Site Suitability for a resupply station in support of a late summer hiking race

LARP 741 Assignment 9

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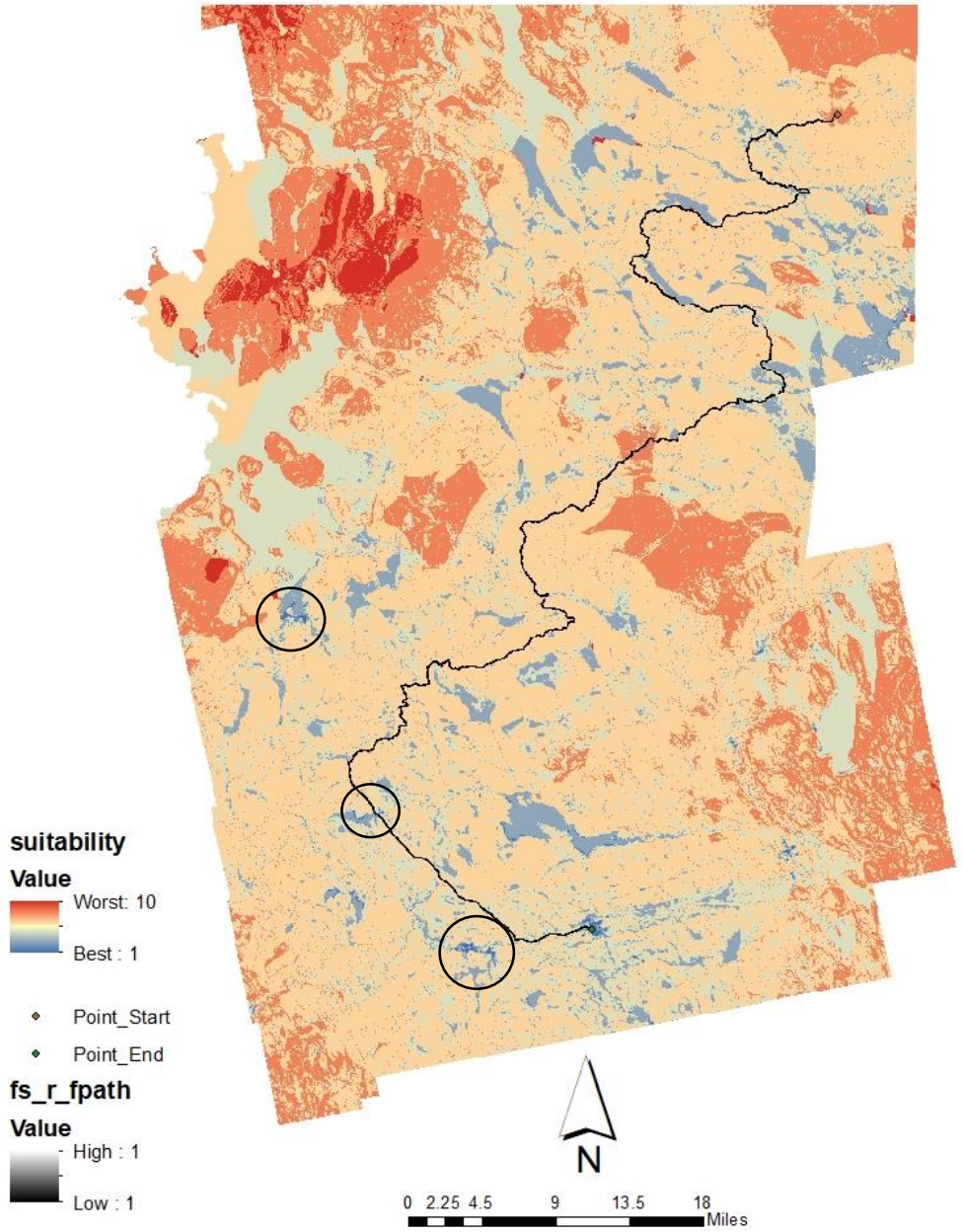
Introduction

Goal: The goal of this report is to indicate the relative suitability for the siting of a resupply station in support of a late summer hiking race from the summit of Mt. Katahdin to the middle of the Piscataquis River bridge in downtown Dover-Foxcroft, Maine. So, by using **Model Builder**, a working model would be developed to set the pixel value in the range of 1 (Best) to 10 (Worst) to achieve the goal.

