COA 690 / 790 GIS in Marine Science

Instructor: Wei Wu

3/6/2017

Due: 3/13/2017 (Monday in spring break's week)

Lab 5 Acquiring Digital Elevation Models (DEMs) and census data

What you need to turn in: Three maps described in the lab document.

1. DEMs

Digital elevation models represent raster depictions of elevation. The USGS maintains digital elevation data at a variety of spatial resolutions. The most common for environmental GIS uses are:

1 degree (1:250,000 scale, 3 arc sec ~90m resolution)
7.5 minute (1:24,000 scale, 1 arc sec 30m resolution)

There is also a newer data set. Much of the contiguous US is now covered by 7.5 minute (1:24,000 scale) data at 1/3 arc sec (10m) resolution. There is also a 3m (1/9 arc sec) resolution product at the 1:24,000 scale being created. This does not currently cover much of the United States.

This data is now available through the national map portal, along with many other USGS products.

Download 24k 30m resolution DEM data

You will download the National Elevation Data (NED). Go to the following link: **https://viewer.nationalmap.gov/launch/**.
From this web page, go to **'Download GIS Data'**. This brings up an interactive browser. You will download the 30m (1'') data for Jackson county of Mississippi.
On the left panel, click **'Elevation Products (3DEP)'** (For more information on this product, see https://nationalmap.gov/3dep_prodserv.html), then click **'1 arc-second DEM'**.
On the right panel, select the **'Coordinates'** button. In the menu that comes up, enter the boundary coordinates of Jackson county: 30.31ºN to 30.70 ºN, -88.90 ºW to -88.44 ºW. Then hit **'Draw AOI'** button. You will see the map is zoomed into the Jackson County area. click **'Show Availability'**. Then click **'Find Products'**, and you will see one product on the left panel. Click **'Download'**. The data as a zip file will be downloaded to your hard drive.

This grid is in geographic, NAD83 coordinates. You will need to '**project'** your data from geographic to UTM 16N NAD83 using "Project Raster" under "Data Management Tool" in ArcToolbox. Be sure to set the cell size to **30 m** in the output.
Create a hillshade of the Jackson county 30m DEM. This can be done in ArcToolbox in the Spatial Analyst>Surface tools. You can accept the defaults. This tool gives the effect of 3D by

modeling illumination from the sun, the light and dark our eyes then interpret as 3D. Note that you can control the position of the sun, both in altitude and azimuth. This means you could model any given day of the year. You also can exaggerate the vertical elevation with the z – factor.

Print the DEM and hillshade maps. Do not forget the main map components.

2. National Wetlands Inventory

Download wetland data for Pascagoula River Basin in Mississippi from https://www.fws.gov/wetlands/data/data-download.html
One the webpage, select 'Wetlands Mapper' to download data by watershed. Then select 'Wetland Mapper V2'. Accept the terms and conditions. Zoom in to the southern Mississippi by clicking the approximate locations a few times until you see city names. Click 'Get Data' on the upper right, select the tab 'By Watershed', and click 'Select Watershed'. Then you will see the watershed boundaries in red. Click to select the one with the city of Pascagoula in it. Then the boundary of the Pascagoula Watershed becomes yellow. Click "HUC 03170006" in "Download Data" to download data. The data will be saved to your hard drive.

We'll now assign a new column to identify general wetland types, based on recurrent selections.

Create an ArcMap project, and add the shapefile *HU8_03170006_Wetlands*. Right click on *HU8_03170006_Wetlands* in the Table Of Contents (TOC), and left click on **Open Attribute Table**. The field, or item, named "Attribute" contains the wetland classification used by the US Fish and Wildlife Service. A complete list is found at the end of this lab exercise.

Close the table. Open the **Properties** > **Symbology** tab for the wetlands data. Select **Categories – Unique values** for the symbology type in the box on the left labeled "Show". And left click on **Apply and OK.**

For simplicity, we will aggregate wetland classes to a few main categories. Readers can only distinguish a limited number of colors or shades on a map. We will reclassify the detailed classes into five groups, aggregating the detailed wetland types into their "parent" categories.

