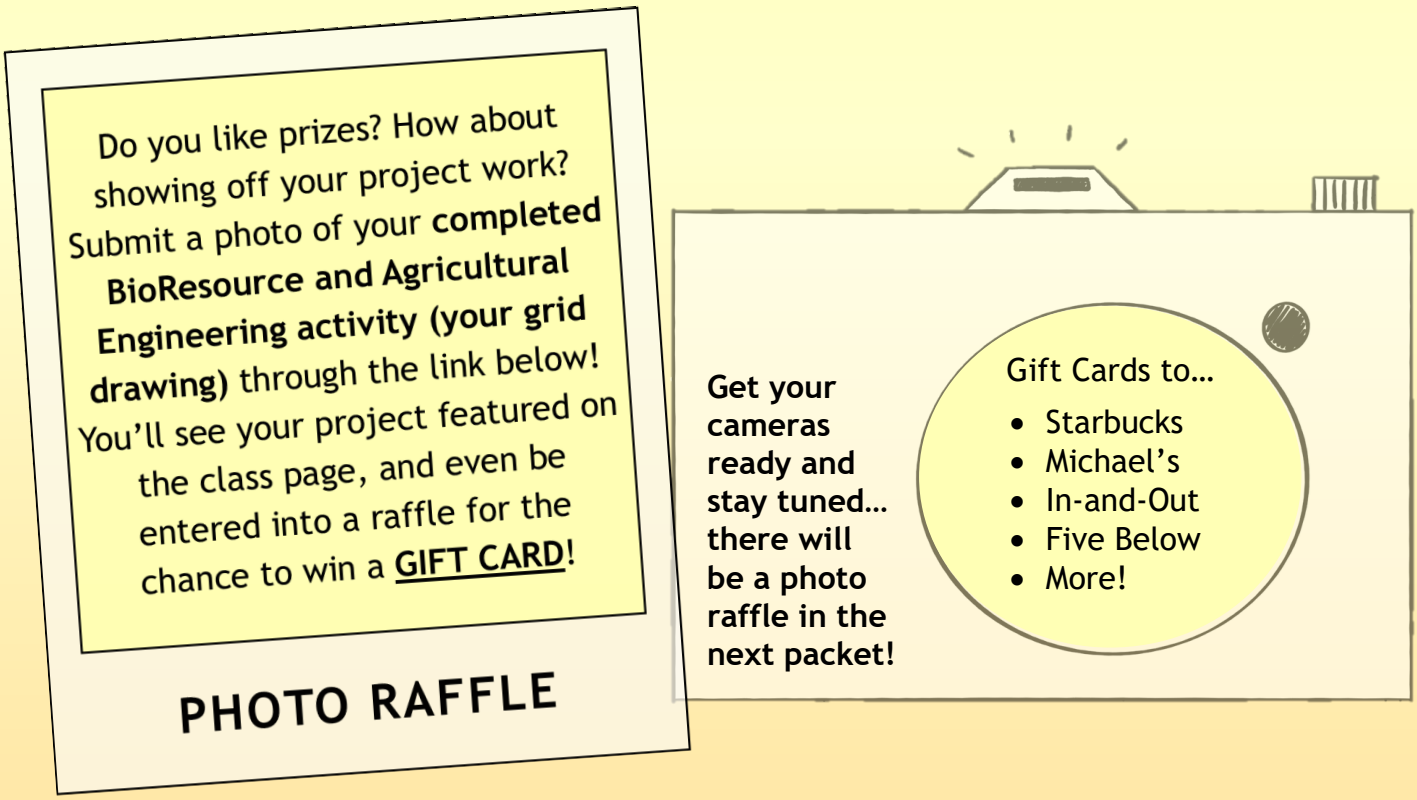
SWEductional

ACTIVITY PACKET

BioResource and Agricultural Engineering Edition

WHAT IS BIORESOURCE AND AGRICULTURAL ENGINEERING ?

BioResource and Agricultural Engineering is the study of earth's resources and their uses in agriculture. They are responsible for making sure that our food grows the best it can, and that we have maps of landforms and different areas. You could find these types of engineers studying what soil is made of, how to map out landforms such as mountain ranges, how to water crops efficiently, and much more!