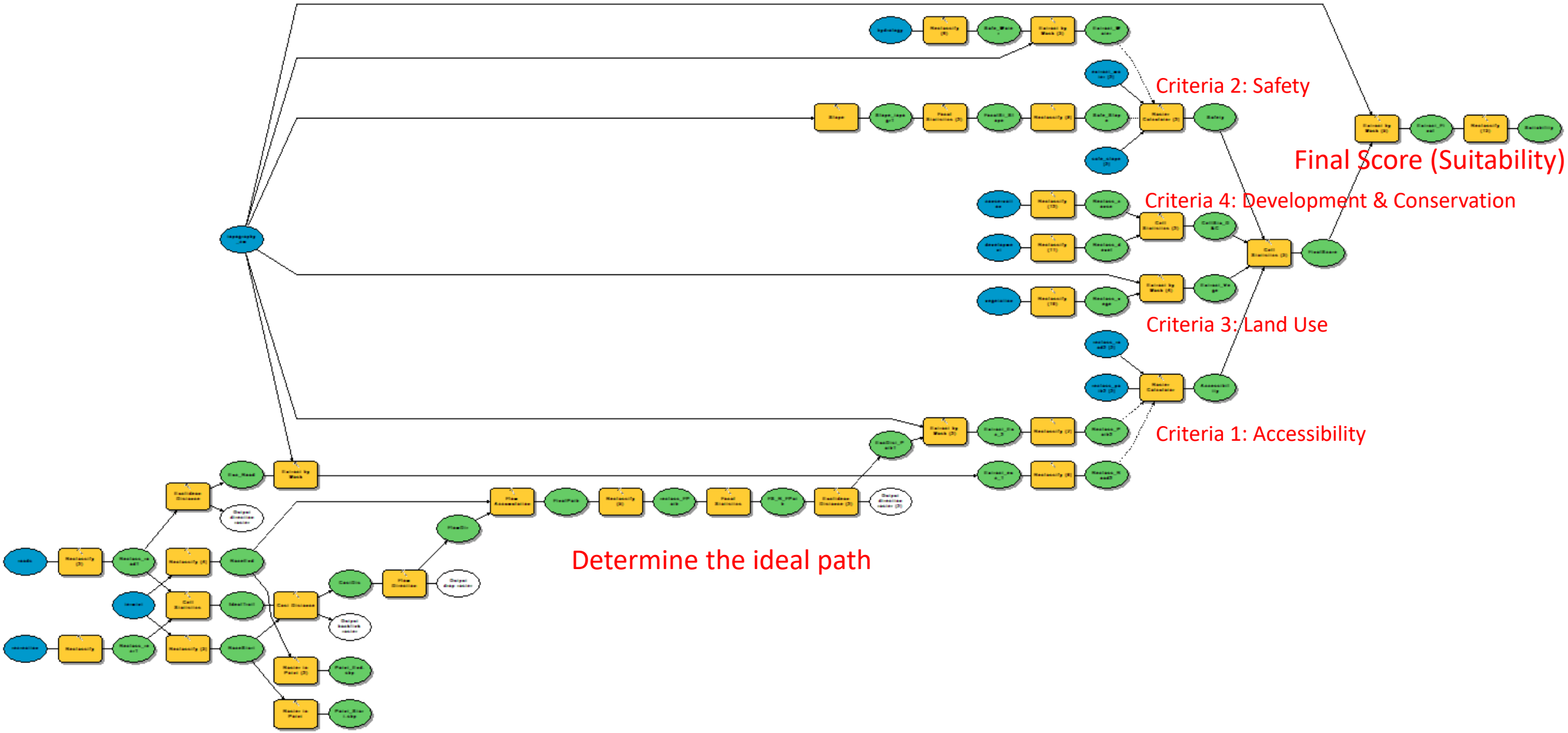
Criteria for site suitability:

1. Accessibility
   - **Close to roads:** The location needs to be close to existing roads, so that it will be accessible to the participants of the race.
   - **Close to Race Path:** The location needs to be close to the ideal race trail to guarantee providing supply to the participants in time.
2. Safety
   - **Slope:** For safety consideration, the location must be on the flat land with a small slope.
   - **Hydrology:** For safety consideration, the location should not be close to the water body (Wetlands).
3. Land Use
   - **Vegetation:** The station should be best located on the land with no vegetation to avoid to influence the natural environment negatively.
4. Development & Conservation
   - **Development Level:** The station should be close to the developed urban areas with high intensity.
   - **Conservation Level:** The station should be close to the developed urban areas like Commercial, Residential areas, because it will be easy to get the necessary supplies for the resupply station.



The circled areas are most suitable for locating the resupply station!

