Name: ___________________

Lab 8: Fluvial and Karst Landforms

Learning Objectives:

- **Learn how to quickly and efficiently analyze topography using Google Earth and realize which applications it is and is not appropriate for**
- **Critically ponder fluvial landscapes and the processes that shape them**
- **Learn to recognize and think about karst topography**

Refer to your textbook for descriptions of any unfamiliar terms or processes.

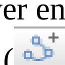
Getting Started:

1. Open Google Earth
2. Make sure you have downloaded the "Lab8" data file from the class website (right next to the link to this lab) before continuing. You will need to unzip the file to a location on your computer where it can be saved.
3. Go to http://www.gelib.com/usgs-topographic-maps-2.htm
4. Scroll down to and click on the link in the center of the page that says "Download With Google Earth".
5. In Google Earth, check the box next to the "USGS Topographic Maps" folder under the "Temporary Places" section of the "Places" catalog (NOTE: if "Places" is not showing up, click the sidebar button () on the top toolbar to make it appear.
6. After a few seconds, a grid with labeled topographic map names should appear. If it hasn't appeared, zoom in until it does (zooming to an eye altitude (lower right corner) of ~50mi should do it).
7. Find the two placemarks on the map labeled "upper end" and "lower end". Download and view the Maybell 7.5 minute quadrangle by clicking within the quadrangle and clicking "Download Map" (the download may take a minute or two, be patient). Note that the downloaded map will include all the information stored on the regular paper version of the map.
8. Note that you can use Google Earth to more easily visualize 3D topography on a topographic map. Feel free to play around a bit and get a feel for Google Earth's controls (see what the Shift key, middle mouse button, and ctrl key do).

Using the Maybell 7.5 minute quadrangle and Google Earth, complete the following problems (NOTE: the box next to "o40108e1" under the "USGS Topographic Maps" folder in Google Earth must be checked to see the Maybell quadrangle).
Note: make sure that the box is checked next to the "Lab8" folder in Google Earth.

1.

a. Determine the sinuosity of the segment of the Yampa River that is shown on this map (between "upper end" and "lower end").

(Hint: use the "Add Path" tool () and view the "Measurements" tab when the path has been drawn).

b. Determine the sinuosity of the Yampa River **valley** as shown on this map (between "upper end" and "lower end").

c. What might this suggest about the rate of incision versus the rate of lateral erosion for this segment of the Yampa River?

2. Observe the arcuate cliff face at: SE1/4 Sec20 T7N R95W on both the topographic map and 3D satellite view (Google Earth)

a. Suggest a process by which this landform developed.

b. Apply uniformitarianism by suggesting 2 other areas on the map (using Township and Range notation) where the same processes are *active* today.

3. Observe what appears to be a large, tributary-fed alluvial fan at: Sec19 T7N R95W.

a. By labeling the landform an alluvial fan we assume that the tributary built the feature through deposition of sediment. Suggest an alternate explanation and associated processes that could also have produced the landform.

b. Do any other tributaries in the Yampa valley possess such large fan-like surfaces? Speculate as to why or why not.

4. Notice the dissected surface 160-180 feet above the southern side of the Yampa River valley. Do you see any evidence that this surface might be a terrace (Hint: look for labels on the topographic map)? Explain.

Using the provided geologic map and the Horse Gultch and Juniper Springs quadrangles (if necessary) on Google Earth, complete the following problems.
Note: make sure that the box is checked next to the "Lab8" folder in Google Earth.

5. Measure the sinuosity of the Yampa River from point A to B, and point B to C.

6. Measure the **valley** sinuosity from point A to B and point B to C.

7. What does the abrupt change in **valley** sinuosity most likely indicate regarding the change in rock type at point B? (Hint: think of bank material vs. bed material resistance)

8. Speculate as to why the channel sinuosity was similar from A to B and B to C, even though the confinement of the channel changed drastically.

Using the Gateway Rapids, Arizona 7.5 minute quadrangle, complete the following problems. (Double click on the "Gateway Rapids Quad" placemark under "Lab8" to be taken directly to the location of the quad. Be sure to download it in the same manner as the step 7 under "Getting Started")

9. a. Determine the sinuosity of the segment of the Colorado River shown on this map.

b. Determine the sinuosity of the Colorado River **valley** as shown on this map.

b. Compare rates of incision versus the rate of lateral erosion for the Colorado River (Gateway Rapids quad) and the Yampa River (Maybell quad).