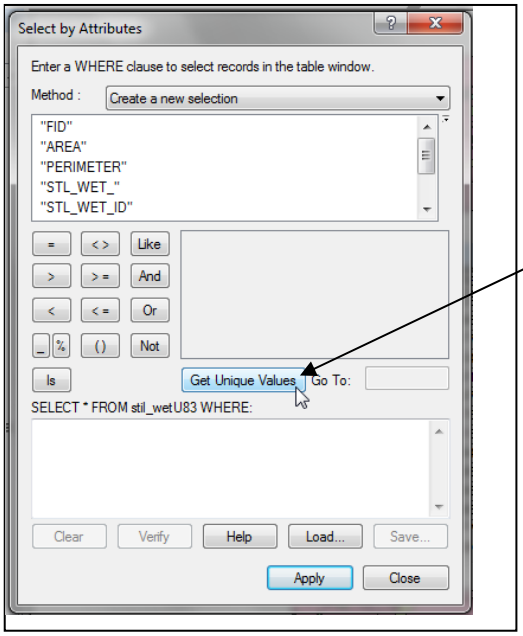
Note that there are several numbers and letters together in a string in the wetland type column, e.g., L1UBHh. These give the wetland System-Subsystem-Class-Subclass and any modifiers, as described in the key at the back of this lab.

The first letter is for the system (L=Lacustrine, P=Palustrine, etc.), the second is for the subsystem (defined for each system) the third is for Class, etc. Your job is to add a system/subsystem column, with appropriate designators for each record. There are many ways to do this; we'll do this by modifying the tables.

The basic steps are 1) add a new field (also called a new item or column), 2) select the appropriate records, and 3) assign appropriate values to the new field for these selected records, 4) repeat steps 2 and 3 until all records are processed.

First, we'll add a field.

- Open the attribute table and select the **Table Options** in the upper left of the window, then left click on **Add Field**.
- Add a field with a name you can remember, something like "reclassed". Make sure your new field has a "Text" type, length 10. Otherwise you will be restricted to only using numbers in your new field. Narrow the columns or expand the window to the right and look at your new field. You have created an additional column at the end of the table.
- Left click on **Select by Attribute** icon**.**



To display the actual values with in a field (such as 'attribute'), left click to highlight the item, then left click on the Get Unique Values button. This will allow you to pick your selection values from a complete list of

Now we need to select the records to reclassify. You build a series of expression from the variables and operators shown in the "Select by Attributes window" shown above. Note that you'll always want to **double click** on the Fields and Values (e.g. reclassed) you enter in a formula, but only **single click** on the operators (<, =, etc.). Double-left click the field named Attribute on the left, then single-left click the <= operator in the middle, and then double-click the "E2USP" value on the right. In this way you build the expression to select all string values an attribute which meet your criteria. The < , <= or >= operators work in that the string values are ranked in alphabetical order, as an ordinal ranking, with uppercase listed before lower case. The expression "ATTRIBUTE" <= 'E2USP' selects all the polygons in the system E. If you don't have a correct expression, a syntax error window may pop up. If so, clear the expression and try again. To convince yourself that this operation selected the records you want, click on the icon of

Zoom to Selected. This displays only the selected records. Verify your selection only contains records beginning with E.

Then, revert back to **Show All** records. Right click on the "Reclassed" column, and left click on the **Field Calculator** in the dropdown menu. Do the similar selections to classify the wetland types based on the systems. So you still need to classify the wetlands starting with L, P, and R. For example, if you want to reclassify L, you need to use the formula:

"ATTRIBUTE" > 'E2USP' .AND. "ATTRIBUTE" <= 'L1UBHx'

After you have done reclassification, click "Clear Selection" icon. Close the table.

Next change your legend display item (TOC, **Properties→Symbology**) to your new Reclassed field. Finally, change the legend symbols used for the Reclassed field to colors and patterns that will display nicely. **Properties→Symbology** can also be used to add more descriptive legend labels.

Produce a map of the wetland data. Use your system/subsystem categories for the legend. Color the upland (U) and OUT polygons white and the others as appropriate to distinguish among them. Remember to include a scale bar (coverage units are meters), North arrow, name, title, description, legend, and a descriptive name to the legend heading.