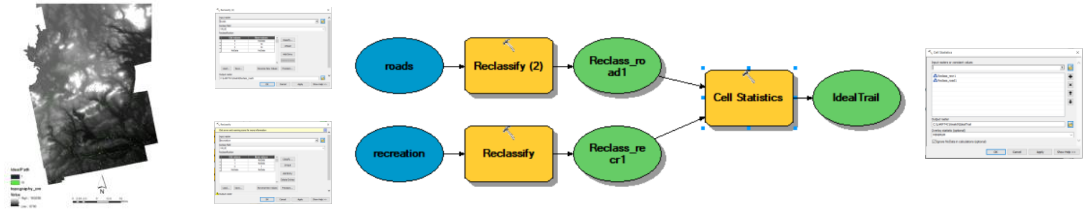
Introduction (Model)



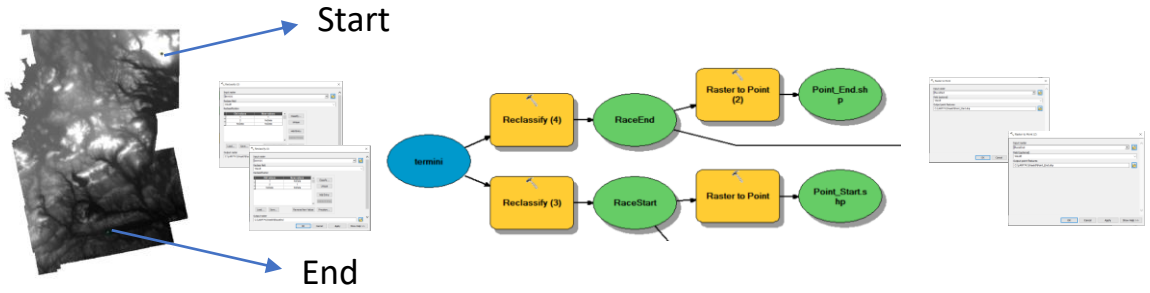
Determine the path location

Logic: the path should have least resistance between two terminus.

Step 1. **Reclassify** the recreation layer to set Appalachian Trail = 1 and others = NoData. Then, **Reclassify** the roads layer to set minor and major roads as 10, and others = NoData.
Step 2. Use **Cell Statistics** (MINIMUM) to combine these two layers to find the ideal trail for the race.



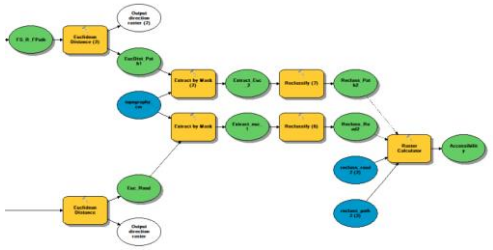
Step 3. **Reclassify** the termini layer to determine the start and end points of the race that start = 1, end = 2. Then, use Raster to Point to make the start and end location more visible on the map.



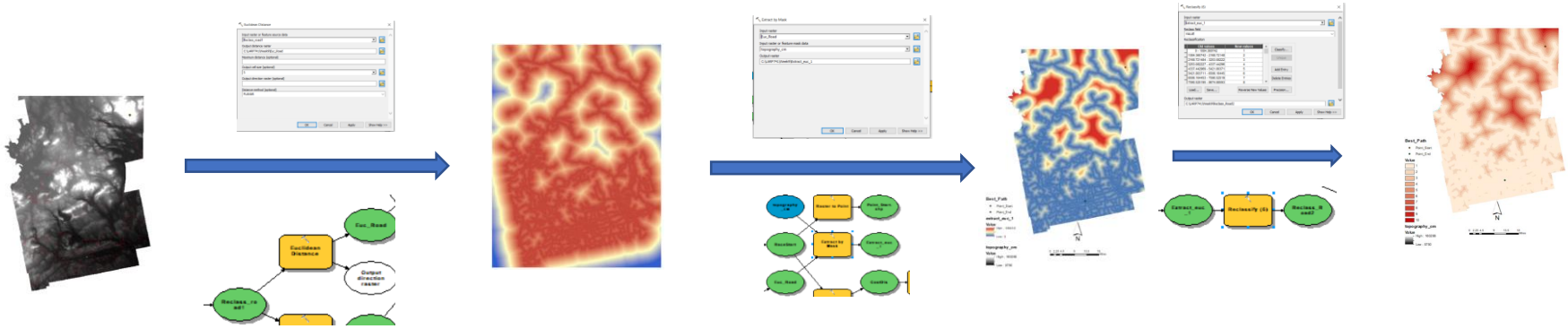
Step 4. Use **Cost Distance** tool with the start location as Input raster or feature source data and the Ideal Trail layer as the Input cost raster. Then, use **Flow Direction** on the cost distance layer, and employ **Flow Accumulation** with the new layer as Input direction raster and the end location as the Input weight raster to get the best route for this hiking race.

Step 5. **Reclassify** the best route layer to set 0 = NoData, 0-1 = 1, and others as NoData. Then, use **Focal Statistics (Mean)** to bolden the best route of the race.