10. Observe the mouths of the Mohawk and Stairway canyons on the Colorado River. Suggest an origin for the low-relief surfaces at their mouths.

11. On a recent river trip down the Colorado River, your know-it-all river guide hypothesized that

Gateway Rapids is a bedrock knickpoint migrating upstream. Closely examine the rapids and associated terrain. Objectively, but savagely evaluate his hypothesis and suggest an alternate hypothesis as well.

12. Observe the forested mesa in the center of the map. By tracing the margins of the mesa, visualize how lateral erosion is consuming the flat upland plateau. Explain how the lithology and geologic structure control the position and development of the mesa.

13. Locate the head of a small, NE-flowing valley atop the forested plateau at:
UTM Northing 4001500mN, UTM Easting 323300mE

a. In what direction is the cliff face adjacent to the head of the small valley retreating?

b. As the cliff face retreats, what is happening to the low gradient stream and associated drainage basin on the plateau?

14. Using approximate Latitude and Longitude coordinates, suggest one other area on the mesa where the same processes inferred in problem 11 are active (Feel free to use Google Earth to attain the lat/lon coordinates, but **make sure they're in degrees, minutes, seconds notation**).

15. a. Using Google Earth and the process shown in class (using the add path, then view elevation profile tools) construct a cross section of the Colorado River valley along the UTM Easting line 322000mE. Start the cross section at 4013000mN and end at 4009000mN. You need not print this cross section, just look at it.

b. What might the cross section suggest about geomorphologic processes and regional uplift in this area?

Using the Diaz Peak, Arizona 7.5 minute quadrangle, complete the following problems.

16. What landform dominates the SW 2/3 of the map?

17. What is the landform centered upon UTM coordinates 3536000mN, 342000mE?

18. What is the geomorphic name applied to the peaks projecting out of the landforms in problem 14? Good examples of such peaks are found west of the Cement Tank in the NW corner of the map.

The following problems can be completed with only Google Earth. Geologic or topographic maps are not required.

Double Click on the "Last Bessemer Creek" placemark (this stream is the one draining directly from the peak of Bessemer Mountain). Activate the "historical imagery" tool (). Starting at the earliest year (1994), go through each image and examine Last Bessemer Creek.

19.What is the possible range of years in which the large landslide on the SW side of the creek could have happened?

20. What are some effects of the landslide on the morphology of the channel?

21. This channel was clearcut around 1930. As a result, there are almost no old growth forest stands within the valley. How might this have impacted the effects of the debris flow?

22. Disabling the historical imagery tool, do you notice any potential problems with using Google Earth to analyze topography?

Using the Asbury, West Virginia 7.5 minute quadrangle, complete the following problems.

23. Observe the nature of Muddy Creek Mountain (MCM) north of Davis Hollow.
    a. If this landform were in an arid region such as Utah, what would you label it?

b. Notice that the top is not completely flat and that the highest elevations atop the landform are on the east and west sides of the mountain. Does this suggest structural control? If so, what type of structure?

24. Locate Raders Valley west of Brushy Ridge. What type of valley is this? Where is the stream that ‘should’ be flowing within it?

Using the Williamsburg, WV 7.5 minute quadrangle, complete the following problems.

25. Observe the heavily dissected upland surface between Butler Mountain and Miller Ridge. Identify and briefly discuss any features (at least 4) that might provide insight as to the origin of this landscape. Be sure to consider erosional histories and geology, and make good use of both the satellite imagery and topographic map.

26. Find Culberson Creek in the north-central portion of the map. Trace the creek until it sinks beneath a cliff face. Note that Culverson Creek may once have flowed south through Raders Valley, but was diverted up one of its own tributaries. Find Spring Creek on the east side of the map. The springs of Spring Creek are the outlet for Culverson Creek Cave and several other of the world’s largest caves.

a. What is the difference in elevation between the end of Culverson Creek (where it enters the cave) and the southernmost spring along Spring Creek?

b. What lithology likely underlies this area?