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

Wetlands codes are typically a string of characters, each corresponding to an attribute in a hierarchy. For example, a wetland might be labeled L1UBG, indicating it is a Lacustrine (System, see below), Limnetic (Subsystem), Unconsolidated Bottom(Class), which is intermitte exposed (modifier G in L1UBG, see modifiers at end of this list). There are at least two shortened designators which may appear on wetlands maps,

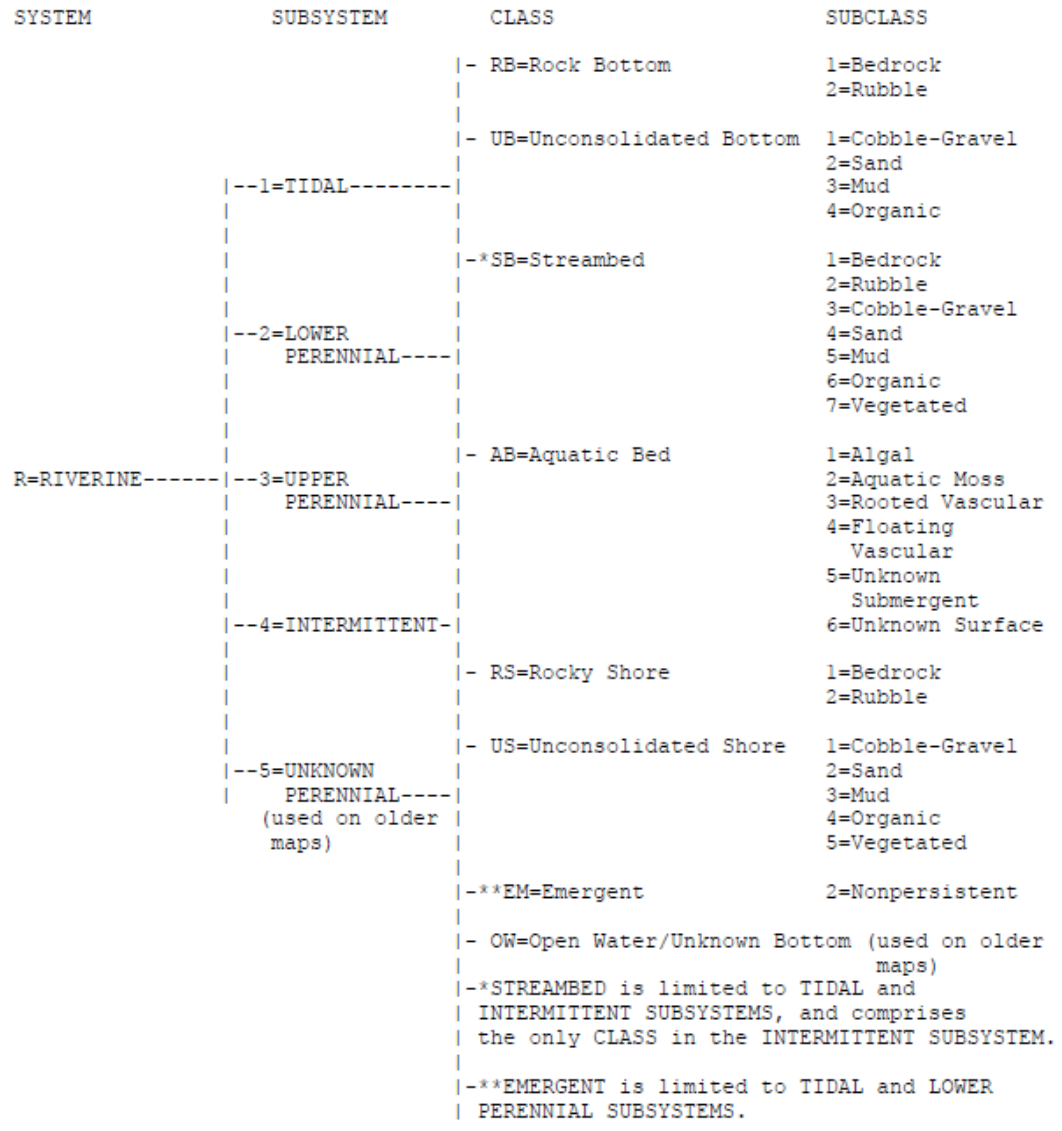
U = Uplands, and

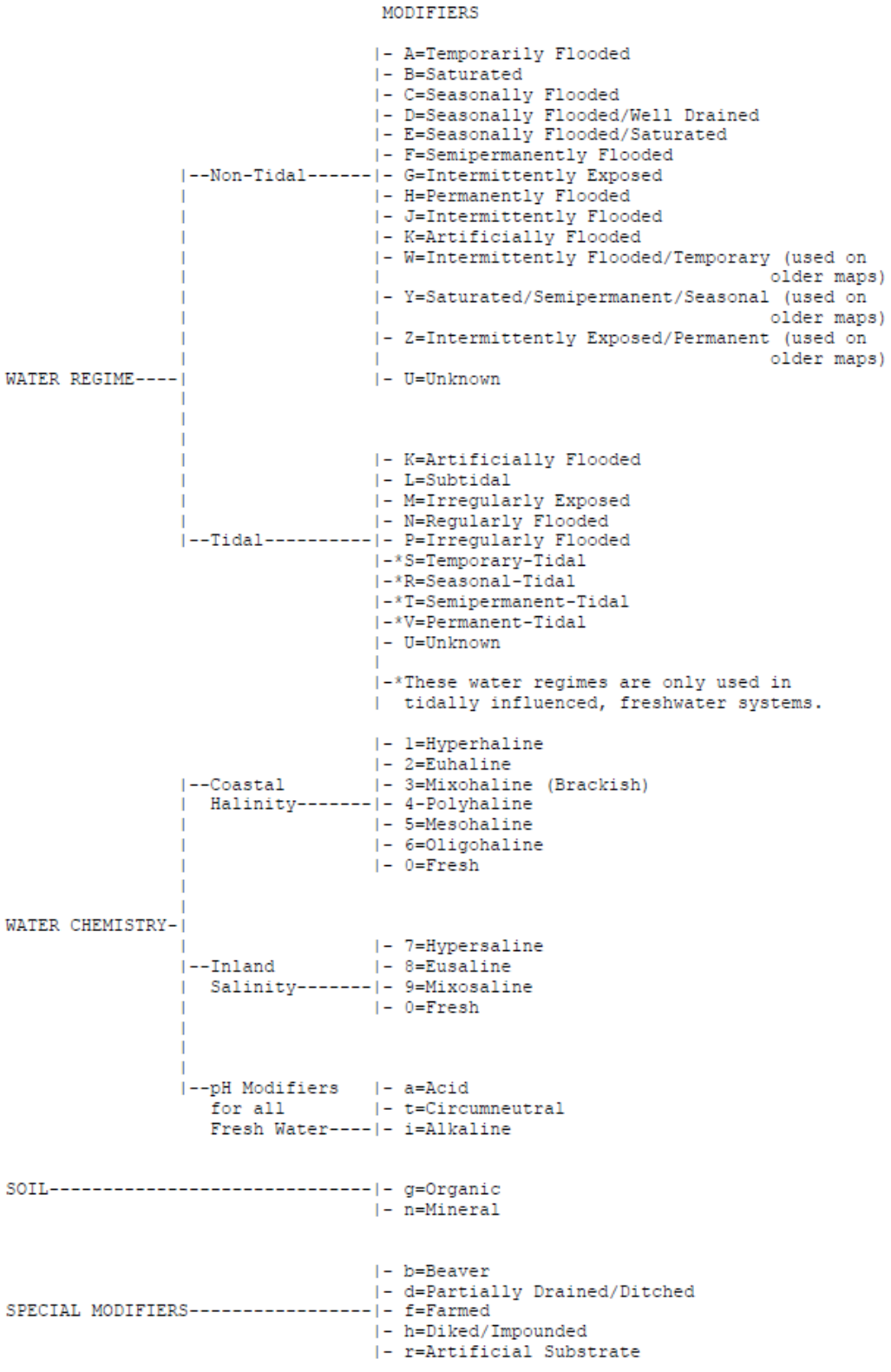
OUT = out of the mapped area

Below is the hierarchy.