Criteria 1: Accessibility



Accessibility to Roads

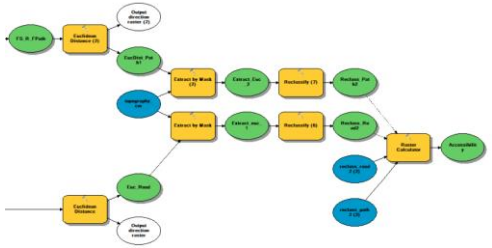


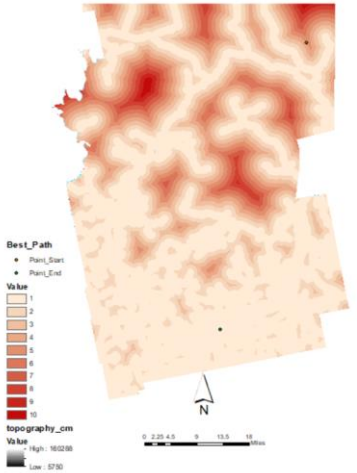
Step 1. Use **Euclidean Distance** on the reclassified road layer to get the distances to the roads. Set the output cell size as 5. Then, use **Extract by Mask** to clip the new layer by the boundary of the topography. Finally, **Reclassify** the clipped layer in 10 classes, the lower the class number, the higher the accessibility to roads would be.

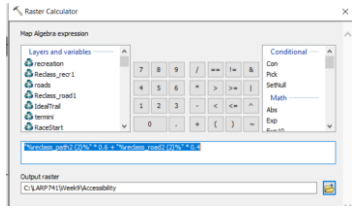
Accessibility to the Race Path

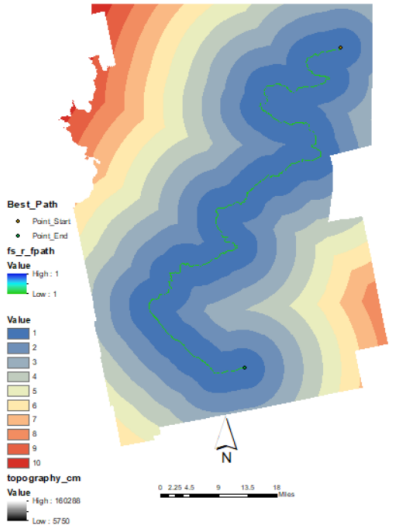
Step 2. Use **Euclidean Distance** on the race path layer to get the distances to the ideal path. Set the output cell size as 5. Then, use **Extract by Mask** to clip the new layer by the boundary of the topography. Finally, Reclassify the clipped layer in 10 classes, the lower the class number, the higher the accessibility to the race path would be.

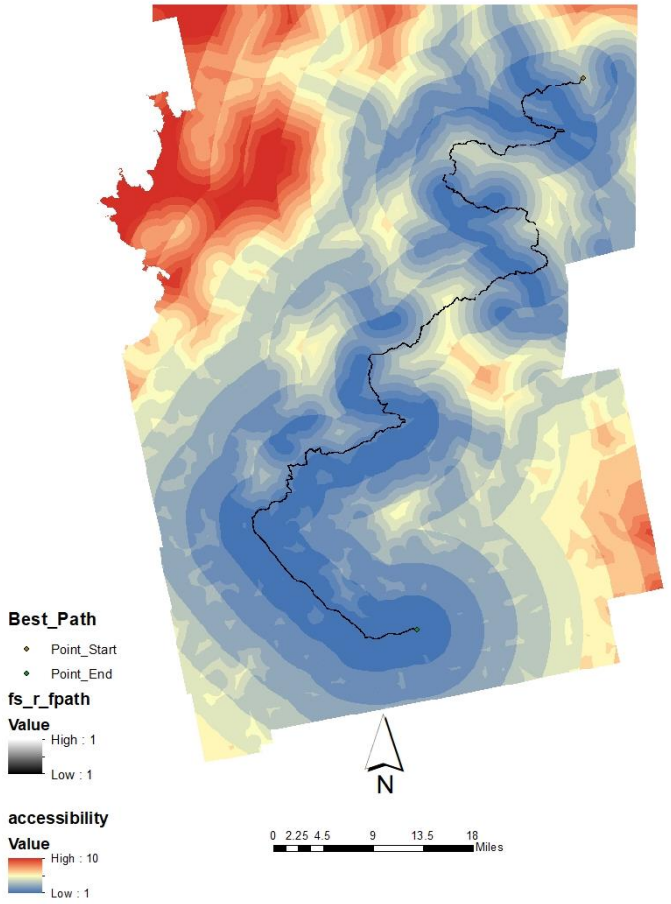
Criteria 1: Accessibility











Step 3. Finally, use **Raster Calculator** to get the score and map for accessibility. The used formula is: 0.6 * accessibility of Best Path + 0.4* accessibility of Roads.

