

The Bandits are escaping and we need to trap them!! Fortunately, we have Kim Possible and her sidekick Wade on the mission.

You'll never find me!!



Ok, Wade-
What's the
Sitch?



I'm on it
Kim!



Here's how I'm going to help you track down where the bandits are escaping and then how to find them using ArcGIS Pro:

1. Identify the Highest Peak which is their Origin point based on Elevation
2. Identify the Rivers, Roads, Non Forest Land and Populated Areas in order to associate high friction costs with each of these
3. Calculate the shortest path for the bandits to go using Distance Accumulation, Flow Direction and Flow Accumulation with the cost raster in previous step
4. Identify places where the shortest path intersects with roads



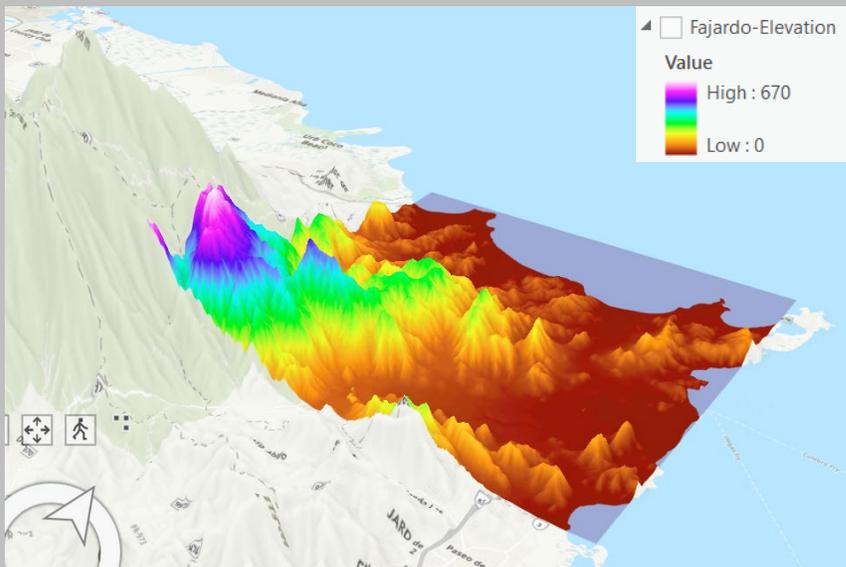
Hehe
Good
Luck Kids!



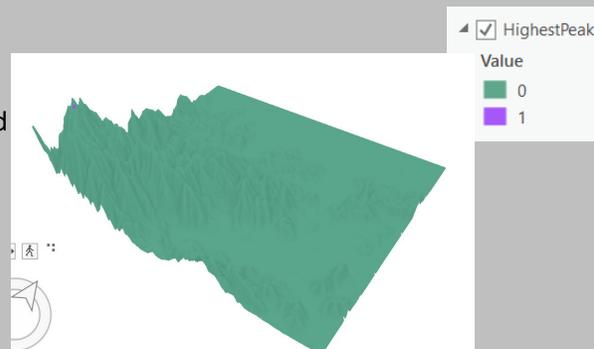
First, we will locate the prominent hilltop which is the origin point. Second we will reclassify the roads layer to prepare it for our friction layer operation.



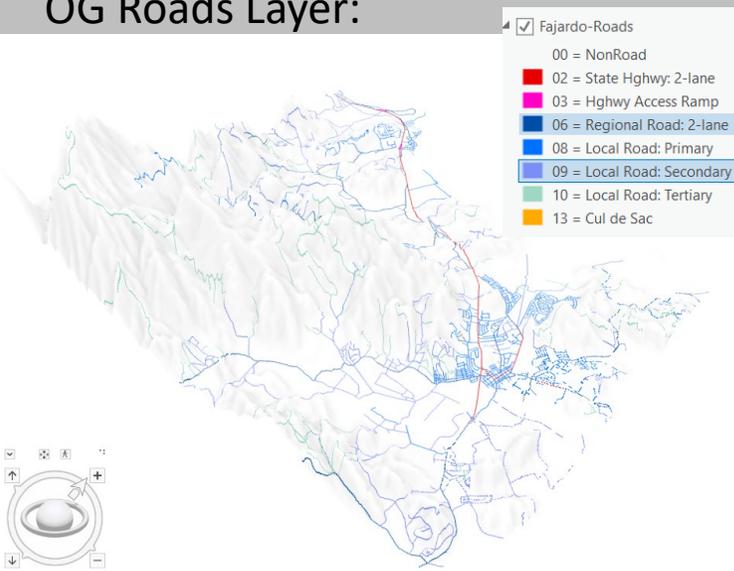
OG Elevation Layer:



Reclassify and set the highest elevation range 660-670 as 1 and everything else to 0



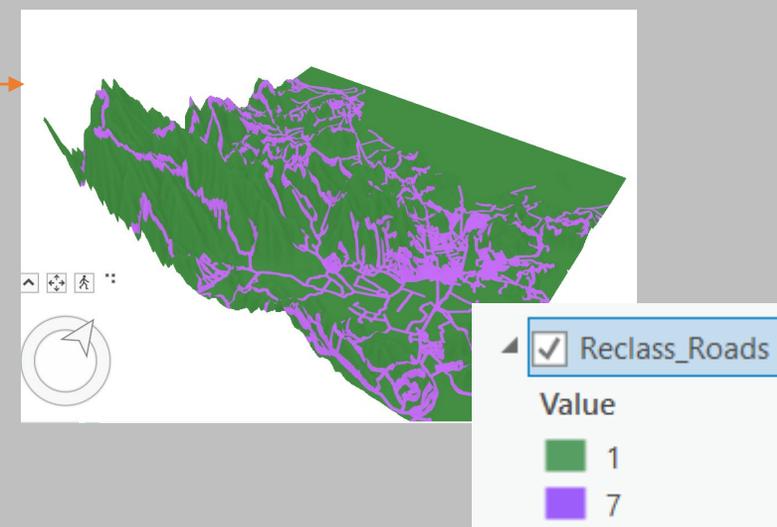
OG Roads Layer:



Reclassify and set the Roads to 1 and everything else to 0. This groups all the roads together.



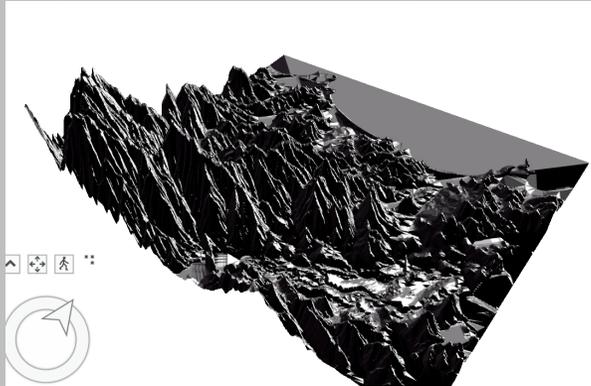
Use Focal Stats (Maximum) to set a slight buffer on the roads in order to give the bandits a wide bearing for where they consider a road, and likelihood to be caught. Reclassify again and set the Roads to 7 which is a high cost and everything else to 1 which shows the areas that are passable.



Next, we create the Rivers using the original elevation layer



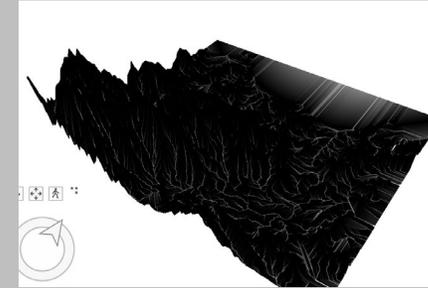
1. Flow Direction
Input Raster: Elevation layer