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https://forms.gle/AcEXCZkePKxmqJCJA

IMPORTANT TERMS

Topography

- Rivers, mountains, roads, cities, and lakes are some physical examples studied through topography.
- In this activity, you will be practicing topography by describing physical features in an area of land.
- What are some other physical features in an area of land that you can think of?

Topographic Map

- When you need to depict different elevations that show the physical features of an area of land, you can make a topographic map.
- In this activity, you will be creating and reading a two-dimensional and a three-dimensional topographic map.
- What are the differences that you can see and gather from a 2D topographic map and a 3D topographic map?

Land Surveying

- Determining the land position of points and measuring the angles, distances, and elevations between them is a technique of land surveying.
- In this activity, you will be exploring land surveying by creating your own topographic map measuring elevations.
- Why do you think bioresource and agricultural engineers use the technique of land surveying?

ACTIVITY INSTRUCTIONS

Today, you will get an introduction to land surveying by understanding how to read topographic maps!

BioResource and agricultural engineers utilize this skill to effectively develop various technologies, machineries, and systems that can make agriculture-related tasks much more efficient. Whether that be in finding ways to create proper water and waste systems in complicated plots of land or analyzing potential problems because of the land, knowing how to read these maps is essential!

SUPPLIES

- A sheet of paper, cardstock, foam paper, or anything else you can easily cut with scissors.

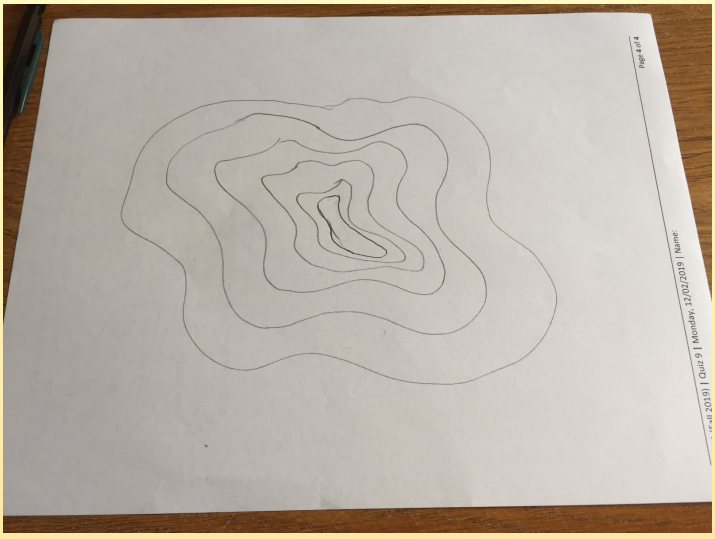
  Ask an adult if it is ok to use the material you selected.

- Paper to use as spacers can use as spacers.
- A printed out copy of our example or you can draw one of your own.
- A pair of scissors or another cutting tool.
- Glue
- Your choice of coloring tools (color pencils, highlighters, markers, crayons, paint, etc.)

