Ecology 190 River Ecology Module, Lab Assignment 1
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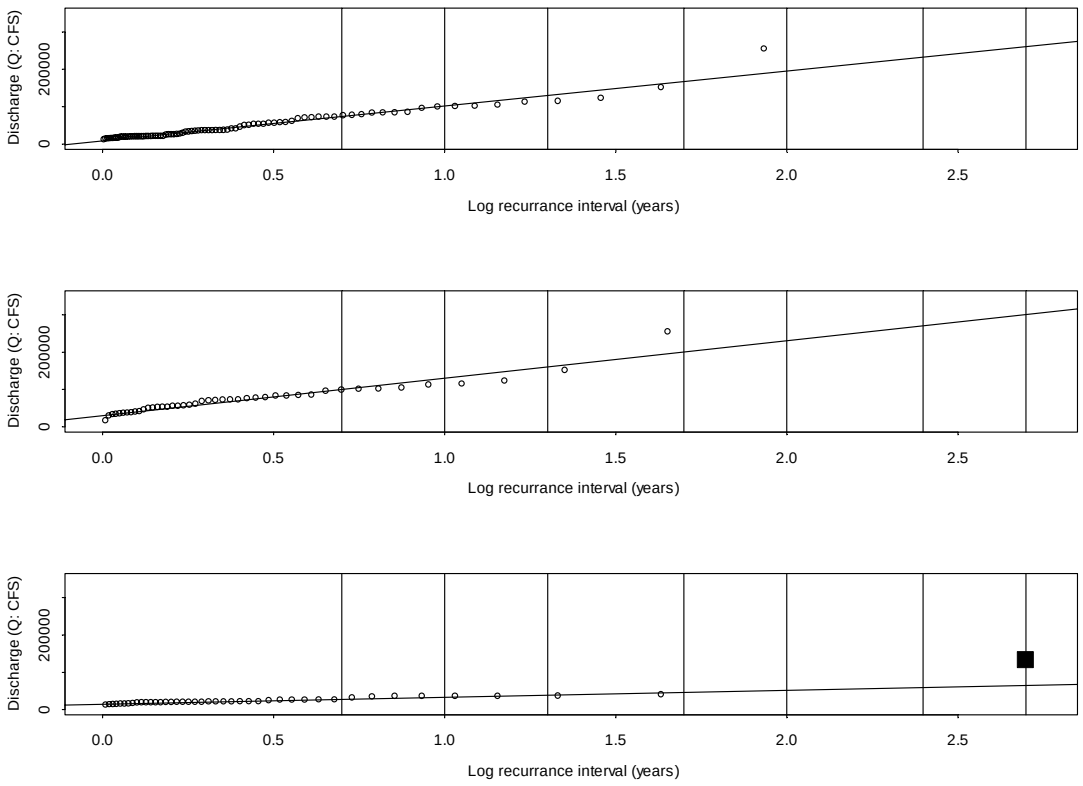
1. Hydrograph analysis

a. Run S-plus and print the last graph (with the 3 plots)



b. In one short paragraph explain what the x and y-variables are, and what the regression line is predicting.

The x-variable is the time in years between floods, adjusted logarithmically so a line could be plotted to the data. The y-variable is the amount of discharge of each flood, measured in cubic feet per second. The regression line predicts what the level of discharge would be for extreme floods, say a 500-year flood, since we don't have any measurable discharge data for such an event.

c. Explain why there are differences in the three plots, and what caused the difference.

The first plot is the discharge vs. log recurrence interval for the entire 1912-1996 time period. The second plot is for only the pre-dam period, 1912-1955. The last plot is for the post-dam period, 1955-1996. The slope is different in all three plots, and this is because once the dam was been added in 1955, it limited the possible discharge

