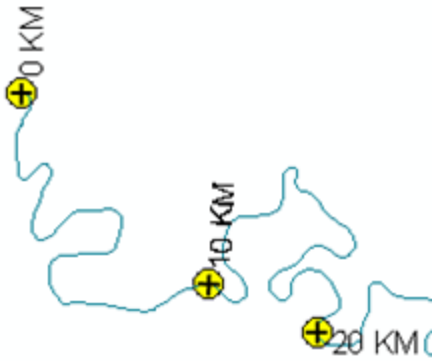
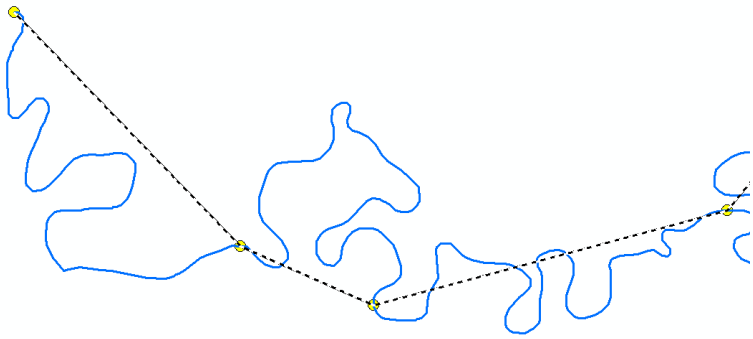
Exercise#2: Steam Reach Sinuosity & Gradient

In this exercise, we will delineate sinuosity and gradient of Beaver Creek 10-km stream reaches. You can do this in the following steps:

1) Create beginning and ending points for each 10-km line



2) Create a straight line between each pair of points and compute the straight line distance in KM.



3) Compute Sinuosity for each 10-km stream reach.

BeaverCreek_StraightLines

Shape *	StraightKM	Sinuosity
Polyline M	4.367507	2.289636
Polyline M	1.956263	5.111786
Polyline M	4.913017	2.035409

To determine reach gradient or drop:

1) Extract elevation values at each 10-km point.

BeaverCreek_10KM_Points_Elev

	ID	From_	To	Grayling	ORIG_FID	RASTERVALU
▸	1	0	10	5	1	102.038246
	1	10	20	5	2	103.155884
	1	20	30	2	3	104
	1	30	40	4	4	105
	1	40	50	1	5	105.128357

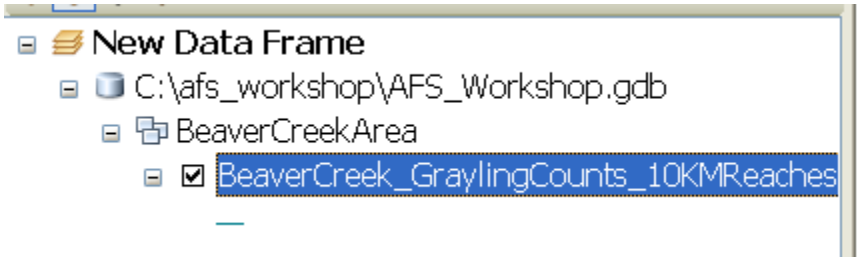
2) Pass the begin and ending reach elevation values to each reach line.

Polyline M	0	10	5	102.04	103.16
Polyline M	10	20	5	103.16	104.00
Polyline M	20	30	2	104.00	105.00
Polyline M	30	40	4	105.00	105.13

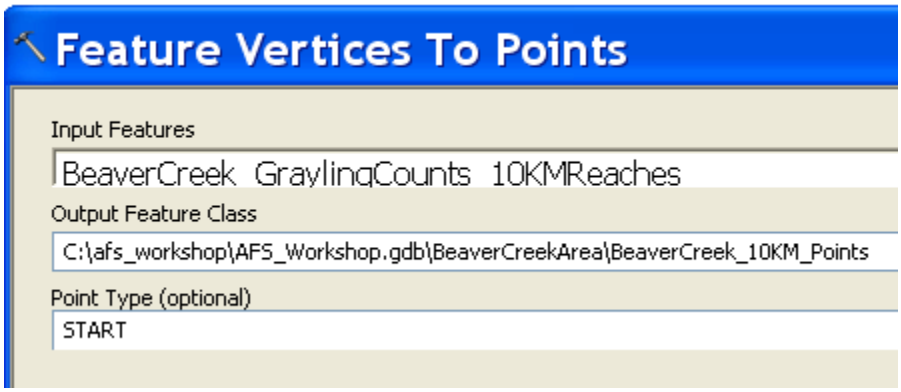
3) And compute the drop in meters as the ending elevation minus the beginning elevation.