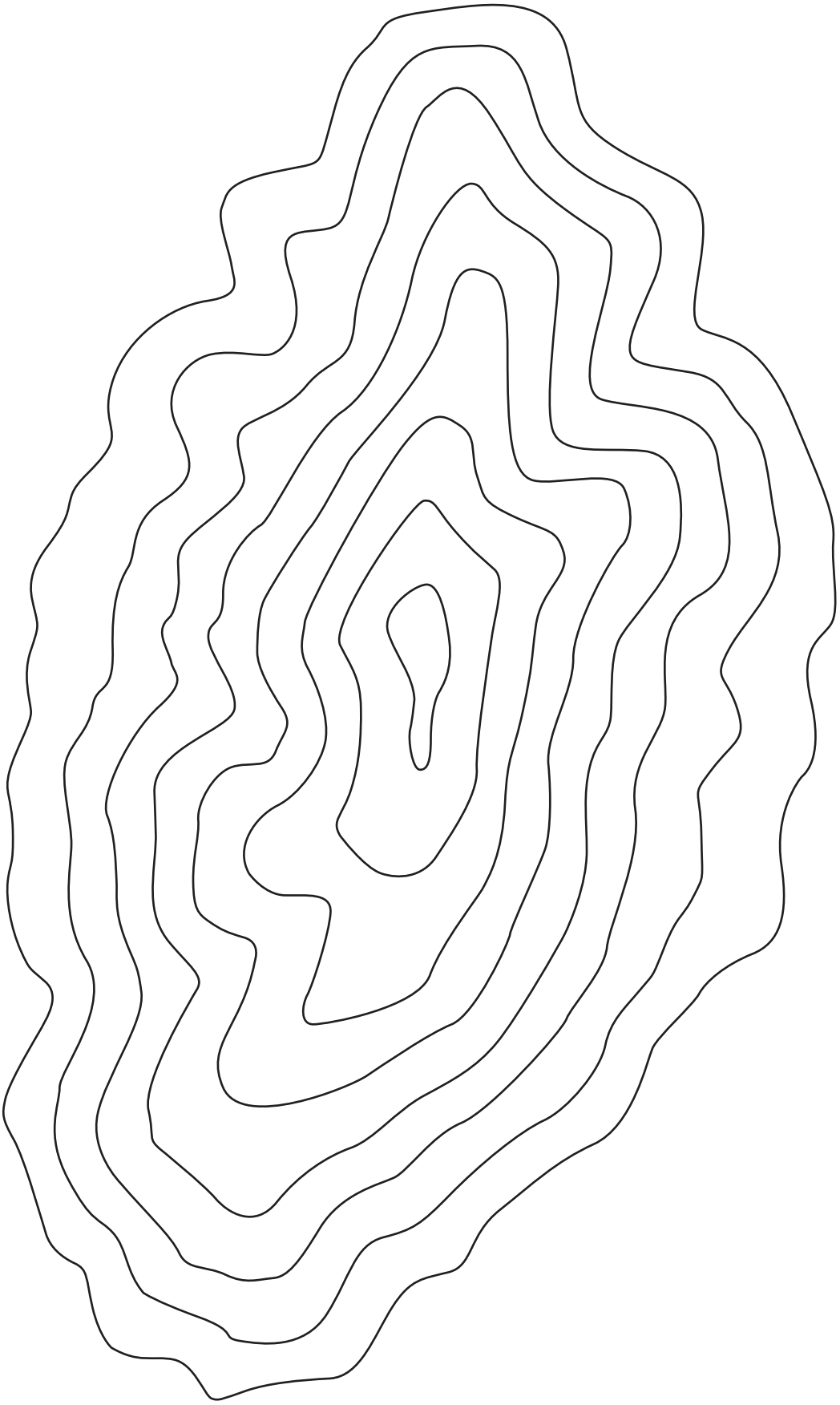
  You may not need these if you already have multi-color sheets.

STEPS

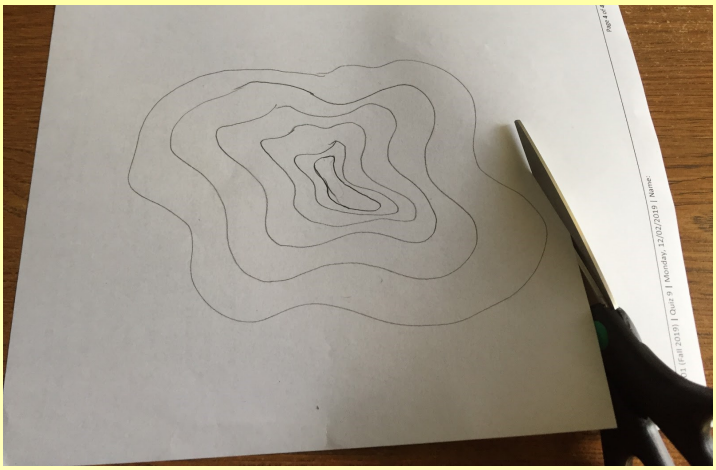
1. Gather your materials. On the next page, you will find an example of a simple topographic map. You can either print this or make your own topographic map by drawing contour lines on a piece of paper.
   a. If you choose to make your own map, you can make any shape that you'd like but be sure to draw at least 6 contour lines (you can have more too!). The space between each contour line can vary. You can make some of the contour lines closer or further apart from each other. Make two copies of this or take a picture so you can review it during and after you make your 3D map. You can refer to our example(s) if you want.