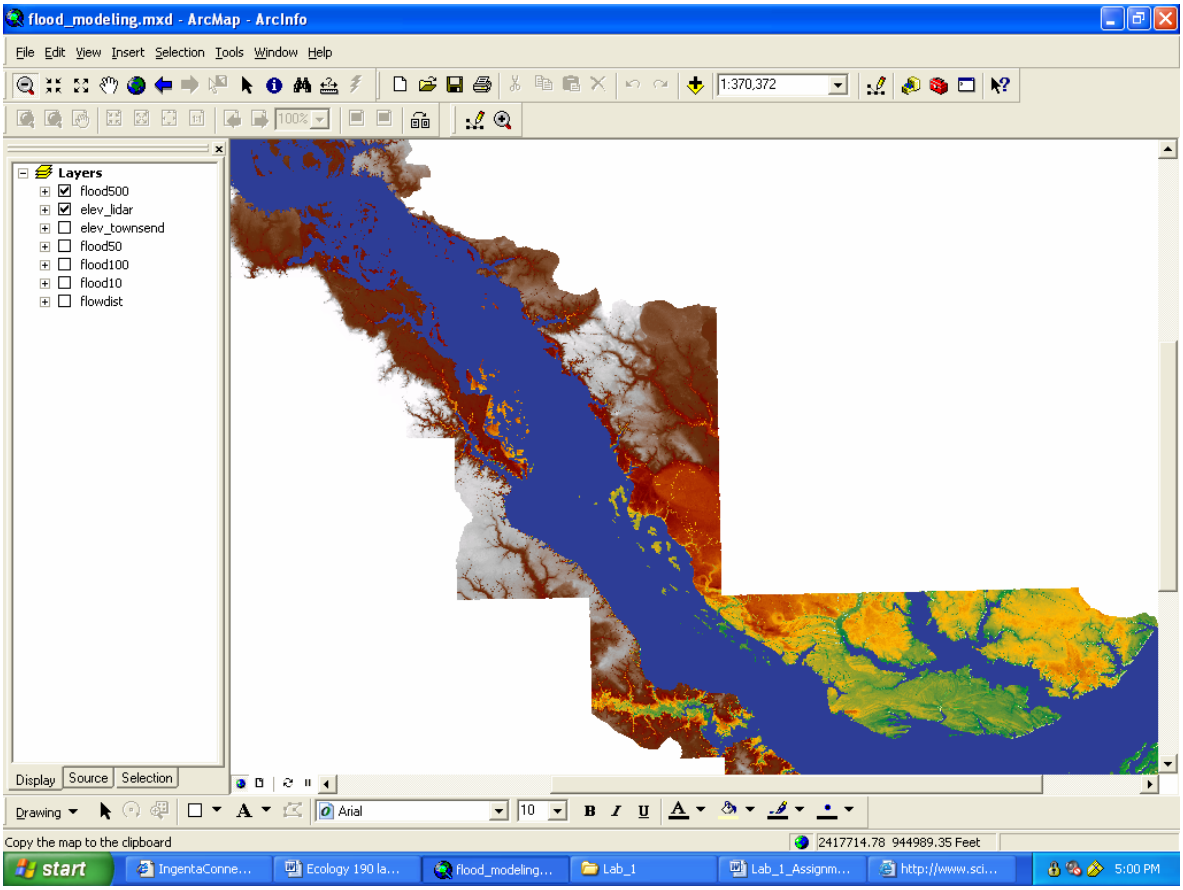
amounts. This is seen in the last plot (post-dam), which has the shallowest slope. The steepest slope is found in the pre-dam plot as expected, since without the dam, the river had the potential to reach higher discharges. The plot for the entire time period has a slope in between the other two, since it includes the post-dam data.

d. Explain to your best ability why there is a difference between the FEMA 500-yr flood and our modeled flood. What are some issues associated with extrapolating floods or weather events beyond our observations? (think about topography, and what that might also do, but don't limit your explanation to topography).

FEMA used ground-based hydrologic profiles to generate their model, whereas Townsend used remote sensing data (Lidar and DEM) of river elevation and topography. FEMA's model likely takes into account things that Townsend's model does not (such as groundwater and runoff inputs downstream from the dam, which would affect discharge measurements), and vice versa. When we make models to try to predict the outcomes of future floods or weather events, our extrapolations strongly depend on the information we include in our models.

2. <u>Modeling floodplains</u>

a. Try to run Arc model and print a map – use the magnifying lens to zoom in and out to have a nice image.



b. In one paragraph, explain the objective of using Townsend's model to map inundation with Lidar and his DEM.

Since Lidar has better resolution than DEM, he wanted to test how the flood model would differ if more accurate elevation information were used.

c. What were the two main differences between Townsend's DEM and the Lidar DEM? Clue – horizontal and vertical

Townsend's DEM had lower horizontal and vertical resolution than the Lidar DEM.

d. Why would using better elevation data result in different estimates (think about the topography of a floodplain; and also think about how changes in grid cell size might affect flood modeling)?

The fine topological variations and geomorphology of a floodplain would likely affect its inundation characteristics. The greater the variation measured and incorporated into the flood model, the more accurate the results will be. This is why the higher-resolution Lidar data would give better estimates than the coarser DEM data.

e. Would you expect larger or smaller differences in flood area estimates, or would the difference be so small it doesn't matter. Also, would the difference in area flooded vary with the magnitude of the flood?

The magnitude of difference in flood area estimates likely depends on the magnitude of resolution increase of the elevation data, but there would probably be little variation. There wasn't much variation when we used ArcGIS to compare Townsend's inundation map using Lidar and the map using coarser DEM data. This is probably because the coarse data has picked up the large topological variations of the floodplain that would affect inundation the most. As for whether the difference in flooded area would vary with the magnitude of the flood, I think it would. The mouth of the river is only so large, so the water of a high-magnitude flood has to go somewhere before it gets discharged from the mouth. It therefore spreads across the floodplain. The greater the flood magnitude, the greater the floodplain inundation.

f. Why did Townsend use distance to mouth to predict river height (see his paper if you need to)?

He did this because there was a pretty good curvilinear relationship between distance to mouth and river height. When far from sea level, there is a more rapid dropoff in flood stage elevation compared to areas very close to sea level (page 304 of his paper).