RASTERVALU	RASTERVALU	Drop_Meters
102.04	103.16	1.1
103.16	104.00	0.8
104.00	105.00	1.0
105.00	105.13	0.1

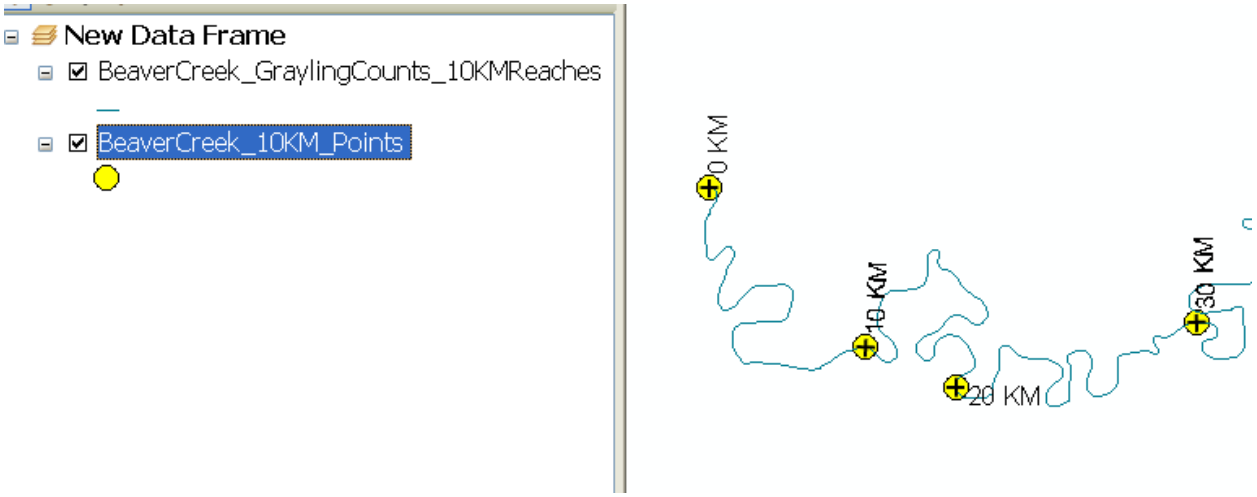
Start by creating a new data frame and adding your 10-km stream reaches to that data frame..



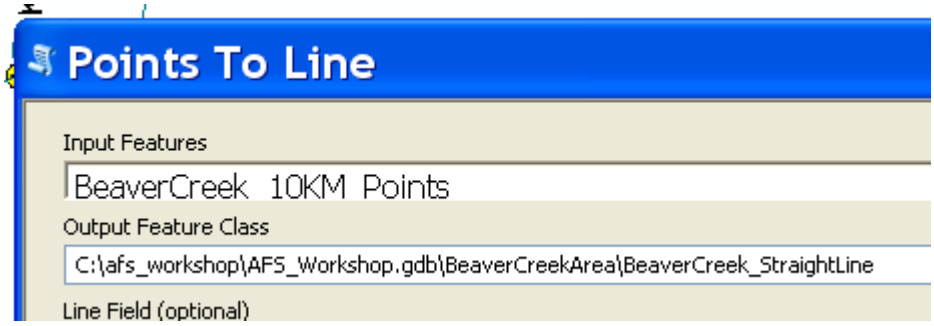
Then use the ***Feature Vertices to Points*** geoprocessing tool to extract the starting point for each 10KM reach.