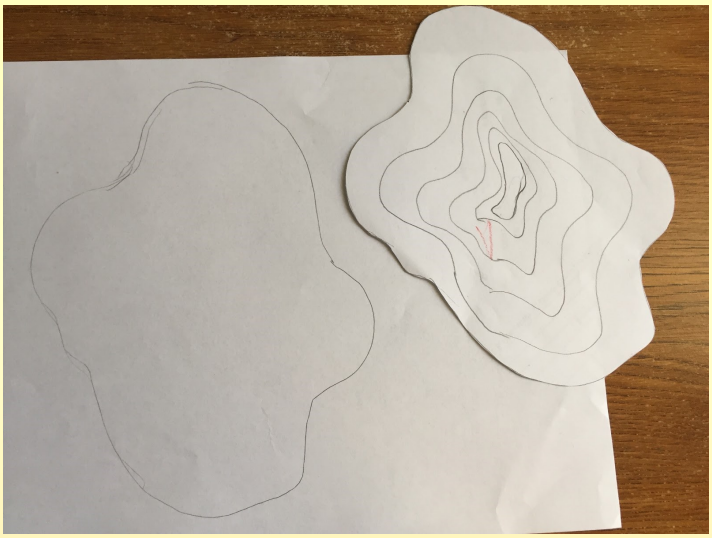
2D Topographic Map: Print Me!



2. It’s time to cut out the pieces. You can ask an adult to cut them out for you if you feel unsure about handling scissors.
   a. Take the example or your drawing and cut out the excess paper around the map.

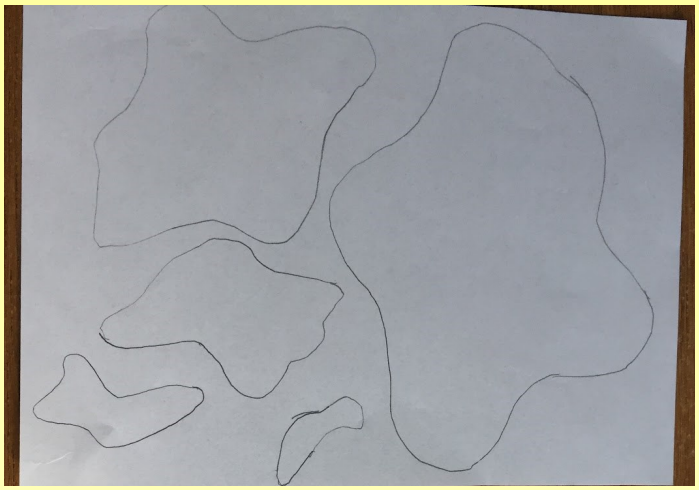


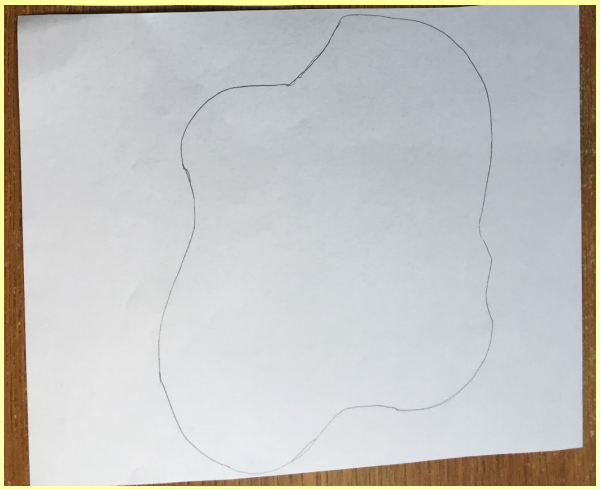
   b. Place the map on your sheet and trace it onto the sheet.



   c. Take the example map and cut out the next layer, until you have 7 layers left.

d. If you have multi colored sheets, place the map on a new color and trace it.





e. Repeat steps (c) and (d) until you have cut and traced all of the layers.

3. This is where you get to be a little creative! Choose your favorite colors and color in each layer. You can use whatever coloring tool you want. You can also choose your favorite color and create a gradient.

Feel free to be creative as you would like, here is our example!

