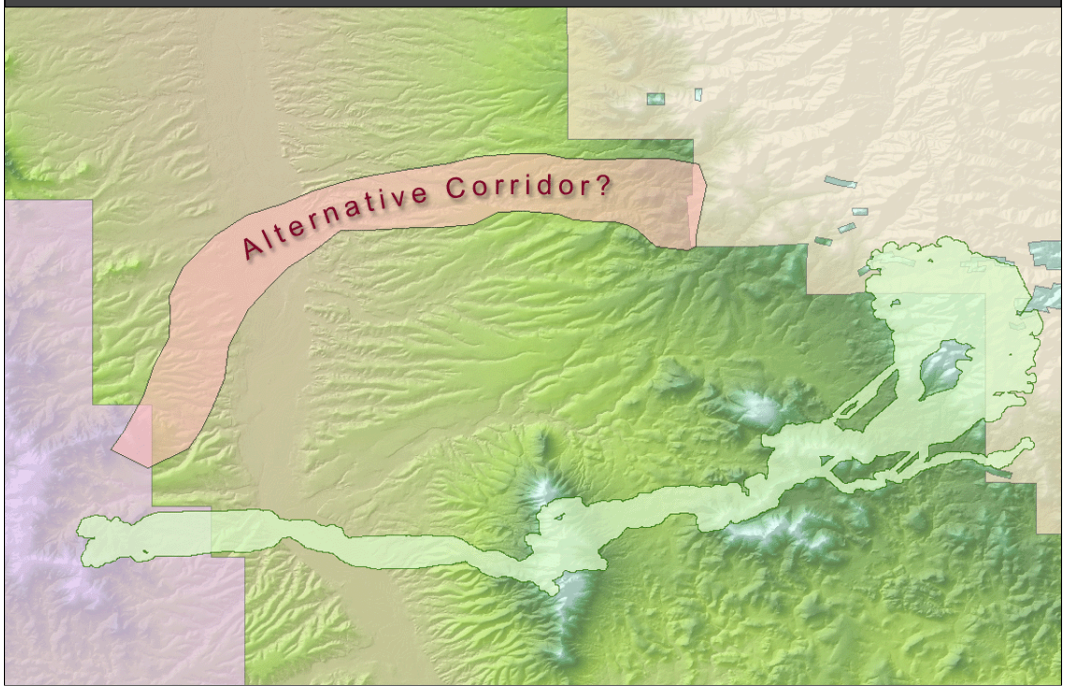
These Corridor Evaluation tools allow you to:

1. Describe how well your proposed linkage design serves each focal species.
2. Compare the biologically optimum linkage design to alternative designs that may better meet cost or political constraints.

Just because it is the best does not mean that it is good enough! We could find the biologically optimum route for a desert tortise to cross the Himalayas, or a cougar to go from here to Hawaii, but that doesn’t mean they would ever do it. These tools will not tell you whether or not the corridor is good enough, but they will provide you with some statistics to let you make your own decision.

Also, just because it is best does not mean it is available to preserve! These tools will allow you to compare the optimum route with more realistic alternatives.

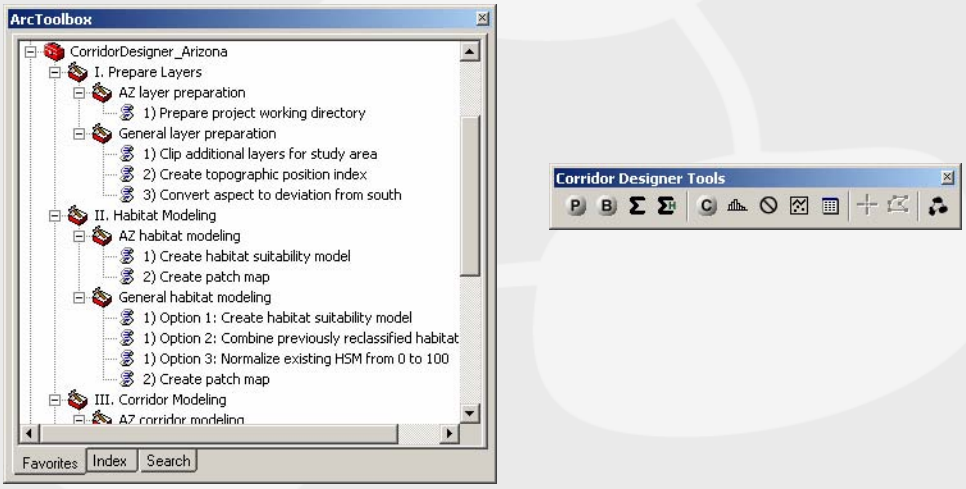
Evaluating Corridors



The biologically best corridor might not be a viable option. You will likely want to compare how well the biologically best corridor compares with alternatives.

Tool Locations

Toolbox vs. Tool Bar



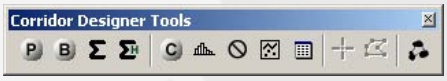
A general comment: The entire suite of Corridor Designer tools are divided into Toolbox Tools and ArcGIS command buttons. All Corridor and Habitat Suitability Model Creation tools are written in Python and are available as Toolbox tools or Command Line functions. All corridor evaluation tools are written in Visual Basic 6 using ArcObjects and are available as ArcGIS command buttons.

The ArcToolbox functions have the advantage that they can be run from both the toolbox and from the command line, and the command line option gives the power user a lot of flexibility to run large batch files. As they are written in Python, users can also easily read the source code and modify it if they wish to.

The ArcGIS command buttons have the advantage of allowing live interaction with the map. An ArcObjects dialog can remain open as users select different objects from the map. Dialogs created in Visual Basic are also much easier to modify, and the Bottleneck Results dialog is a good example of a function that would be impossible as an ArcToolbox function.

Evaluating Corridors

Four Metrics:



- *Patch-to-Patch Distances*
- *Bottlenecks*
- *General Statistics*
- *Habitat Suitability Model Statistics*