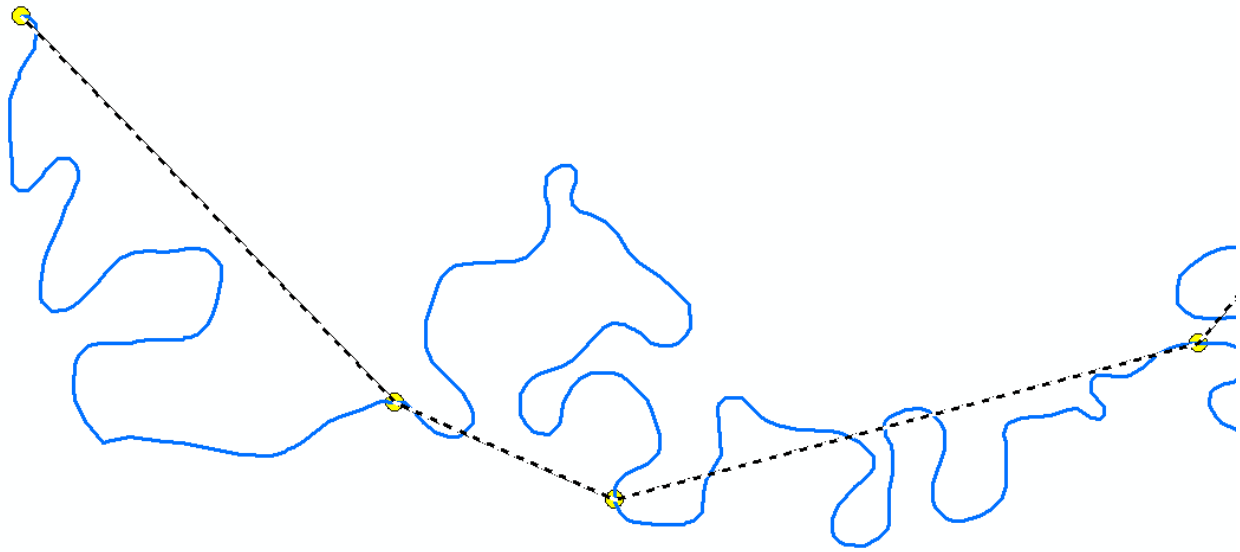


Notice that the points are shape PointM so they contain measures in KM. Hatch your line every 10km…

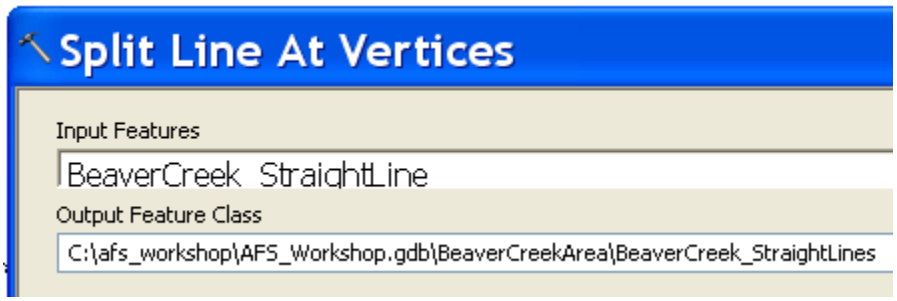


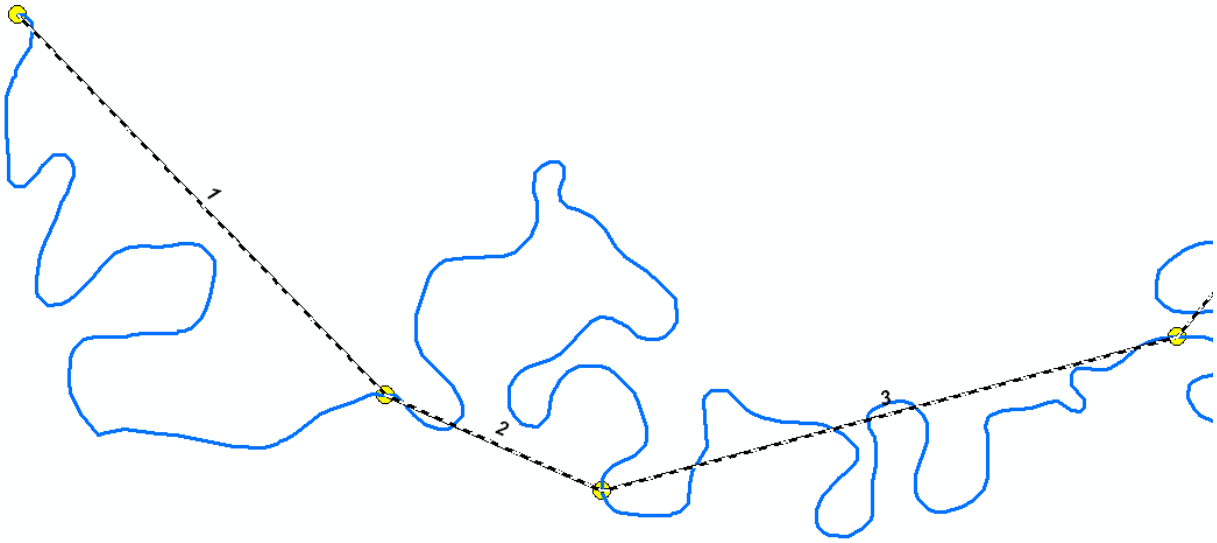
Next we need to compute the straight line distance between each pair of 10KM points. Use the Points to Line geoprocessing tool to "connect the dots" .