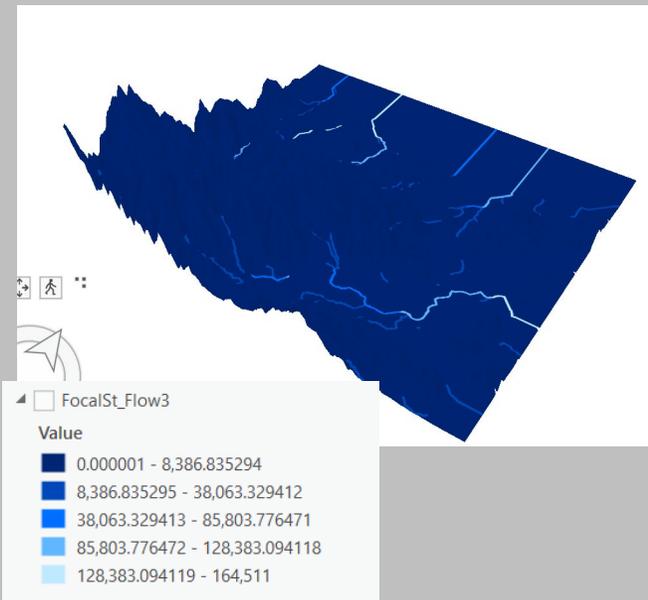
2. Flow Accumulation
Input Raster: Flow Direction



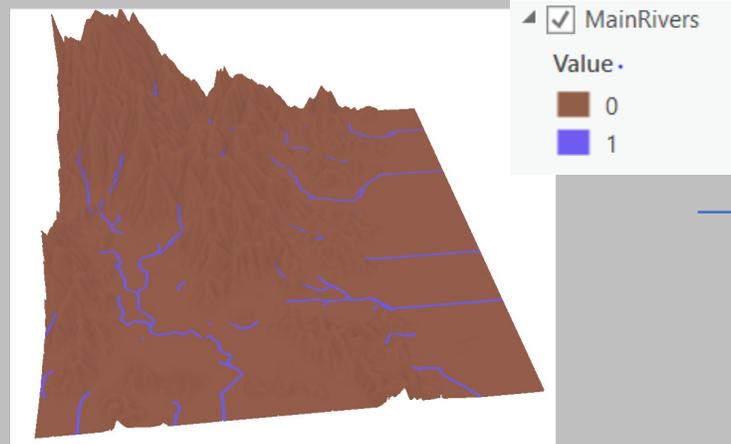
3. Click on Symbology and change the Stretch type to Histogram Equalize to better see the water flow



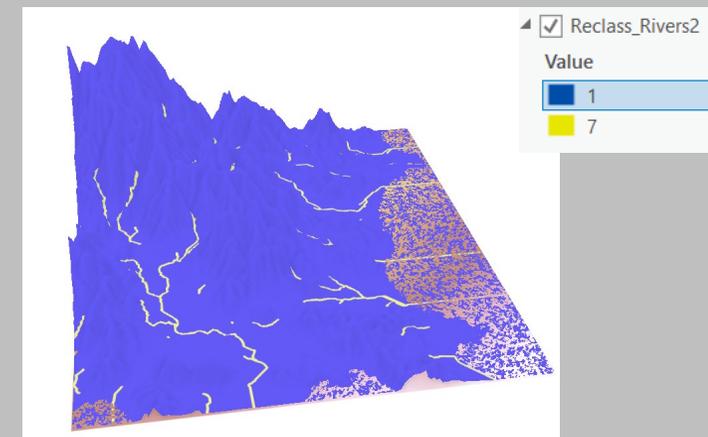
4. Change symbology to Classify with 5 Natural Break classes



5. Reclassify so that the top four highest classes are equal to 1 being a River and the rest are equal to 0 being no river. This step gives us the biggest rivers and separates them from all other land.