Several Ancillary Tools

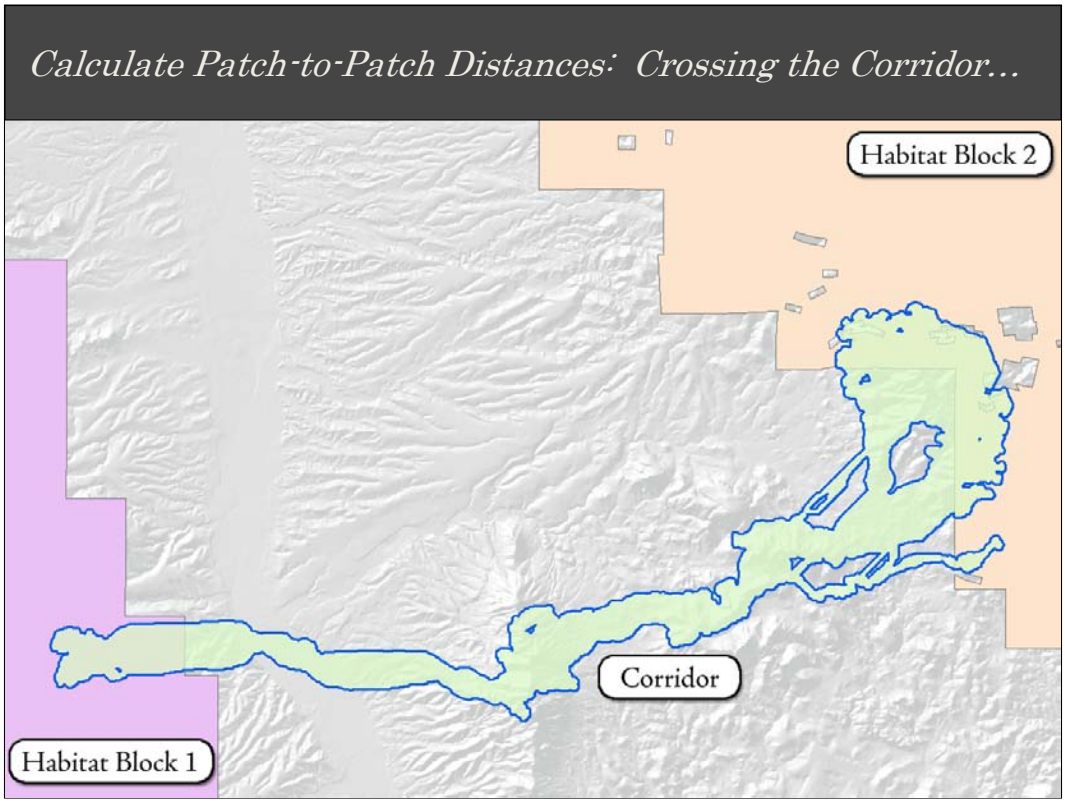
- *Clip to Polygon*
- *Standard ArcGIS Statistics*
- *Clear Corridor Graphics*
- *Convert Graphics to Shapefile*
- *Open Table*

These are tools that we thought up as we considered different ways to evaluate corridors. We invite new ideas for future revisions of Corridor Designer.

Four general metrics: Patch-to-patch distances, Bottleneck analysis, General statistics, Habitat Suitability Model statistics.

Ancillary Tools include: a "Clip to Polygon" tool, The standard ArcGIS Statistics tool, a "Clear Corridor Graphics" tool, a "Convert Graphics to Shapefile" tool, which can also be used to create new empty shapefiles, an "Open Table" tool.

This slide show will discuss all metrics, and give illustrations of 3 ancillary tools.



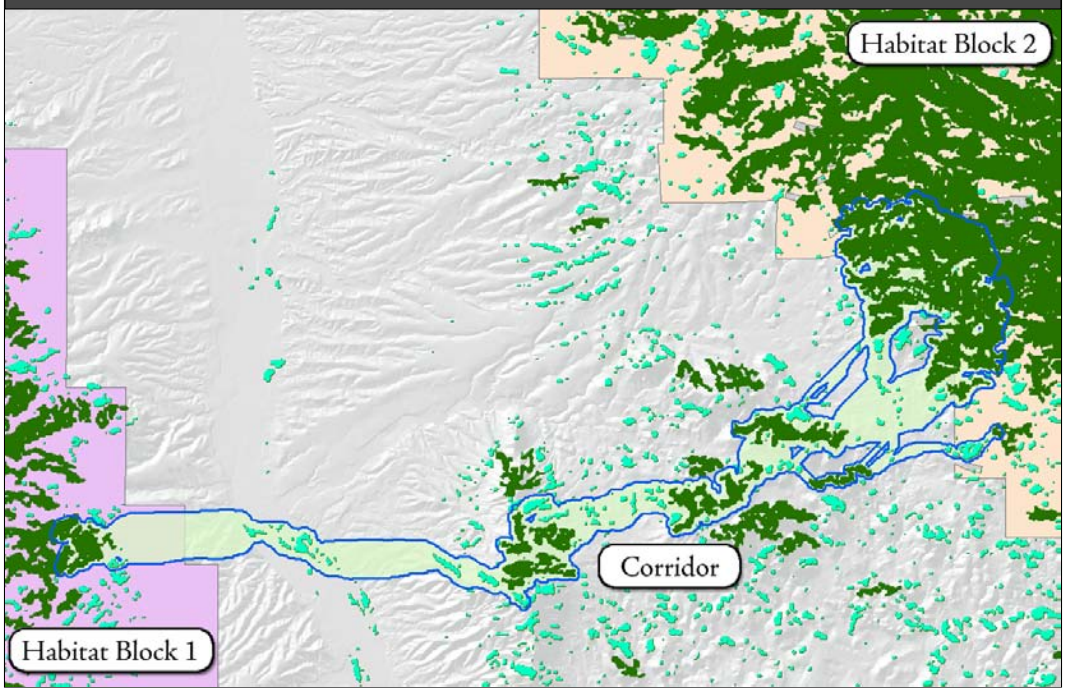
Given a corridor and two habitat blocks:

The species must make it through the corridor, but the corridor may not be completely composed of good habitat. Therefore the species may have to cross some regions with poor habitat. Is the species capable of crossing poor habitat? If so, is there a threshold distance above which the species will not cross that habitat? This function will identify the largest gaps necessary for the species to make it from one habitat block to the next.

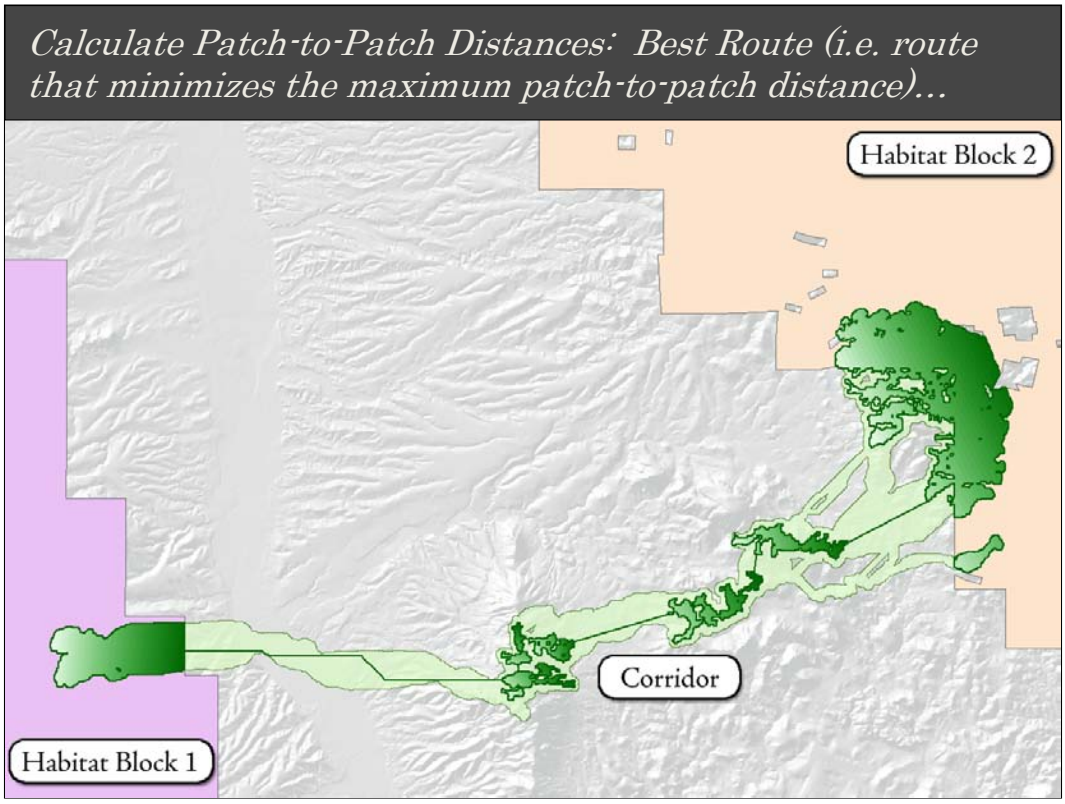
Calculate Patch-to-Patch Distances: Include patches of good habitat…