Then split the line into many straight lines using the ***Split Line at Vertices*** geoprocessing tool.





We know the river distance between points is 10km, so add a double precision field named StraightKM and compute that distance for each reach..

BeaverCreek_StraightLines

OBJECTID *	Shape *	StraightKM
1	Polyline M	4.367507
2	Polyline M	1.956263
3	Polyline M	4.913017
4	Polyline M	3.174556
5	Polyline M	3.444947

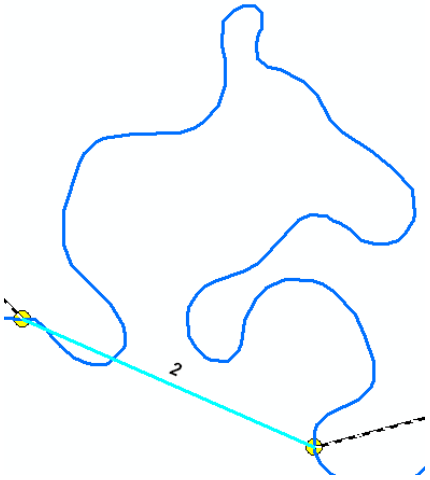
And compute Sinuosity as 10.0 / StraightKM.

BeaverCreek_StraightLines

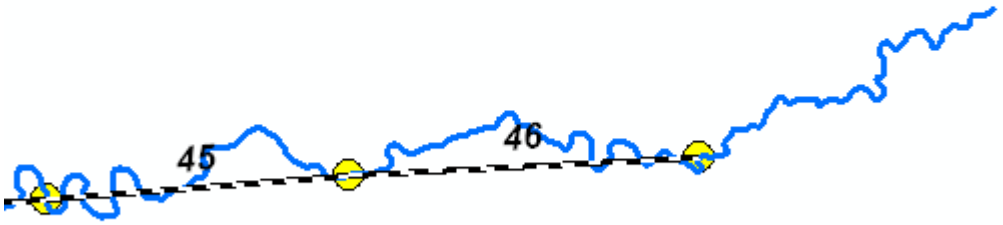
Shape *	StraightKM	Sinuosity
Polyline M	4.367507	2.289636
Polyline M	1.956263	5.111786
Polyline M	4.913017	2.035409
Polyline M	3.174556	3.150047
Polyline M	3.444947	2.902802

Sort descending on your sinuosity field and select the 10-km reach with the greatest value.

Then from the Selection Menu→Zoom to Selected Feature…



Note we will not have a sinuousity value for the last 10-km reach:



Use the ***Join Field*** geoprocessing tool to pass the sinuousity values to your original 10-km stream reach lines.