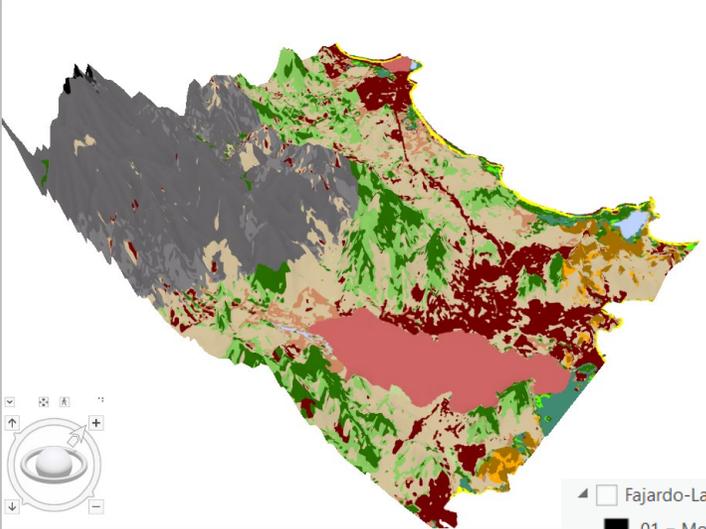
6. Reclassify again so that rivers are equal to 7 which creates a higher cost for later on when we combine friction layers. The Bandits are avoiding rivers so we assign them a high value of 7 and all 0 values are 1 representing routes that are passable or routes that don't involve rivers.



The Bandits are also trying to avoid non forest areas and highly populated areas. We use the landcover layer to assign costs to both of these areas in addition to other types of landcover areas.



OG Landcover Layer:



Reclassify this layer giving all values associated with a forest a value of 1 which shows they are passable. We assigned 7 to the urban area which is the most populated. We assigned costs to other landcover types based on how non similar to forests they were (highest cost being 9 to Sand or Rock which is very non similar to a forest). If the landcover provides places to hide it has a low cost, if there is wide visibility like in a field, there is a high cost as the bandits could be seen.

Fajardo-LandCover

01	=	Montane	Wet	Softwood	Cloud Forest (tall)
02	=	Montane	Wet	Softwood	Cloud Forest (elfin)
03	=	Submontane	Wet	Softwood	Forest
04	=	Submontane	Wet	Softwood	Forest/Shrubland (o)
05	=	Lowland	Moist	Softwood	Forest
09	=	Lowland	Moist	Hardwood	Shrubland
10	=	Lowland	Moist	Softwood	Forest
11	=	Lowland	Dry	Hardwood	Forest
12	=	Lowland	Dry	Hardwood	Shrubland
13	=	Tidal		Softwood	Forest
15	=	Seasonally Flooded Rain Forest			
16	=	Wetlands (or seasonally flooded areas)			
18	=	Pasture			
19	=	Agriculture			
20	=	Agriculture (or hay field)			
21	=	Urban (or barren)			
22	=	Sand or Rock			
23	=	Inland Water Body			
24	=	Ocean			