An example of high-quality habitat distributed across the landscape. Presumably these patches provide refuges and safe zones for the species. The inter-patch matrix is the threat.

Calculate Patch-to-Patch Distances: Possibly only consider patches of a certain size…



We may consider small patches to be insufficient to support the species at the level it would require. Therefore we can restrict the analysis to only patches of a certain size.

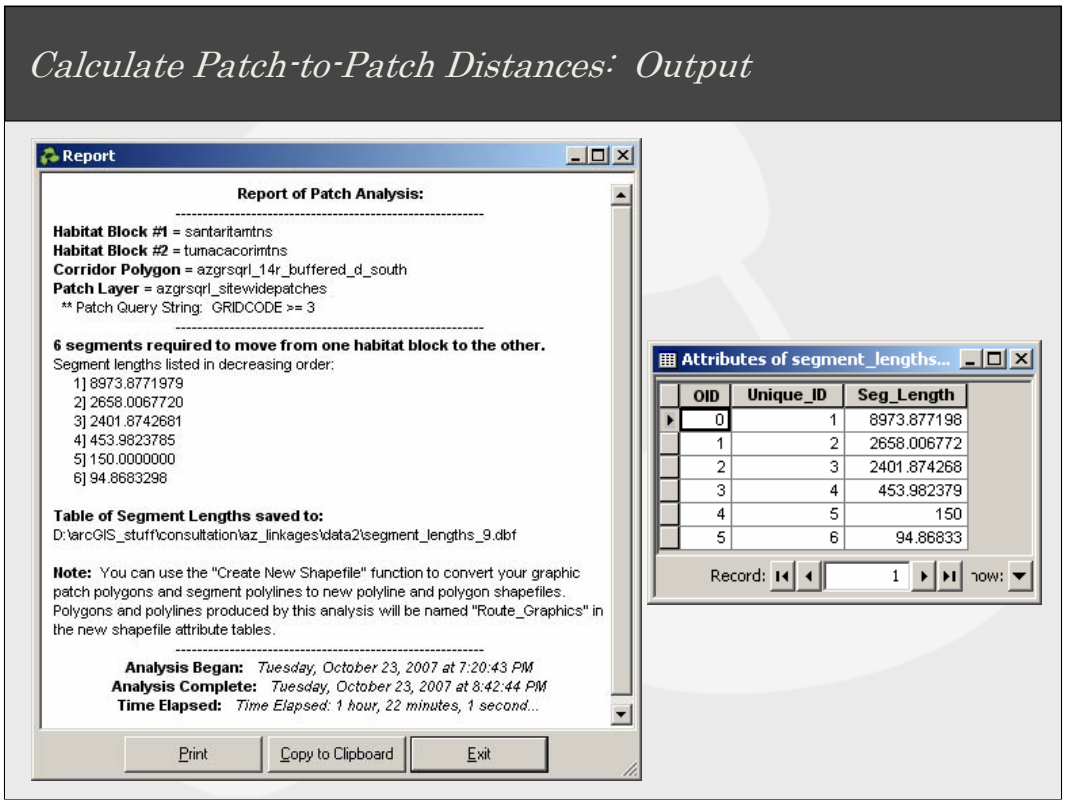


Actual best route is calculated as an abbreviated Minimum Spanning Tree using an adaptation of Kruskall's algorithm. The manual explains more thoroughly and gives a citation.

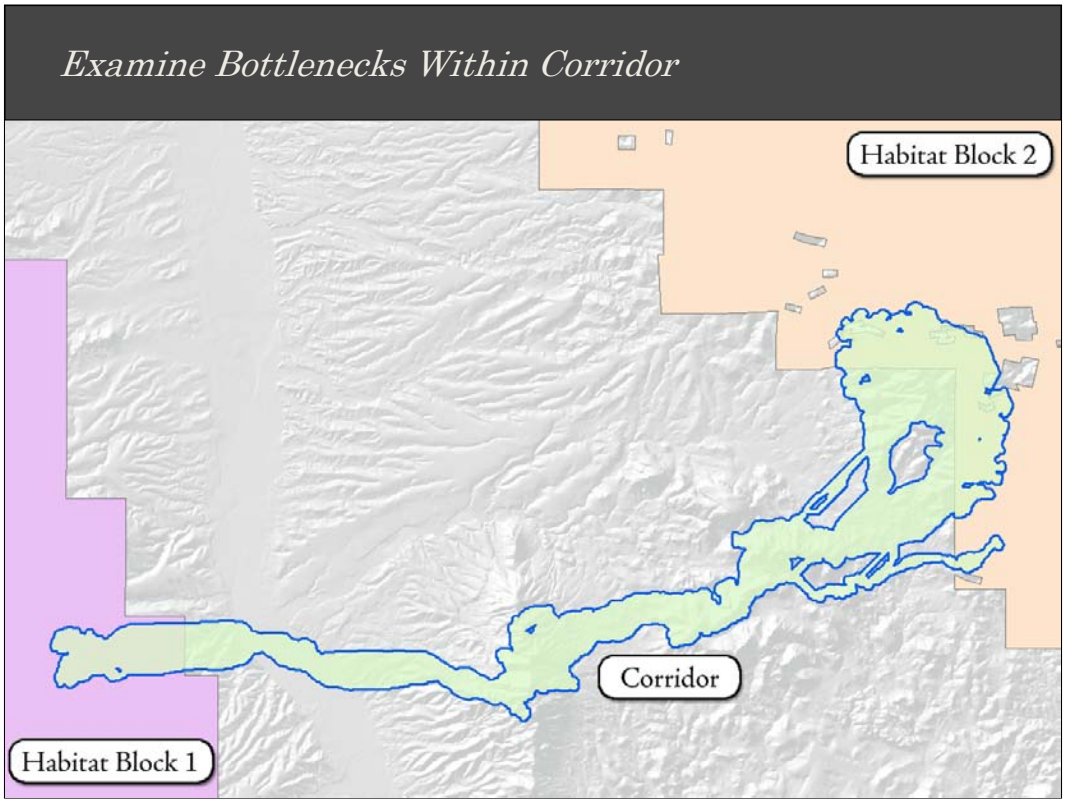
Cool function, but we are not satisfied with 2 aspects:

1) Takes a very long time! This example took 1.5 hours to run.
2) If the straight-line connecter between patches goes outside the corridor, then the tool resorts to Least Cost functions which restrict the connector to 45° increments. These lines are artifically longer than they should be.