BeaverCreek_StraightLines

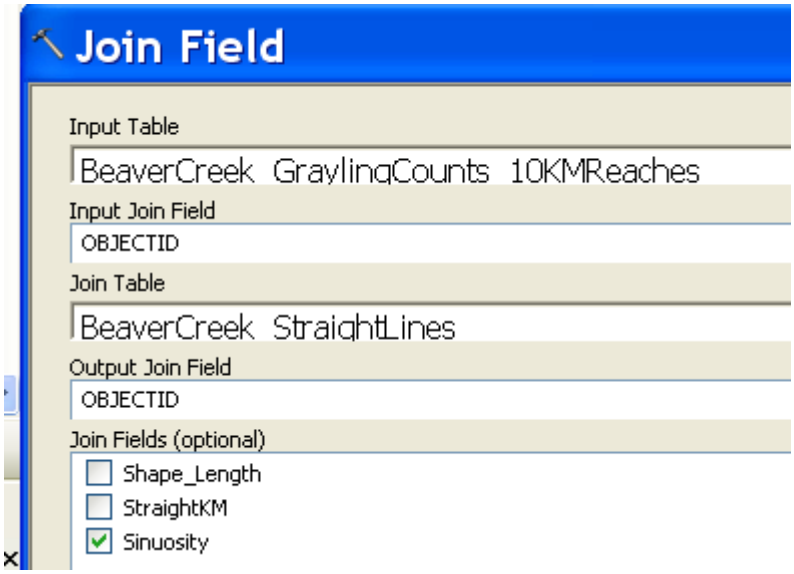
OBJECTID *	Shape *	StraightKM	Sinuosity
1	Polyline M	4.367507	2.289636
2	Polyline M	1.956263	5.111786
3	Polyline M	4.913017	2.035409
4	Polyline M	3.174556	3.150047
5	Polyline M	3.444947	2.902802
6	Polyline M	2.946666	3.393666
7	Polyline M	3.841877	2.602894
8	Polyline M	3.858382	2.59176
9	Polyline M	2.601468	3.843984
10	Polyline M	5.457172	1.832451
11	Polyline M	6.134379	1.630157

0 (0 out of 46 Selected)

BeaverCreek_StraightLine | BeaverCreek_StraightLines

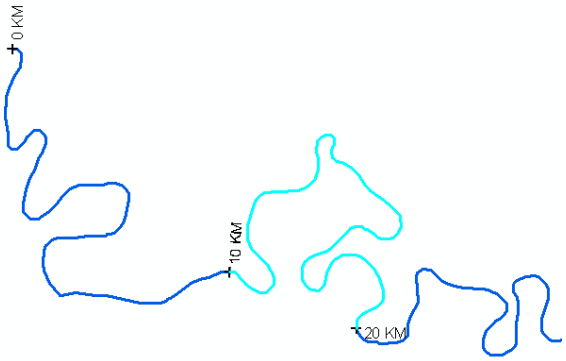
BeaverCreek_GraylingCounts_10KMReaches

OBJECTID *	Shape *	ID	From_	To	Grayling
1	Polyline M	1	0	10	5
2	Polyline M	1	10	20	5
3	Polyline M	1	20	30	2
4	Polyline M	1	30	40	4
5	Polyline M	1	40	50	1
6	Polyline M	1	50	60	6
7	Polyline M	1	60	70	6
8	Polyline M	1	70	80	2
9	Polyline M	1	80	90	4
10	Polyline M	1	90	100	3
11	Polyline M	1	100	110	2