Reclassify

Parameters Environments

Input raster: Fajardo-LandCover

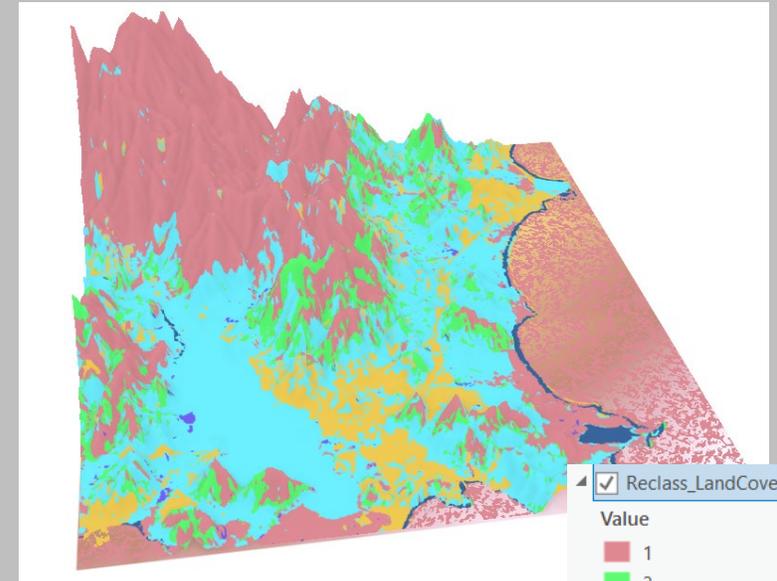
Reclass field: VALUE

Reclassification

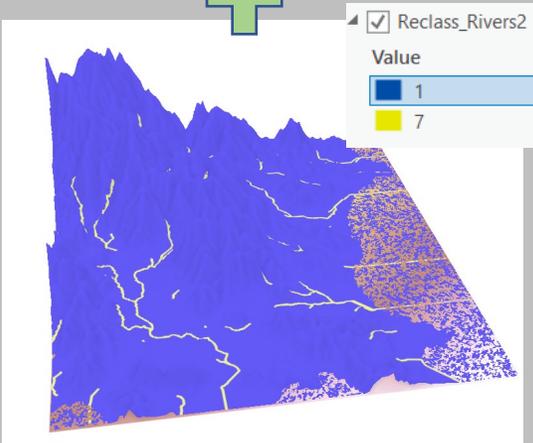
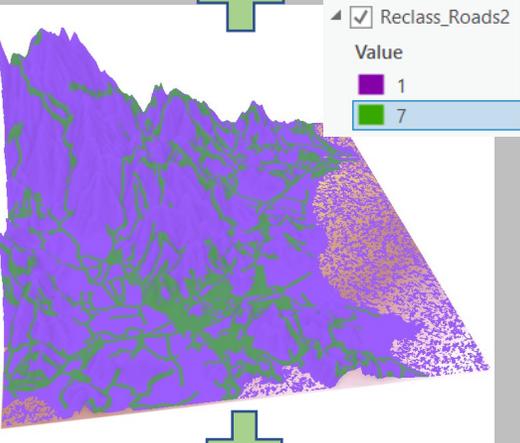
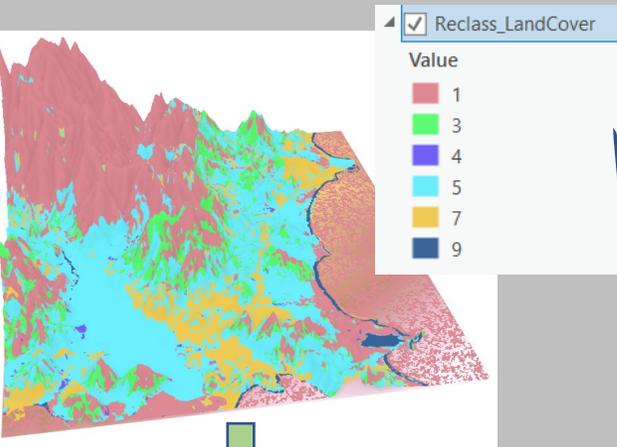
Value	New
13	1
15	4
16	4
18	5
19	5
20	5
21	7
22	9
23	9
24	1
NODATA	NODATA

Unique Classify

Reclassified Landcover Layer:



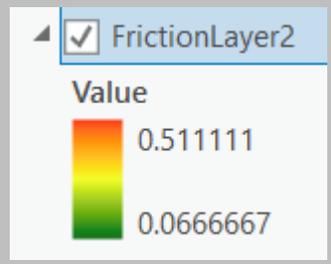
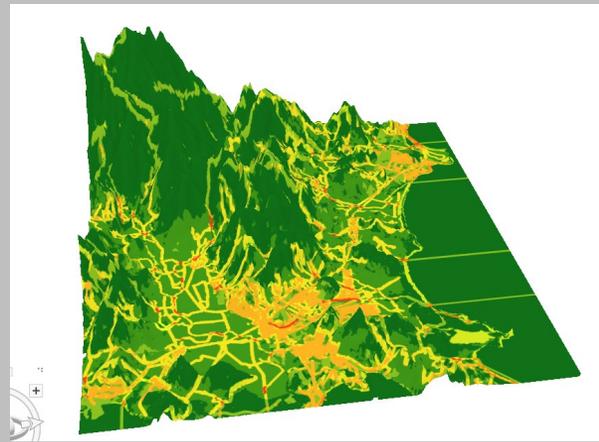
**We set Ocean to 1 because this is the Bandits ultimate destination



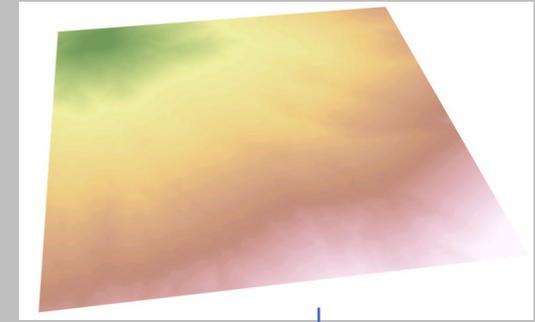
Next, we create our friction layer and use it as a cost raster for determining the shortest path for the bandits.