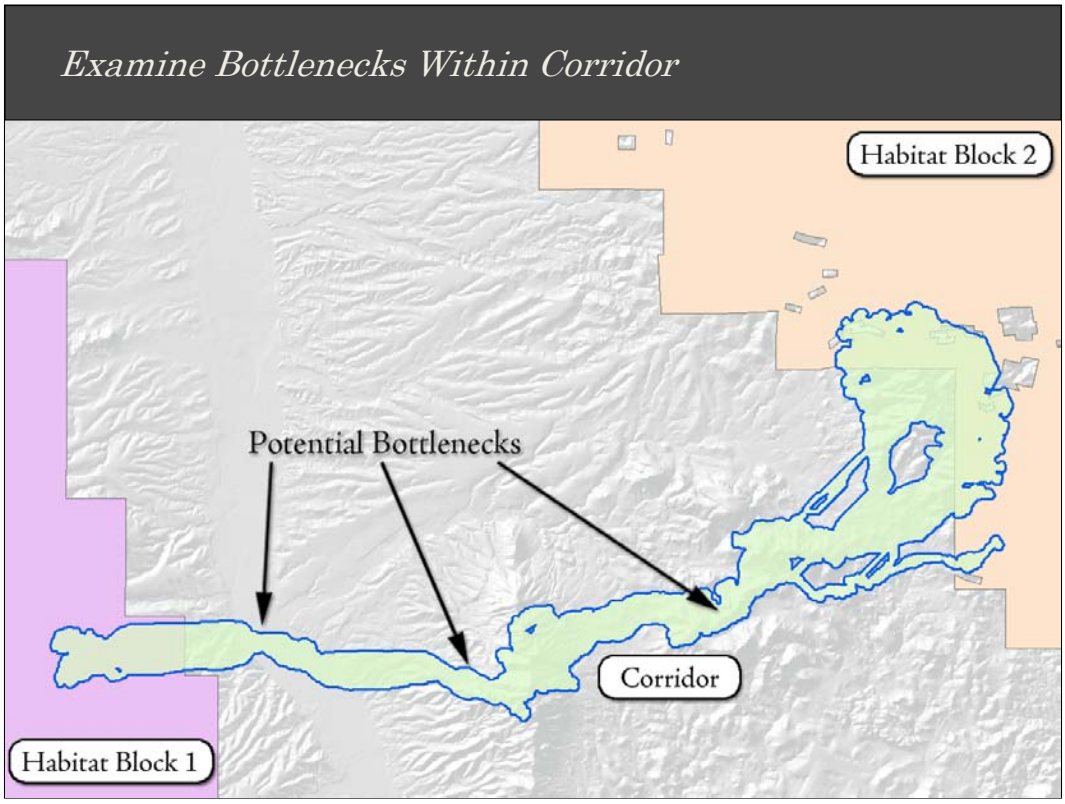
Calculate Patch-to-Patch Distances: Output



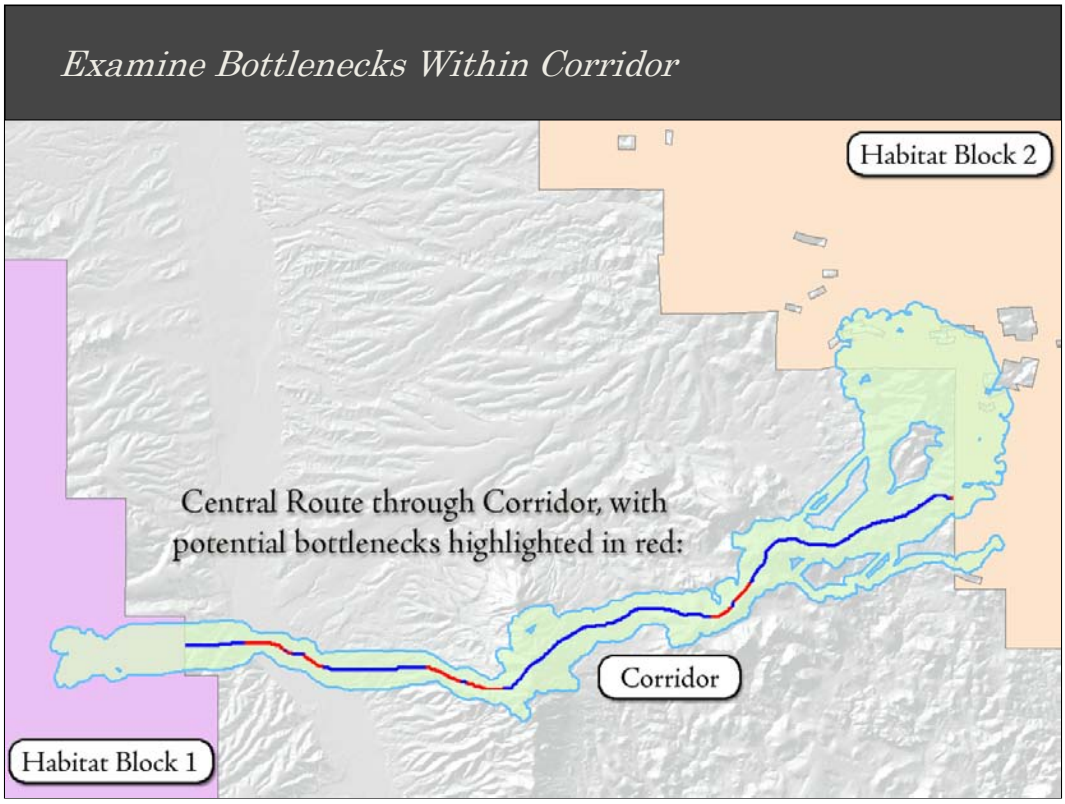
Output includes a text report and a dBASE table of segment lengths.



Most relevant to species that require a minimum distance from developed areas, or who do poorly with edges.

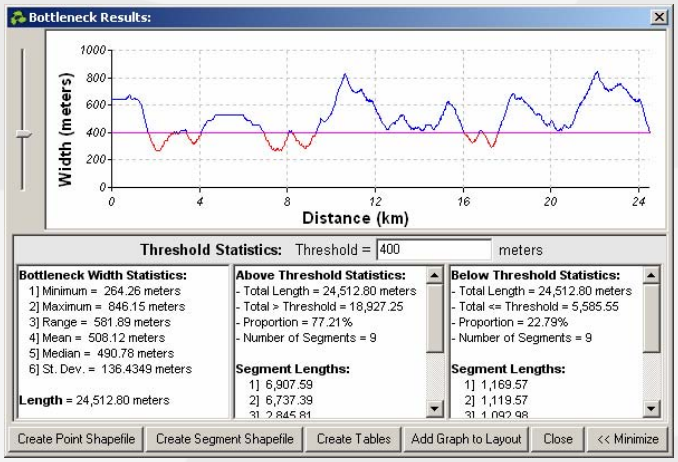


We may visually identify a few potential bottlenecks in the corridor. We could also use the Measure tool to estimate the width an individual spots.