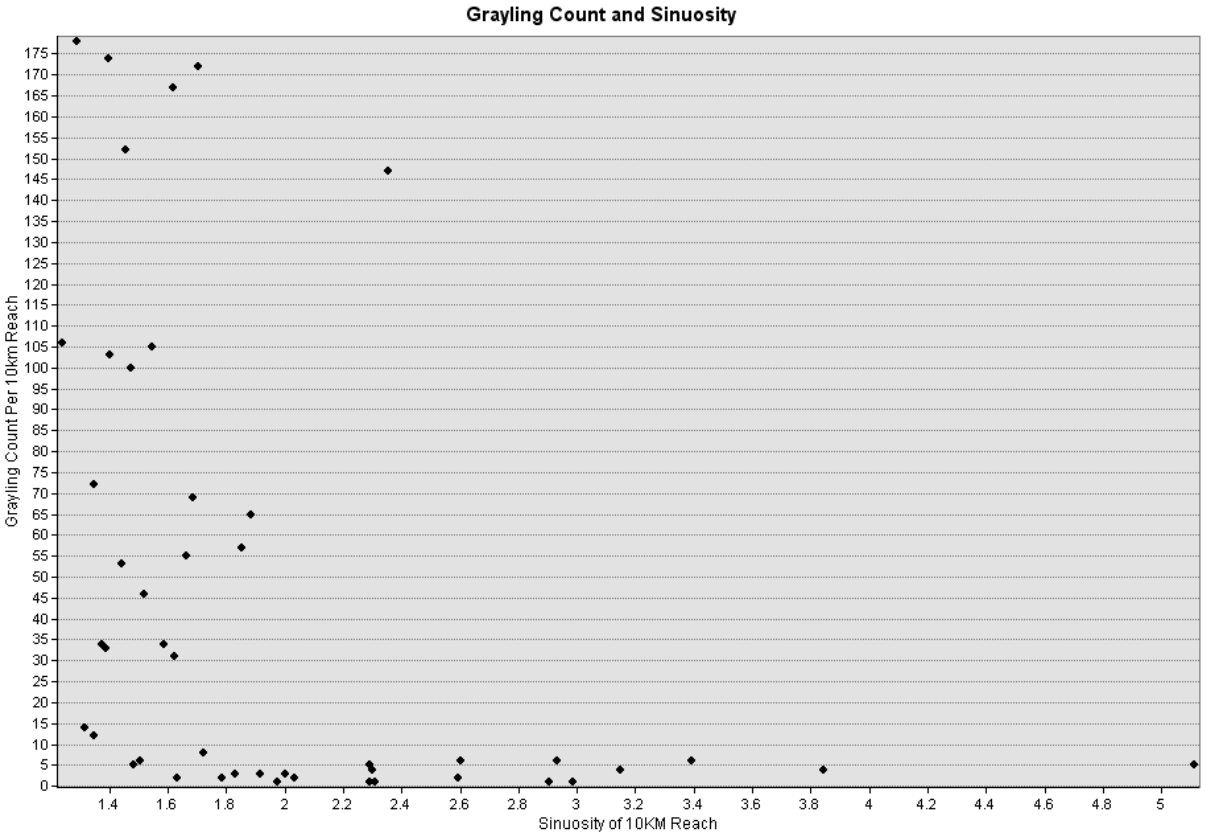


BeaverCreek_GraylingCounts_10KMReaches

ID	From_	To	Grayling	Sinuosity
1	0	10	5	2.289636
1	10	20	5	5.111786
1	20	30	2	2.035409
1	30	40	4	3.150047
1	40	50	1	2.902802
1	50	60	6	3.393666
1	60	70	6	2.602894
1	70	80	2	2.59176
1	80	90	4	3.843984
1	90	100	3	1.832451
1	100	110	2	1.630157
1	110	120	4	2.297668

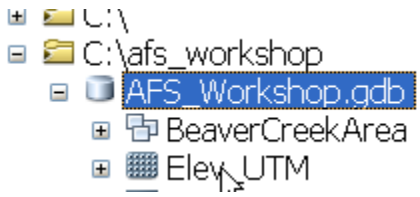


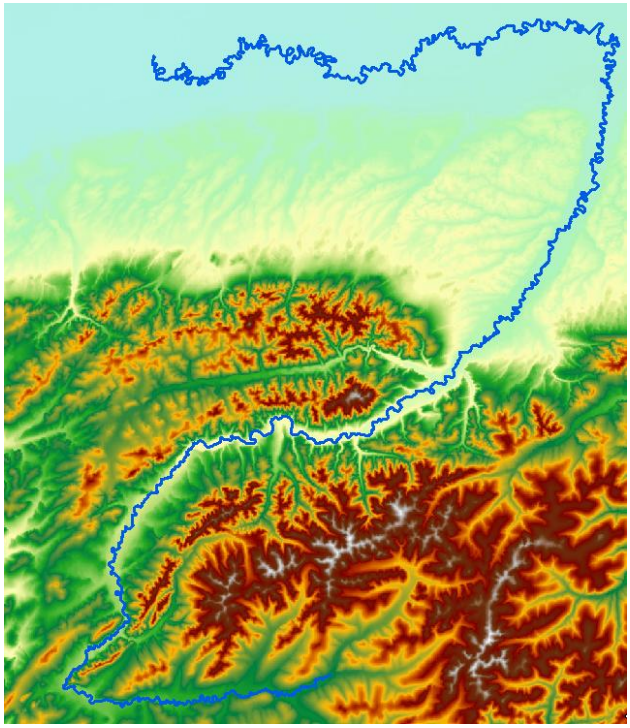
And create a scatter plot of grayling counts per 10km reach as a function of reach sinuosity…


Grayling Count and Sinuosity
Grayling Count Per 10km Reach
Sinuosity of 10KM Reach
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5