1. Use Raster Calculator to add up all three of these reclassified layers. Divide by 45 (which is the total sum when each value in each layer is added up) in order to create a scale of passable and impassable areas.

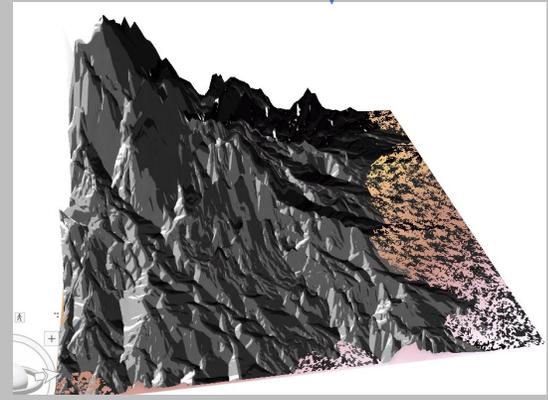
$$\frac{\text{Reclass_LandCover} + \text{Reclass_Roads2} + \text{Reclass_Rivers2}}{45}$$



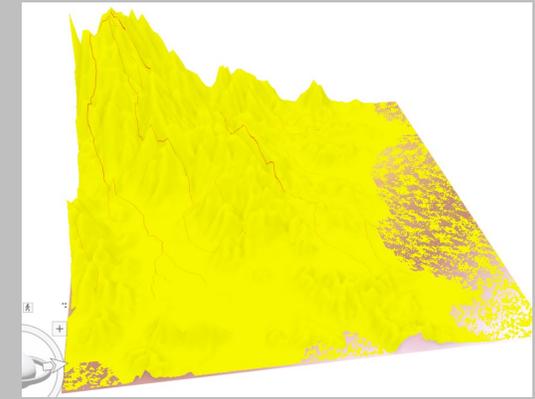
2. Friction layer with green being passable areas and red being areas fugitives will likely avoid/higher travel costs for them.



3. Distance Accumulation:
Input Raster: OriginPoint Layer
Cost Raster: Friction Layer
Output Layer: DistanceFromOrigin



4. Flow Direction:
Input Raster: DistanceFromOrigin
Output Layer: FlowDirection



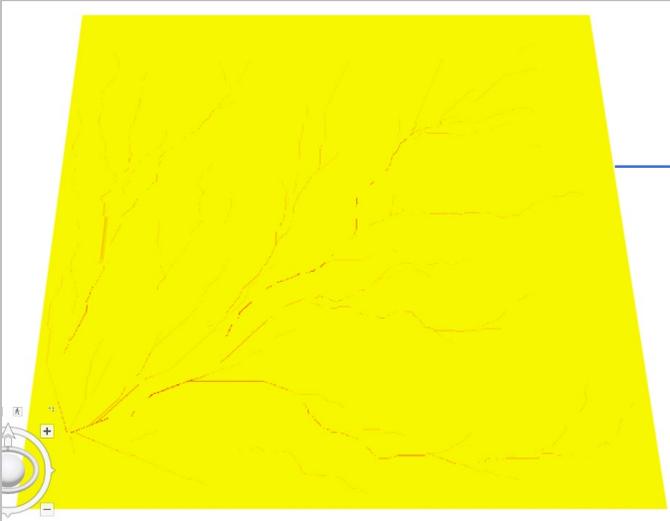
5. Flow Accumulation:
Input Raster: FlowDirection
Output Layer: FlowAccumulation