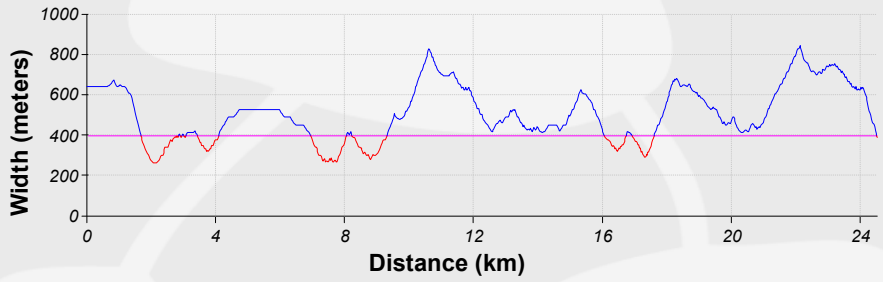
Ideally, we would want to know both the locations and extent of possible bottlenecks within the corridor. How long is the region that is below some threshold width?

Examine Bottlenecks Within Corridor



Example of Bottleneck Results dialog. You can adjust the threshold several ways, and the statistics and map will change automatically as you set different thresholds.

Examine Bottlenecks Within Corridor



Attributes of bottleneck_stats_9

OID	Unique_ID	Statistic	Value
0	13	Minimum Width	264.264
1	14	Maximum Width	845.151
2	15	Range of Width Values	581.887
3	16	Mean Width	508.124965
4	17	Median Width	490.775
5	18	Standard Deviation of Width	136.434921
6	19	Centerline Length	24512.8
7	20	Width Threshold Value	555
8	21	Length Below Threshold	16236.118051
9	22	Proportion Below Threshold	0.662353
10	23	Length Above Threshold	8276.681949
11	24	Proportion Above Threshold	0.337647

Record: 1 Show: All Selected records

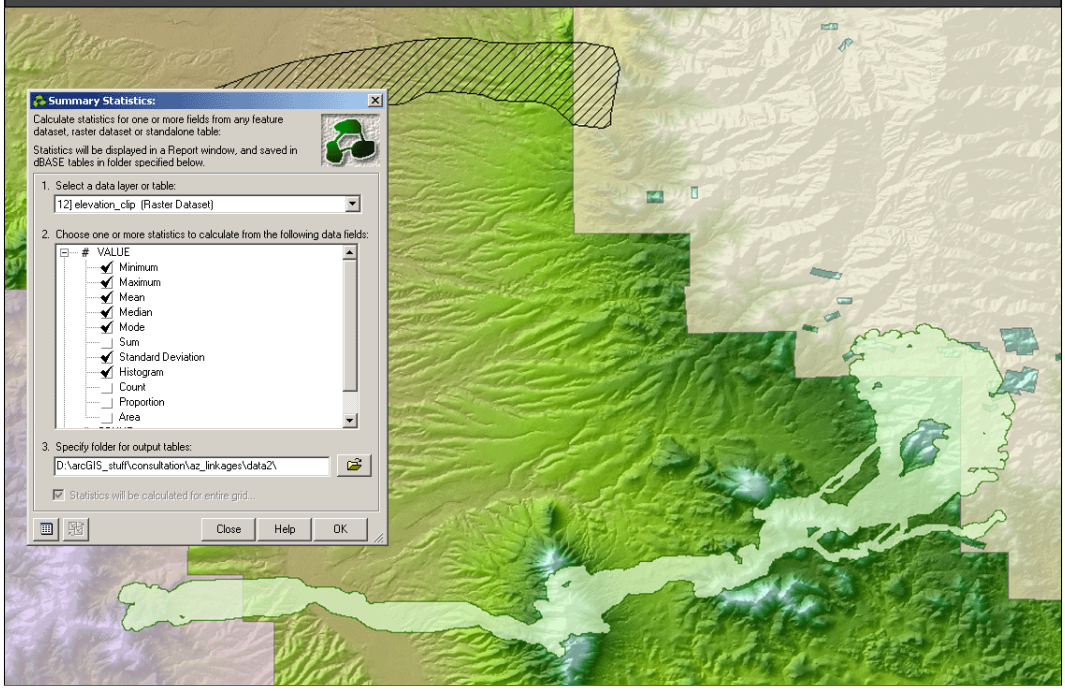
Attributes of threshold_lengths_9

OID	Unique_ID	Name	Length
0	1	Total Length	24512.6
1	2	Threshold Value	555
2	3	Above Threshold #1	3016.212466
3	4	Above Threshold #2	2037.051493
4	5	Above Threshold #3	1436.797267
5	6	Above Threshold #4	1252.935043
6	7	Above Threshold #5	533.689689
7	8	Below Threshold #1	8598.269076
8	9	Below Threshold #2	3084.575347
9	10	Below Threshold #3	2283.753713
10	11	Below Threshold #4	1999.342005
11	12	Below Threshold #5	290.173913

Record: 1 Show: All elected

Bottleneck Results dialog generates a graph, several statistical tables and two types of shapefiles.

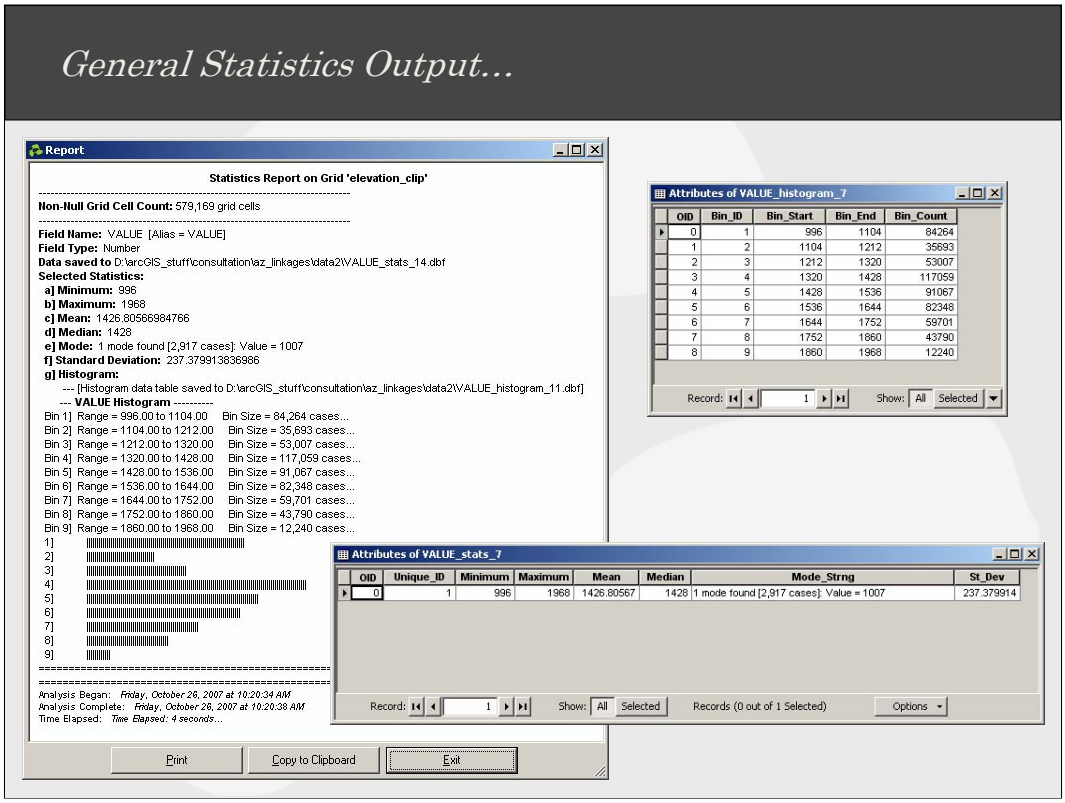
Calculate General Statistics Within Corridor