4. Now that you have all the pieces colored, carefully cut them out.

5. Take a moment to think about your sheet, is it thin or thick?

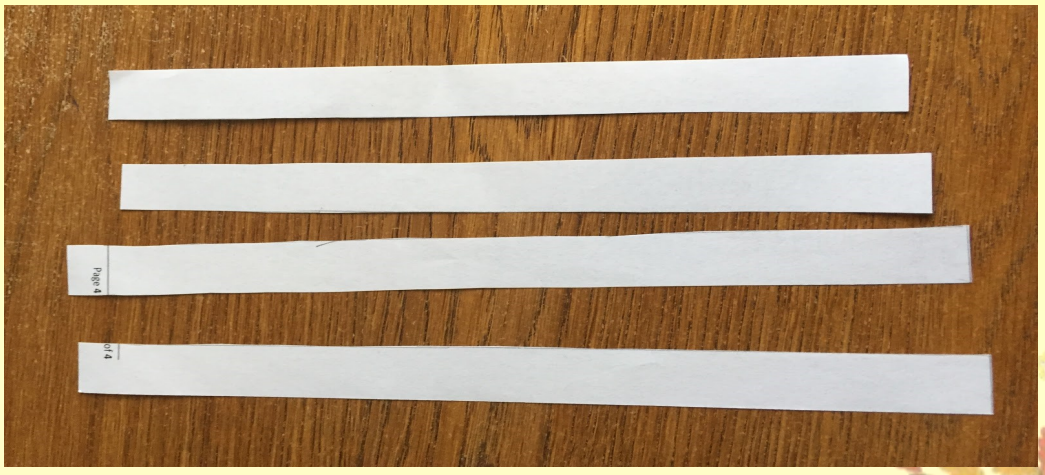
If it is thick, like foam sheets, you can skip this step.

If it is thin, like paper or cardstock, you will have to use a spacer. Let's talk about spacers for a bit, they are used to give some gap between the topography layers. This gap is important because it will help you get elevation and, thus, imagine a 2D map in a 3D form. If your sheet is thick, then the thick sheet will act as a spacer.

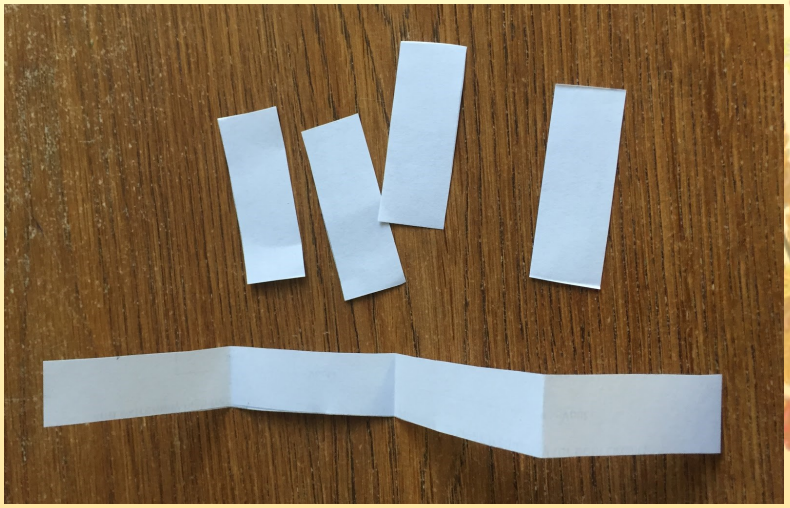
If it is thin, like paper or cardstock, let's make the spacers!

Pieces of plastic straws, bottle caps, or small pieces of cardboard are some options that could also be used as spacers.

a. First, take a piece of paper and cut it into long strips about 1-½ inches thick.

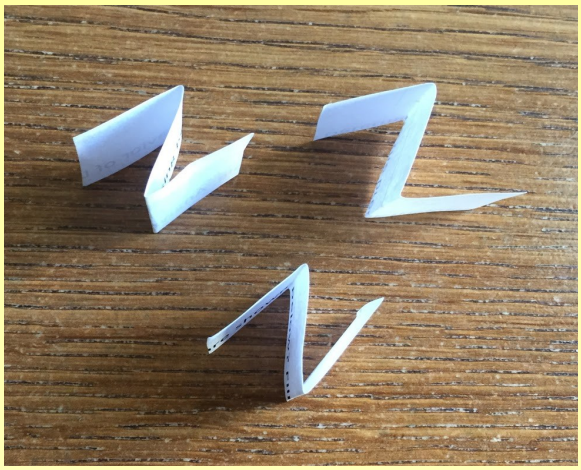


b. Then, cut the long strips into roughly even rectangles.