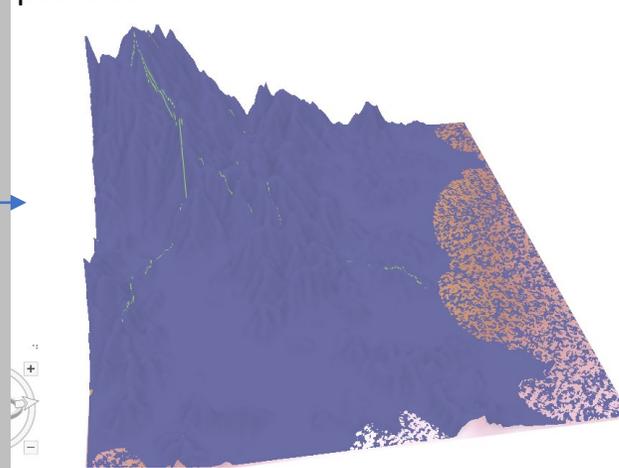
Lastly, we find the shortest path and where that intersects with the Roads so the police can catch the Bandits



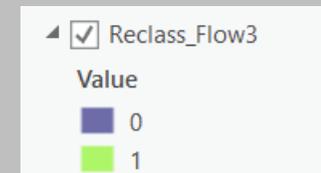
1. Set Flow accumulation to 9 Natural Breaks classes in the symbology tab



2. Reclassify setting the lowest three classes to 0 and the other paths to 1.



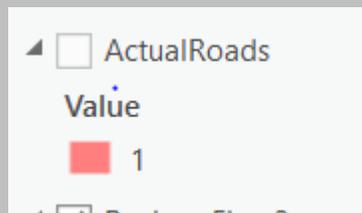
Start	End	New
0	9145.05098	0
9145.05098	41152.729412	0
41152.729412	91450.509804	0
91450.509804	141748.290196	1
141748.290196	196618.596078	1
196618.596078	278924.054902	1
278924.054902	333794.360784	1
333794.360784	384092.141176	1
384092.141176	1161421.47451	1
NODATA	NODATA	NODATA



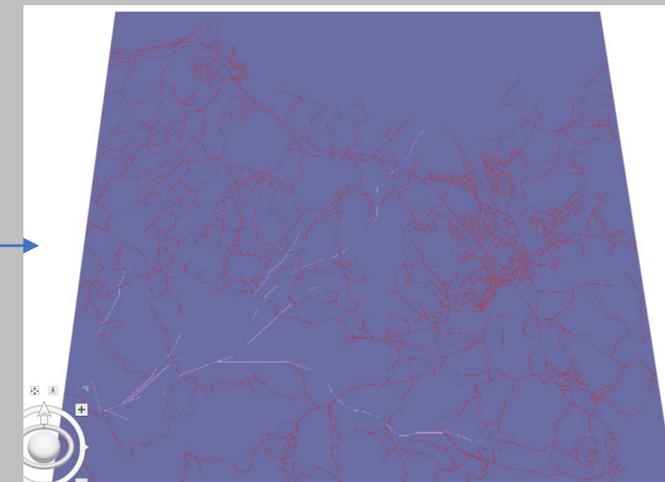
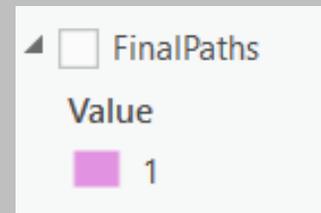
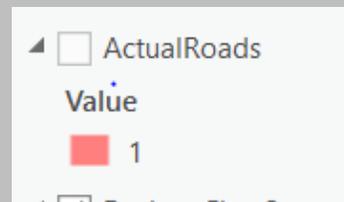
3. Reclassify again and set the zero's to NoData and the 1 to 1 to get a layer which are the final paths.



4. Reclassify JustRoads layer to set the roads to 1 and everything else to NoData



5. Use Raster Calculator to set the FinalPaths layer equal to the ActualRoads layer to find where they intersect.



6. Use the Raster to Point tool to get a better visual understanding of intersections....

Hooray! We have found all the points where the police should lie in wait in order to catch the bandits. Let's hope they don't make it to the ocean!



Good Job Wade!
Another win for
ArcGIS Pro!



Thanks Kim!

Thanks
team. We
caught the
Bandit!