General statistics on any background dataset, plus special case for habitat suitability statistics.

Important! Must clip grid to polygon first.

General Statistics Output…



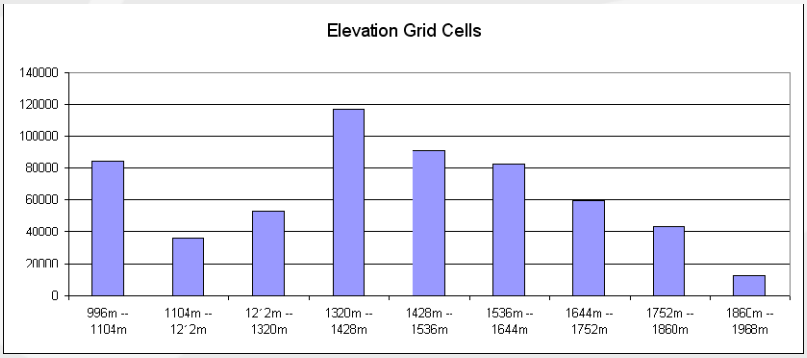
Output includes dBASE tables and a text report.

General Statistics Output…

Attributes of VALUt_histogram_/

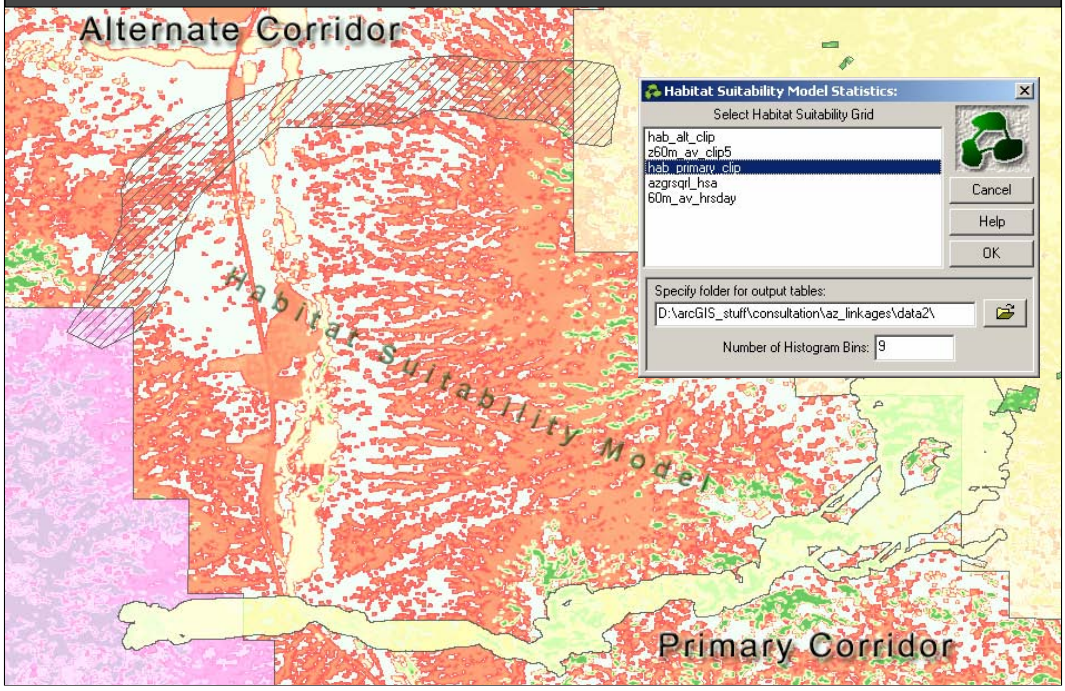
OID	Bin_ID	Bin_Start	Bin_End	Bin_Count
0	1	996	1104	84264
1	2	1104	1212	35693
2	3	1212	1320	53007
3	4	1320	1428	117059
4	5	1428	1536	91067
5	6	1536	1644	82343
6	7	1644	1752	59701
7	8	1752	1860	43791
8	9	1860	1968	12240

Record: 1 Show: All Selected



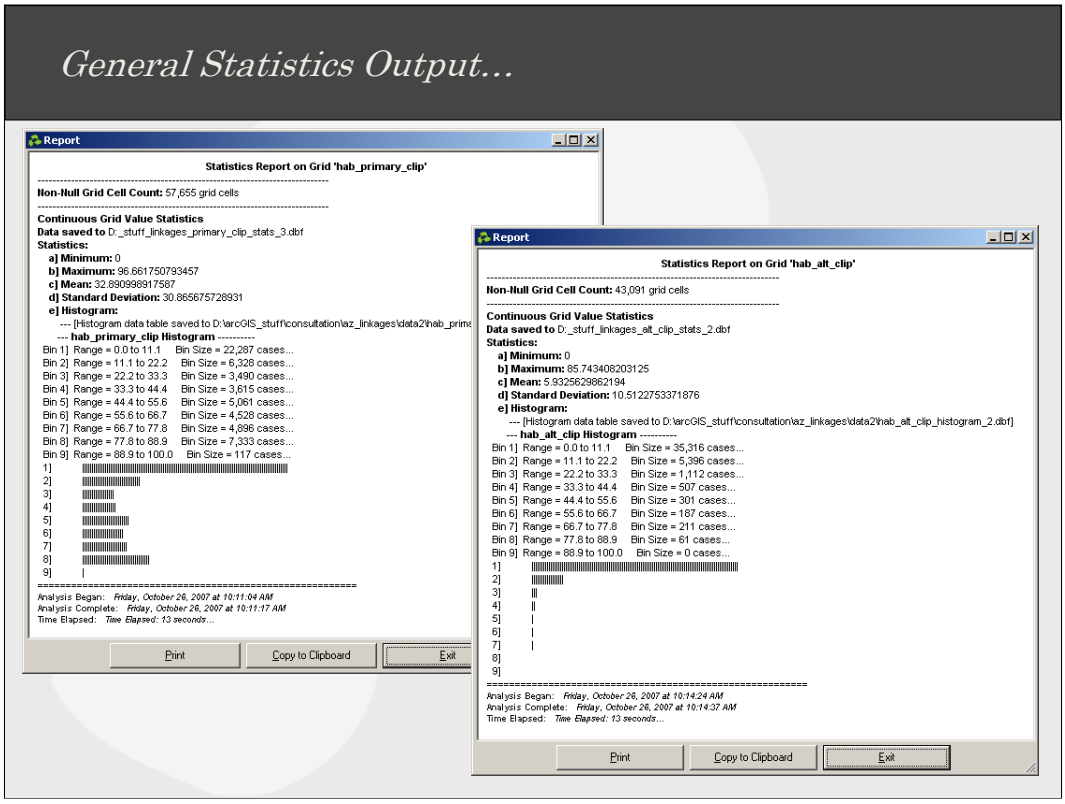
The dBASE Table can be opened up in Excel for more advanced graphing functions.

