**Topography Prototyping Lab**

**Objective:** To determine where water erosion is more likely to be a problem in their targeted waterway

**Background:** Soil is “the unconsolidated cover of the earth, made up of mineral and organic components, water and air and capable of supporting plant growth.” Certainly, our survival depends on our capacity to produce enough crops to feed the increasing population on the earth. And to do that, we need to maintain our soils.

However, there are many problems affecting the soil. One of the most important is soil erosion which “is the process of detaching and removing soil materials from their original sites.” Erosion is caused mostly by natural factors such as flood water, wind, and volcano eruptions among others.

We know that soil erosion can also be caused, or at least increased, by human activities such as deforestation, overgrazing, and road or trail building. Knowing where this can happen would be very beneficial in the mitigation of erosion’s negative effects.

**Materials:**

* Lab Computers with the modeling software
  + Autodesk Inventor
  + Blender
* USGS Topographical Map Information
* 3D Printer
* Casting materials
  + Fine Sand
  + A Water Soluble Adhesive like PVA or Craft Glue
* 20 oz. Bottle and testing apparatus to hold bottle over model

**Procedure**

1. Find the 3D landscape data of your waterway of interest

- USGS National Map Viewer: [https://viewer.nationalmap.gov/basic/](https://www.youtube.com/redirect?redir_token=ffL20WaF4awaIvXr9dIsSRGGuvN8MTUyOTE1NzkxMkAxNTI5MDcxNTEy&q=https%3A%2F%2Fviewer.nationalmap.gov%2Fbasic%2F&event=video_description&v=bSNy9iUqDbI)

- Terrain Party (Much Simpler): [https://terrain.party](https://www.youtube.com/redirect?redir_token=ffL20WaF4awaIvXr9dIsSRGGuvN8MTUyOTE1NzkxMkAxNTI5MDcxNTEy&q=https%3A%2F%2Fterrain.party&event=video_description&v=bSNy9iUqDbI)

1. Highlight your stream in 1/3 arc-second and download the information to our desktop
2. Open blender and follow these steps
   1. Delete the default box
   2. Add a work plane
   3. Add a modifier to the plane to subdivide the workspace
   4. Add another modifier to displace – choose the merged version of your topographical information
   5. Adjust your displacement to best show your topography (scale z-axis, color, amount of subdivisions)
   6. Export the file as a .stl
3. Open Autodesk Inventor
   1. Import the .stl you just created in blender
   2. Convert the mesh to a working surface
   3. Create a 4”X 4” X .5” extrusion up to the surface of your topography
   4. Enclose the extrusion in a box so that you can make a sand cast of the profile of your topography from a 3D print
4. Print your casting
5. Spray the inside of your cast with cooking spray. Fill your casting with a good working mix of fine sand and adhesive
6. Once your cast is dry, set it up in the testing apparatus and let water slowly flow through your sand model
7. Observe where the erosion f your stream has happened and where it didn’t seem to be a problem

**Hypothesis (***where will erosion be the most prevalent in your model and why?)***:**

**Observation Notes:**

**Analysis Questions**

1. Did your observation support your hypothesis? Why or why not?

2. Compare your results with one other group who used a different topography than you. How do your results compare?

3. What do your results suggest about the different landscapes and how they show erosion? What recommendations would you make to help prevent erosion?