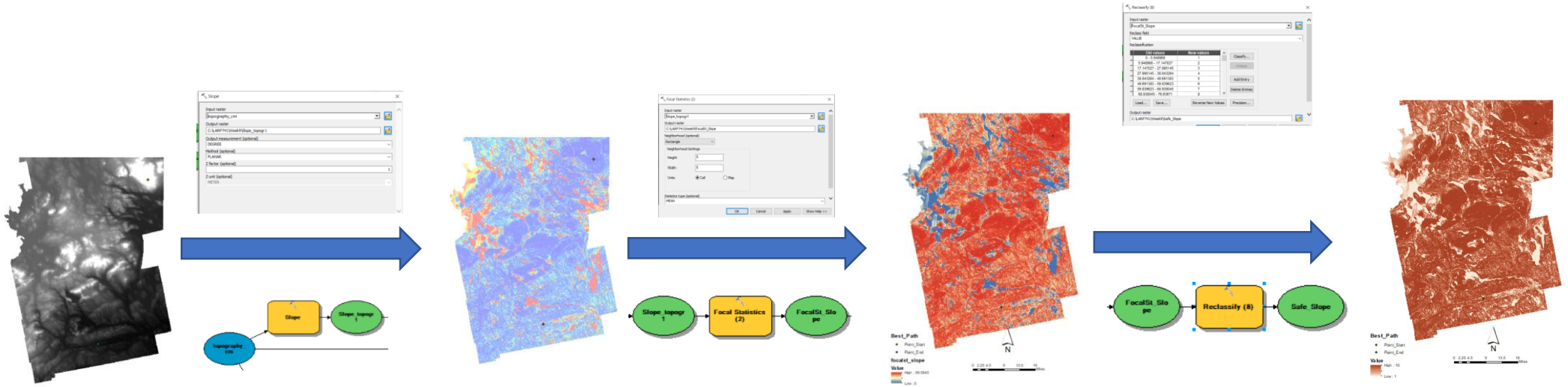
Summary: <u>The smaller the score (Blue), the higher the accessibility would be.</u>

Criteria 2: Safety (Slope)

Step 1. Since the station should be on the flat land, I firstly use **Slope** tool to get the slopes for the whole topography area.

Step 2. Then, I use **Focal Statistics** to smooth the slope map in a range of 0 to 89.5845.

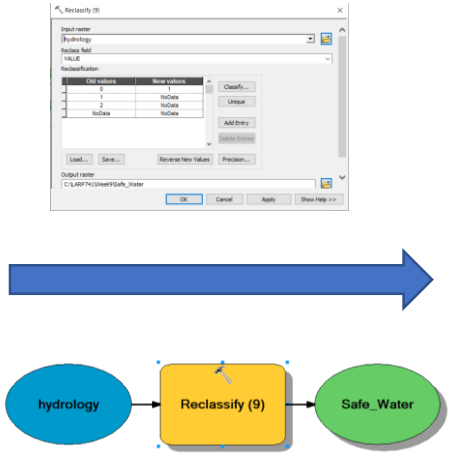
Step 3. After that, use **Reclassify (Equal Interval)** tool to get 10 classes for the slope layer. <u>The lower the class number, the flatter and safer the location is.</u>

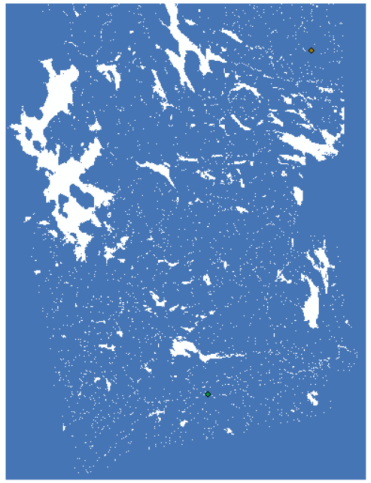


Criteria 2: Safety (Hydrology)

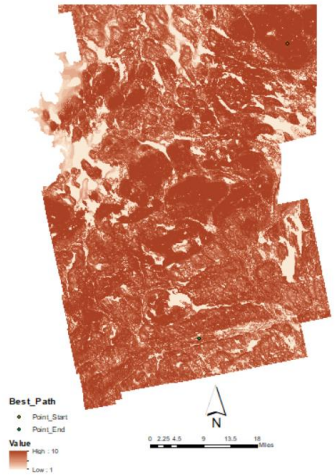
Step 1. The station should not be located in water (wetlands), which would be really dangerous. Thus, use **Reclassify** tool to set Background as 1 and others as NoData for Hydrology layer.