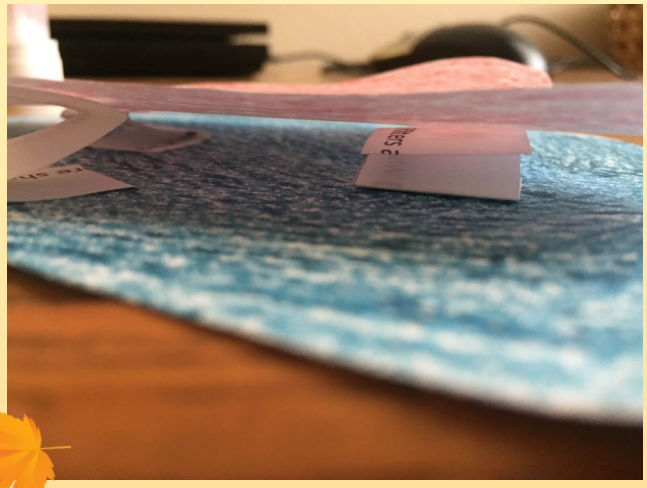
c. As you might have noticed, some of the layers are big and others are very small. So, make sure you have at least twice the number of strips as you have layers.

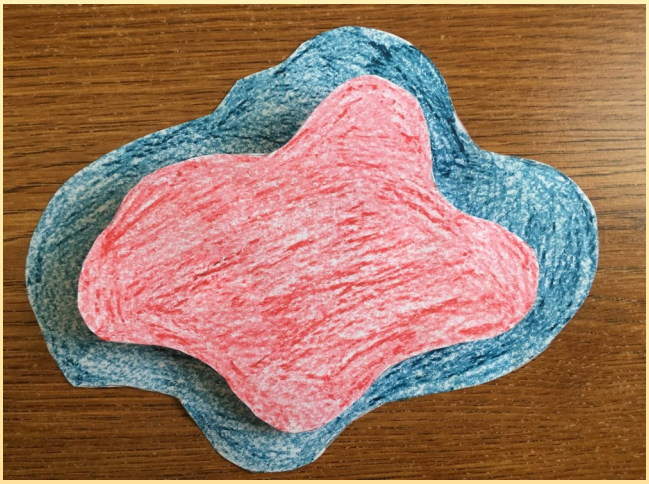
d. Then take each spacer and fold it into a zig-zag or a z shape, like shown.



6. We will start putting together our 3D topographic map now.
   a. Take your largest sheet first, and glue one side of your spacer on it. You might want to glue a few more to make sure that the large sheet is stable.

   b. Apply some glue the opposite sides of each of the spacers and place the second largest sheet on the glue. Your topo map should look a little like a sandwich at this point, with the spacers glued between the two layers.





c. Now, you have to glue a few spacers on top of the second largest sheet. Like in the previous step, apply glue to the opposite side of the spacers and place the third target sheet on them. You might start seeing the process now, which is just repeating the steps of gluing the required amount of spacers and then gluing the next largest sheet.