Habitat Suitability Model Statistics



Habitat Suitability Statistics tool is intended specifically for floating-point grids that range from a minimum possible value of 0, up to a maximum possible value of 100.

General Statistics Output…



Habitat Statistics Report is similar to General Statistics Report. However, note that the histogram range always has a minimum of 0 and a maximum of 100, regardless of the actual minimum and maximum values found in the grids. This fact makes it much easier to compare alternative corridor polygons.

General Statistics Output…

Attributes of hab_primary_clip_histogram

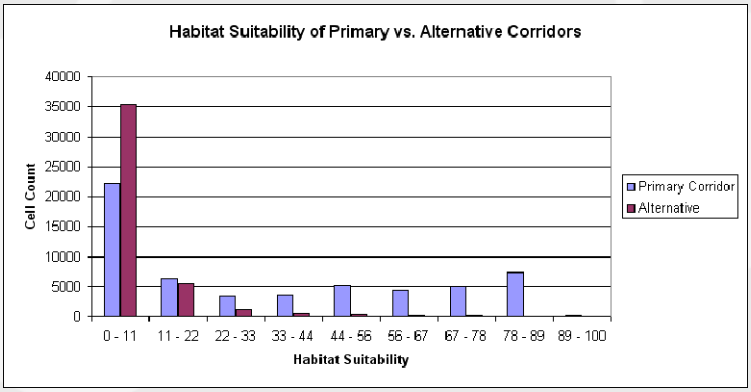
OID	Bin_ID	Bin_Start	Bin_End	Bin_Count
0	1	0	11.111111	22287
1	2	11.111111	22.222222	6328
2	3	22.222222	33.333333	3490
3	4	33.333333	44.444444	3615
4	5	44.444444	55.555556	5061
5	6	55.555556	66.666667	4528
6	7	66.666667	77.777778	4896
7	8	77.777778	88.888889	7333
8	9	88.888889	100	117

Record: 1 Show: All Selected

Attributes of hab_alt_clip_histogram

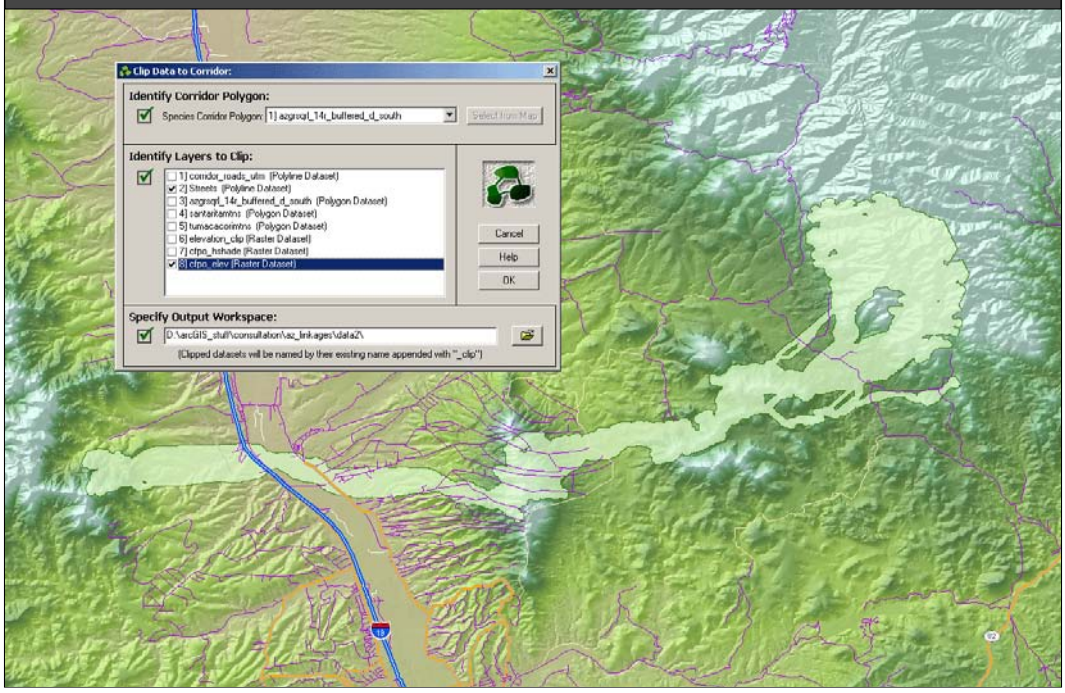
OID	Bin_ID	Bin_Start	Bin_End	Bin_Count
0	1	0	11.111111	35316
1	2	11.111111	22.222222	5396
2	3	22.222222	33.333333	1112
3	4	33.333333	44.444444	507
4	5	44.444444	55.555556	301
5	6	55.555556	66.666667	187
6	7	66.666667	77.777778	211
7	8	77.777778	88.888889	61
8	9	88.888889	100	0

Record: 1 Show: All



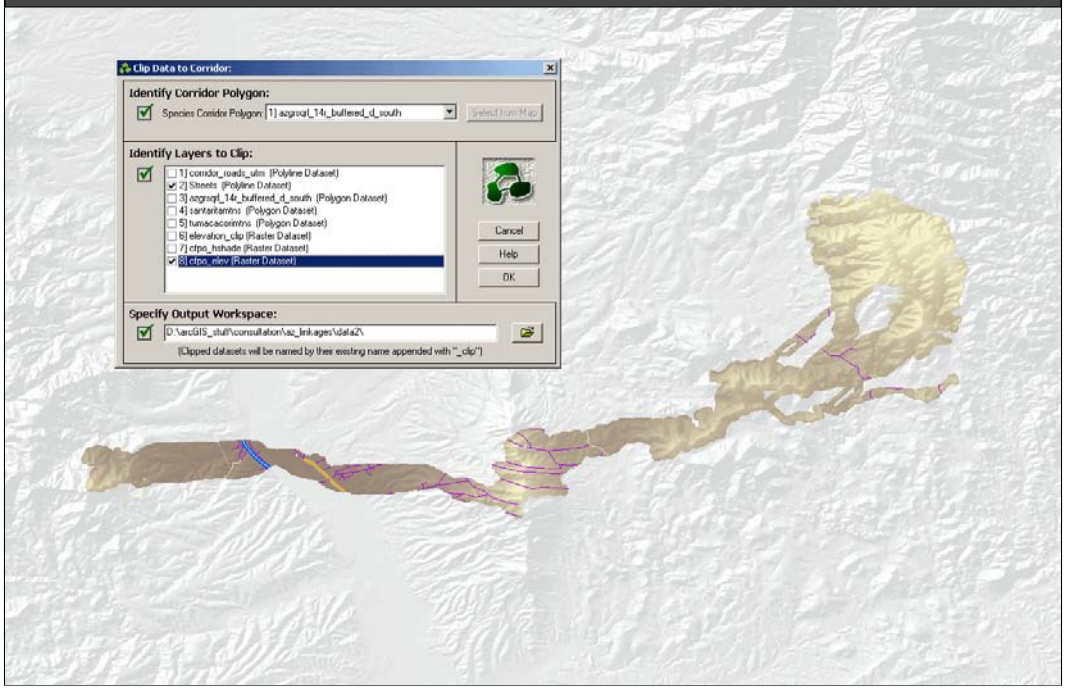
Again, the dBASE tables may easily be brought into Excel.