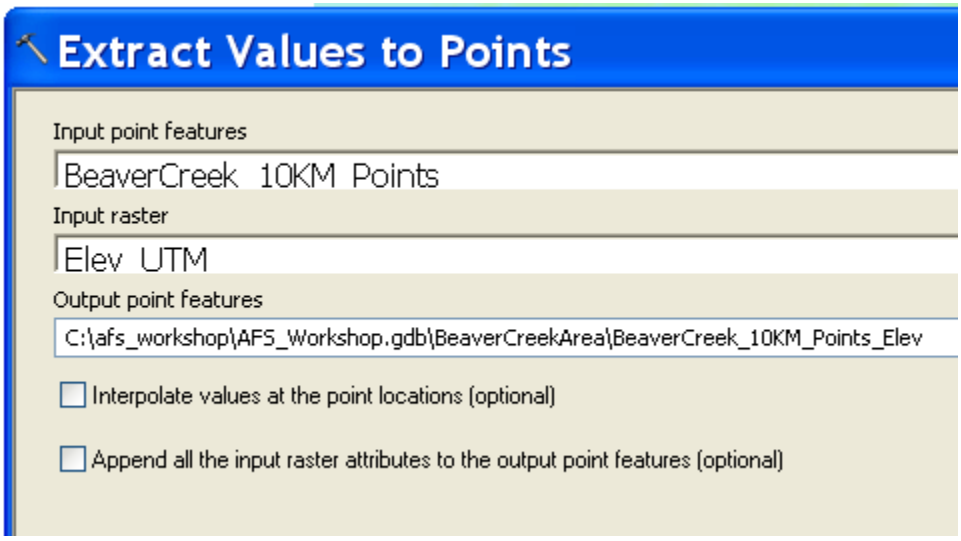
To determine stream gradient, we need the elevation at the start and end of each 10km reach.

Add the elevation raster to your data frame…





Use the ***Extract Values to Points*** geoprocessing tool to determine the pixel elevation of each point..

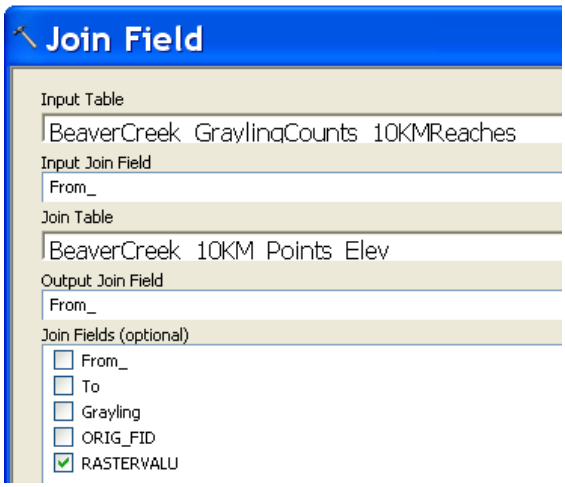


BeaverCreek_10KM_Points_Elev

	ID	From_	To	Grayling	ORIG_FID	RASTERVALU
▸	1	0	10	5	1	102.038246
	1	10	20	5	2	103.155884
	1	20	30	2	3	104
	1	30	40	4	4	105
	1	40	50	1	5	105.128357

The field RasterValu is the elevation at each point location.

Use the ***Join Field*** geoprocessing tool to pass the line ***starting elevation*** values to your original 10-km stream reach lines..



Use the ***Join Field*** geoprocessing tool to pass the line ***ending elevation*** values to your original 10-km stream reach lines..

BeaverCreek_GraylingCounts_10KMReaches

	To	Grayling	Sinuosity	RASTERVALU	RASTERVALU
	10	5	2.289636	102.04	103.16
	20	5	5.111786	103.16	104.00
	30	2	2.035409	104.00	105.00

And finally compute the drop in elevation along each 10-km reach

BeaverCreek_GraylingCounts_10KMReaches

	Sinuosity	RASTERVALU	RASTERVALU	Drop_Meters
	2.289636	102.04	103.16	1.1
	5.111786	103.16	104.00	0.8
	2.035409	104.00	105.00	1.0
	3.150047	105.00	105.13	0.1
	2.902802	105.13	106.05	0.9
	3.393666	106.05	106.95	0.9
	2.602894	106.95	106.27	-0.7
	2.59176	106.27	106.44	0.2

Select any rows with negative drop values and calculate these as 0.1 drop values.

Finally create a scatterplot of Sinuosity versus drop per 10km.