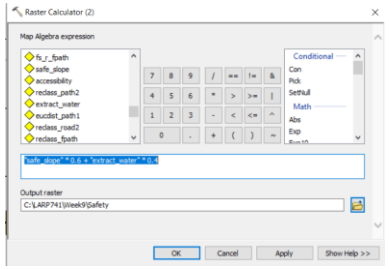
Step 2. Use **Extract by Mask** to clip the new layer to the boundary. Then, I get the final hydrology safety score map.

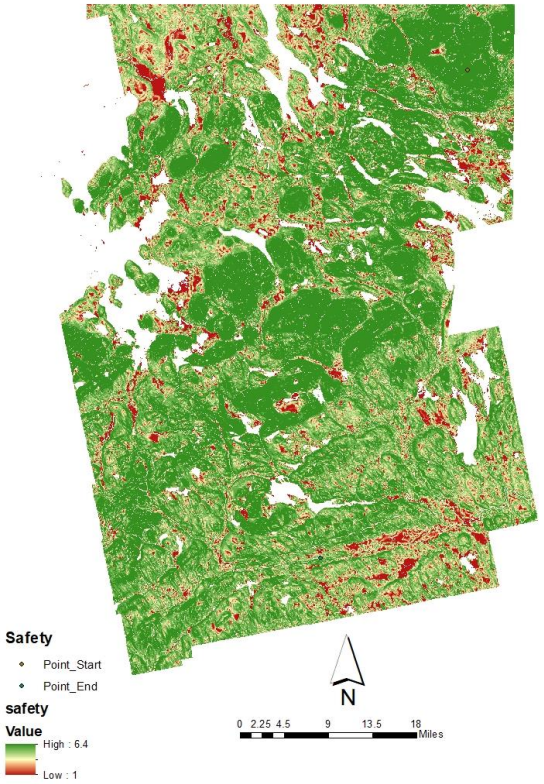




Criteria 2: Safety







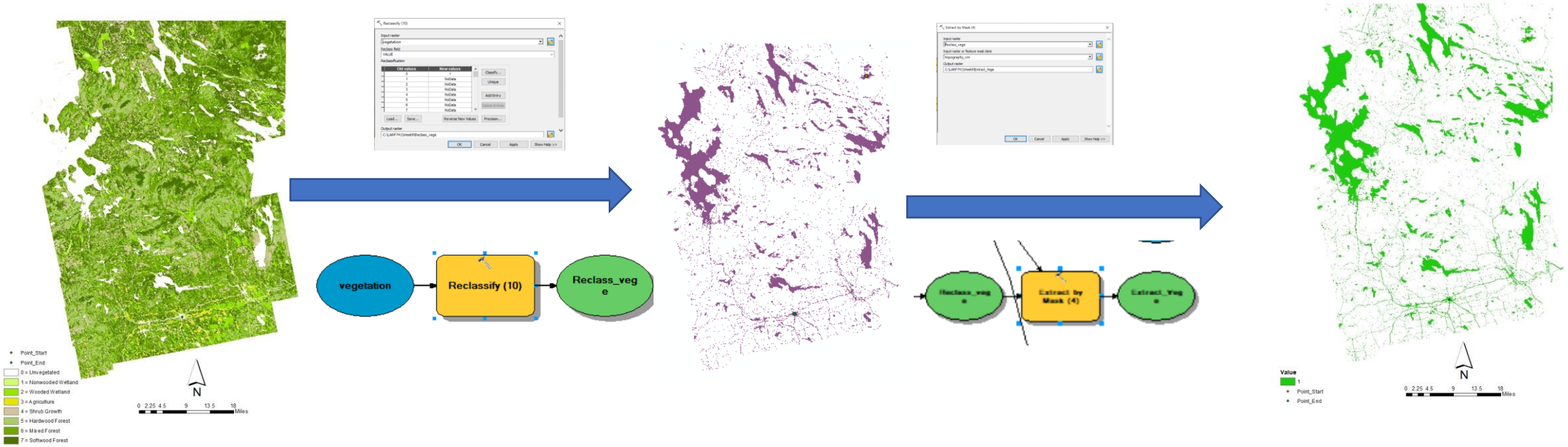
Step 3. Finally, use **Raster Calculator** to get the score and map for Safety. The used formula is: 0.6 * Safety of Slope+ 0.4* Safety of Hydrology.