Ancillary Tool: Raster and Vector Layer Clipper



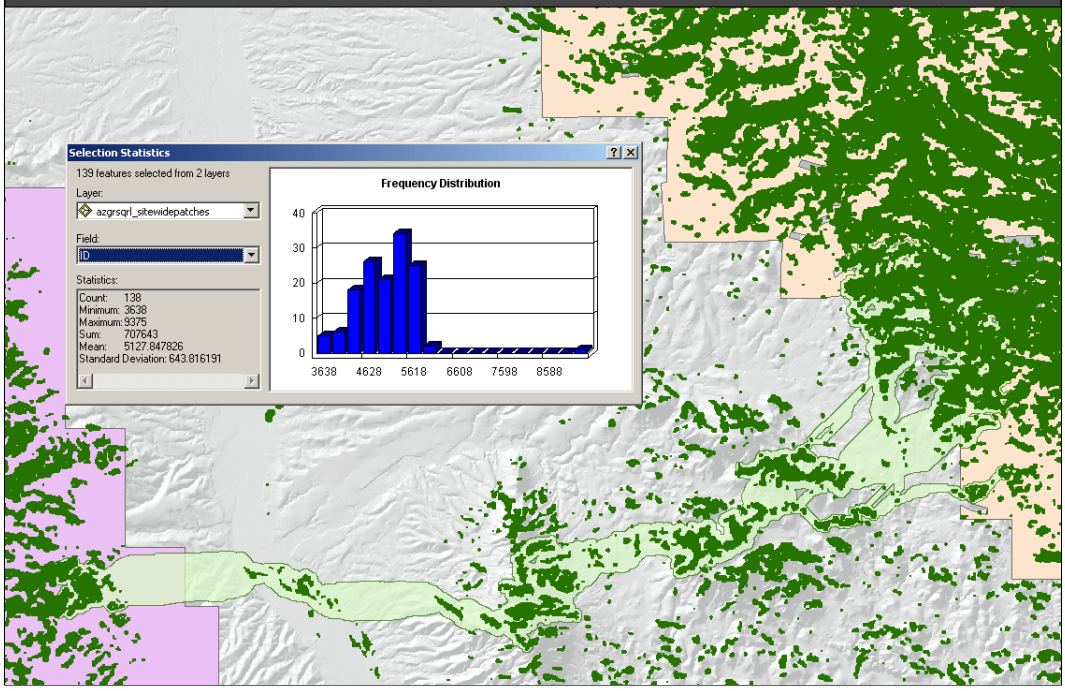
The statistics tools work on clipped data, so this tool will clip your data for you. It clips both grid and vector data, and it will successfully clip to multi-part polygons or polygons with holes.

Ancillary Tool: Raster and Vector Layer Clipper

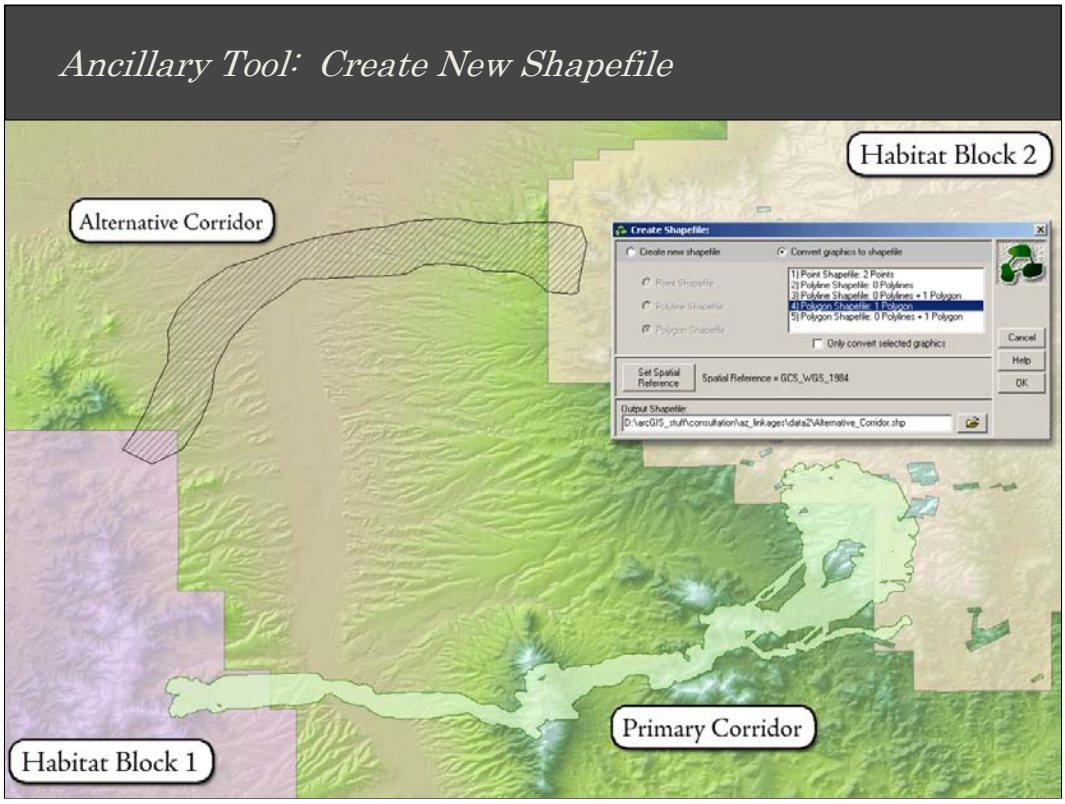


Example of both a raster and vector layer clipped to a complex corridor polygon.

Ancillary Tool: General ArcGIS Statistics



This is a standard function available in ArcGIS. It only works on vector data, and it only works on selected features, but it is very useful within that narrow definition. We added a button to make it easier to implement this standard function.



This function allows you to either create brand new empty shapefiles, or convert graphics on the screen to shapefiles. If any graphics are selected, it allows you to only convert the selected graphics.