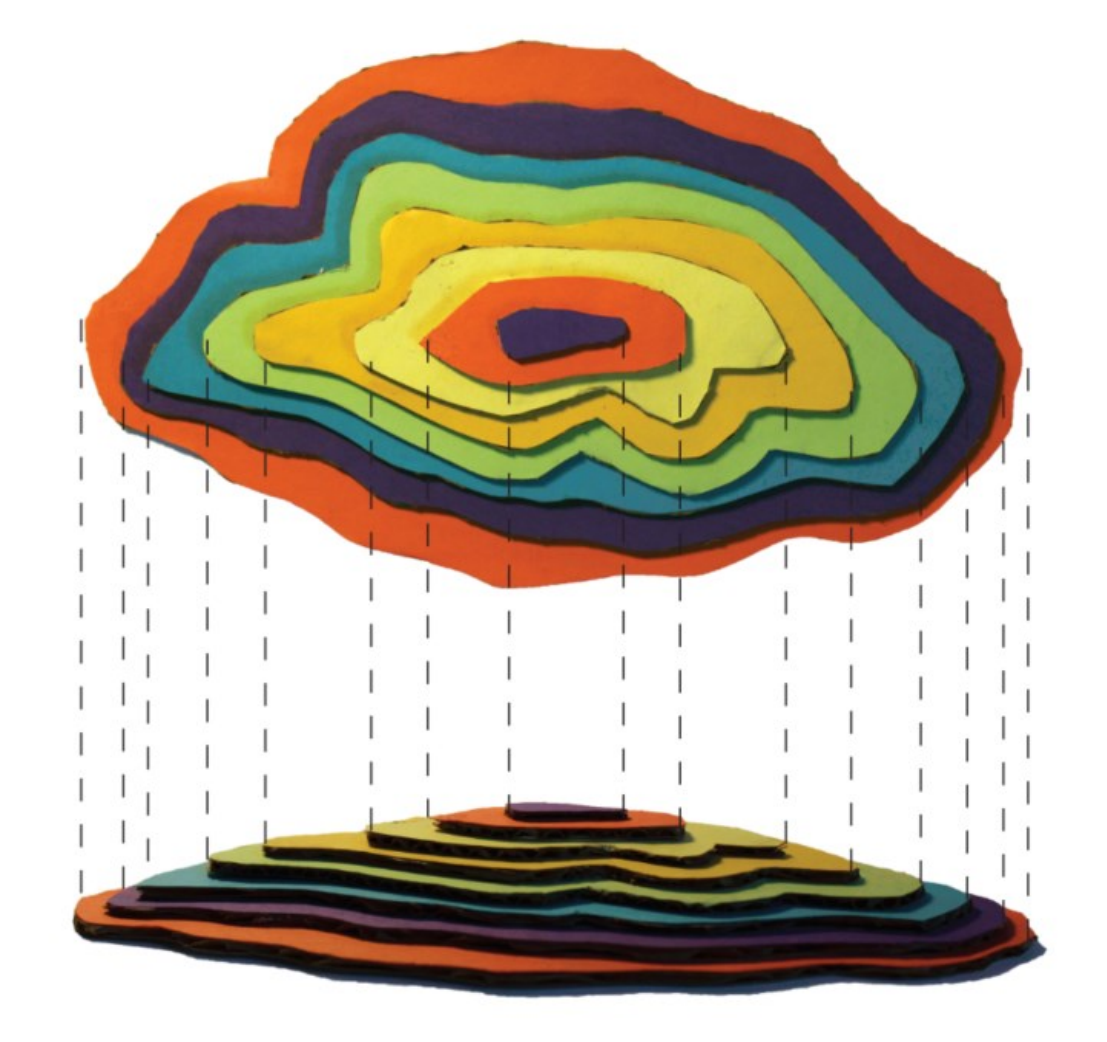
If your sheets are thick, like foam, you can directly glue layers on top of one another.

Don't forget to make sure that the layers are aligned by referring to your original 2D map. That is, if you look at the 3D map from above, it should roughly match your 2D map/design.

7. Now that you've finished making a 3D map, look back at the 2D map.
   a. Compare and contrast your 2D and 3D topographic maps.
      i. What do you notice about contour lines that are further or closer apart?
      ii. Where on the map is the peak? Where is the lowest?
   b. Some other things to think about:
      i. What do you think are the challenges of building on higher ground?
      ii. In agriculture, would it be more beneficial to have an elevated or flat ground?

You can make as many maps as you would like!
If you want a challenge, try to imagine and draw the "side" view (elevation) of the map before making your model.

Now, if you chose to print and cut our 2D topographic map example, the model below shows how its contour lines correspond to each layer of the 3D model.



Each layer has an elevation (example: the thickness of each layer or how thick your spacers are in your model), which tells you how high that layer is from the ground.

RESOURCE LINKS / VIDEOS

- Educational Farming Games (Grades K-5th) - http://www.myamericanfarm.org/
- Educational Farming Games (Grades 6-12th) - https://www.nationalgeographic.org/interactive/top-crop/