Summary: <u>The smaller the score (Red), the higher the safety would be.</u>

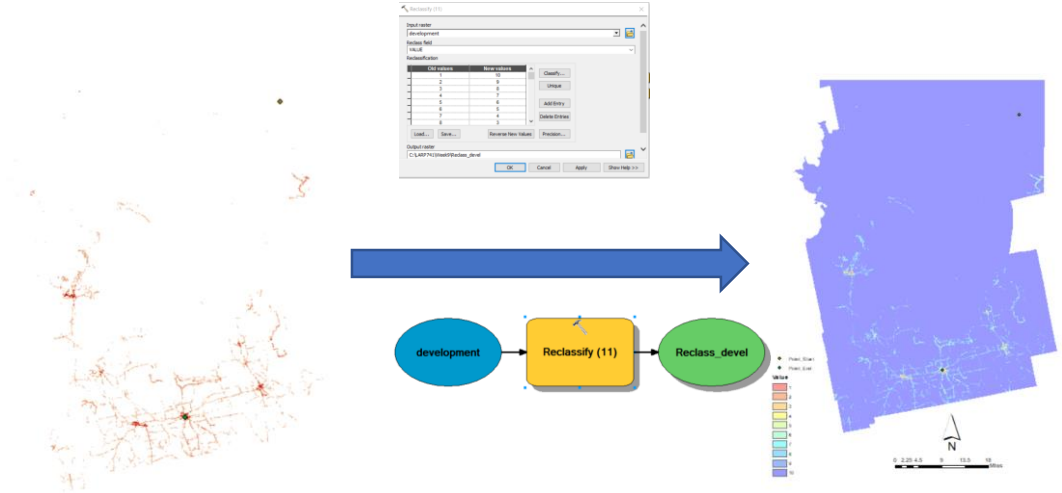
Criteria 3: Land Use (Vegetation)

Step 1. The station should be best located on the land with no vegetation to avoid to influence the natural environment negatively. Thus, use **Reclassify** tool to set Unvegetated as 1 and others as NoData for vegetation layer.

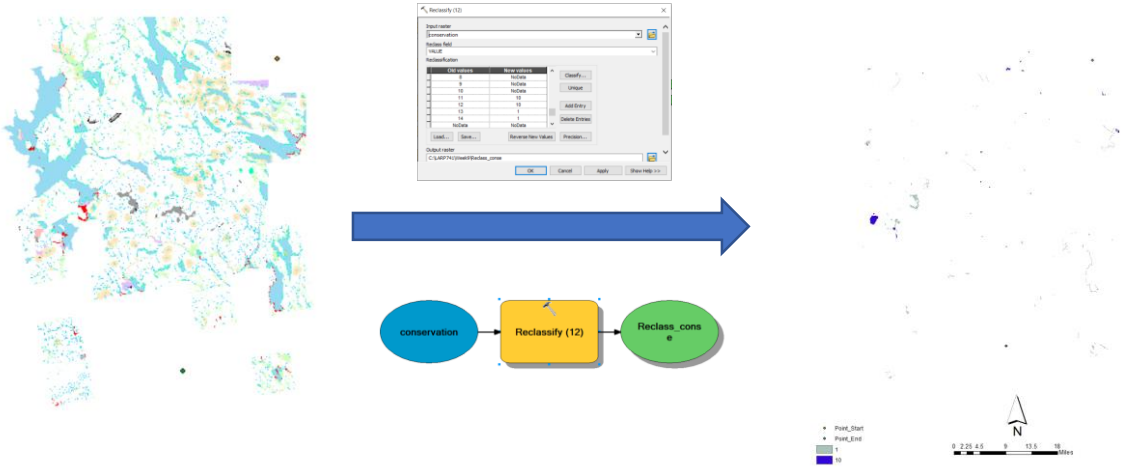
Step 2. Use **Extract by Mask** to clip the new layer to the boundary. Then, I get the final hydrology safety score map.



Criteria 4: Development & Conservation



Development

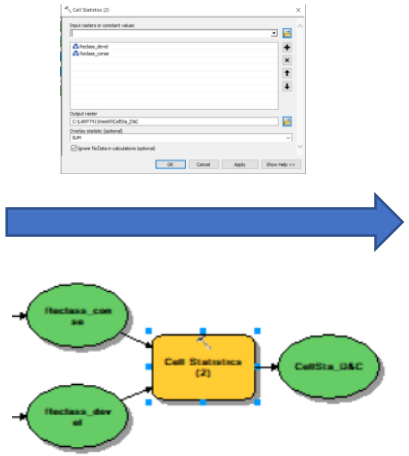


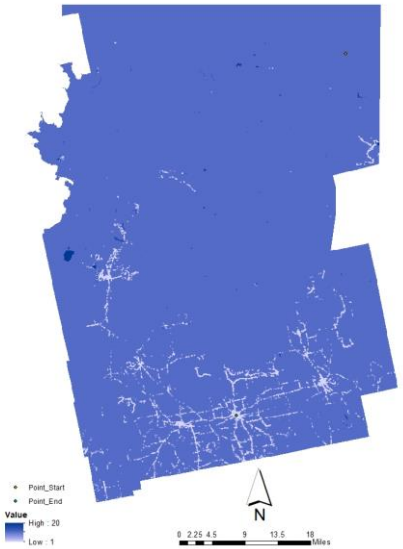
Conservation

Step 1. Use **Reclassify** tool to set Old Value 1-10 as New Score Value 10 to 1.

Step 2. Use **Reclassify** tool to set Development: Commercial & Residential as 1, Recreation & General as 2 and others as NoData.

Step 3. Use **Cell Statistics (SUM)** to combine the score of development and conservation levels to get the final score and map for Development & Conservation.

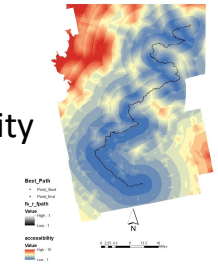




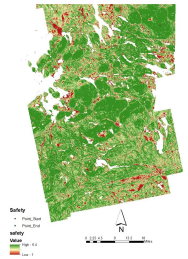
Summary: **<u>The lower the score (light blue), the more suitable for the resupply station would be.</u>**

Result (Combination of the scores)

Accessibility

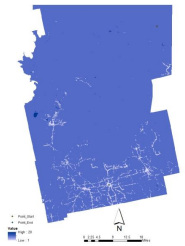


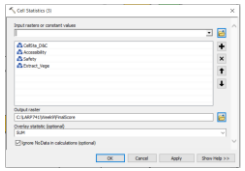
Safety

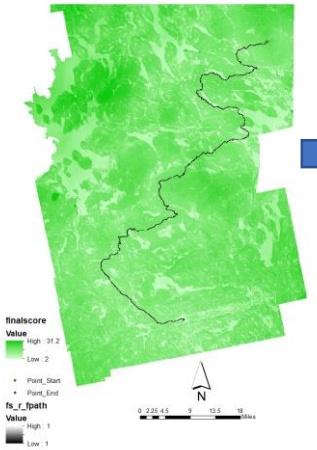


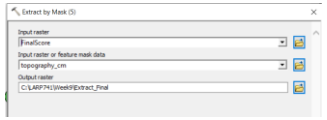
Land Use

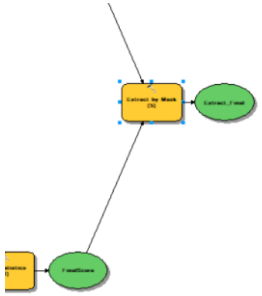
Development & Conservation

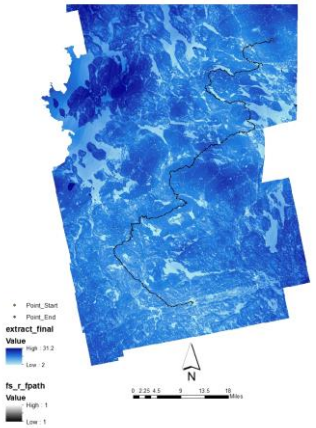


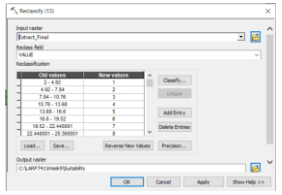








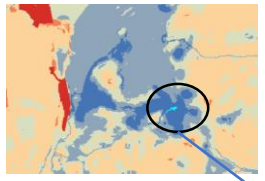


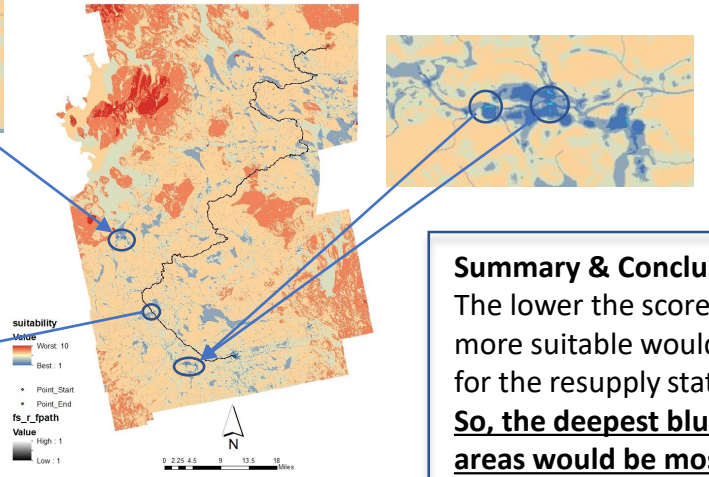


Step 1. Use **Cell Statistics (SUM)** to combine the score of all 4 criteria together to get the total score and map for these criteria.

Step 2. Then, use **Extract by Mask** to clip the new layer by the boundary of the topography

Step 3. Finally, use **Reclassify (Equal Interval)** tool to get 10 classes ranging from 1 to 10 for the final score layer.





Summary & Conclusion:
The lower the score, the more suitable would be for the resupply station.
So, the deepest blue areas would be most suitable for the station!!