SYSTEM	SUBSYSTEM	CLASS	SUBCLASS
L=LACUSTRINE	1=LIMNETIC	RB=Rock Bottom	1=Bedrock 2=Rubble
		UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		OW=Open Water/Unknown Bottom	(used on older maps)
	2=LITTORAL	RB=Rock Bottom	1=Bedrock 2=Rubble
		UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		RS=Rocky Shore	1=Bedrock 2=Rubble
		US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic 5=Vegetated
		EM=Emergent	2=Nonpersistent
		OW=Open Water/Unknown Bottom	(used on older maps)

SYSTEM	SUBSYSTEM	CLASS	SUBCLASS
P=PALUSTRINE		RB=Rock Bottom	1=Bedrock 2=Rubble
		UB=Unconsolidated Bottom	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic
		AB=Aquatic Bed	1=Algal 2=Aquatic Moss 3=Rooted Vascular 4=Floating Vascular 5=Unknown Submergent 6=Unknown Surface
		US=Unconsolidated Shore	1=Cobble-Gravel 2=Sand 3=Mud 4=Organic 5=Vegetated
		ML=Moss-Lichen	1=Moss 2=Lichen
		EM=Emergent	1=Persistent 2=Nonpersistent
		SS=Scrub-Shrub	1=Broad-Leaved Deciduous 2=Needle-Leaved Deciduous 3=Broad-Leaved Evergreen 4=Needle-Leaved Evergreen 5=Dead 6=Indeterminate Deciduous 7=Indeterminate Evergreen
		FO=Forested	1=Broad-Leaved Deciduous 2=Needle-Leaved Deciduous 3=Broad-Leaved Evergreen 4=Needle-Leaved Evergreen 5=Dead 6=Indeterminate Deciduous 7=Indeterminate Evergreen
		OW=Open Water/Unknown Bottom	(used on older maps)


SYSTEM
SUBSYSTEM
CLASS
SUBCLASS
R=RIVERINE
1=TIDAL
2=LOWER PERENNIAL
3=UPPER PERENNIAL
4=INTERMITTENT
5=UNKNOWN PERENNIAL (used on older maps)
RB=Rock Bottom
1=Bedrock
2=Rubble
UB=Unconsolidated Bottom
1=Cobble-Gravel
2=Sand
3=Mud
4=Organic
*SB=Streambed
1=Bedrock
2=Rubble
3=Cobble-Gravel
4=Sand
5=Mud
6=Organic
7=Vegetated
AB=Aquatic Bed
1=Algal
2=Aquatic Moss
3=Rooted Vascular
4=Floating Vascular
5=Unknown Submergent
6=Unknown Surface
RS=Rocky Shore
1=Bedrock
2=Rubble
US=Unconsolidated Shore
1=Cobble-Gravel
2=Sand
3=Mud
4=Organic
5=Vegetated
**EM=Emergent
2=Nonpersistent
OW=Open Water/Unknown Bottom (used on older maps)
*STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.
**EMERGENT is limited to TIDAL and LOWER PERENNIAL SUBSYSTEMS.


MODIFIERS
|- A=Temporarily Flooded
|- B=Saturated
|- C=Seasonally Flooded
|- D=Seasonally Flooded/Well Drained
|- E=Seasonally Flooded/Saturated
|- F=Semipermanently Flooded
|--Non-Tidal------|- G=Intermittently Exposed
|- H=Permanently Flooded
|- J=Intermittently Flooded
|- K=Artificially Flooded
|- W=Intermittently Flooded/Temporary (used on older maps)
|- Y=Saturated/Semipermanent/Seasonal (used on older maps)
|- Z=Intermittently Exposed/Permanent (used on older maps)
WATER REGIME----|- U=Unknown
|- K=Artificially Flooded
|- L=Subtidal
|- M=Irregularly Exposed
|- N=Regularly Flooded
|--Tidal----------|- P=Irregularly Flooded
|-*S=Temporary-Tidal
|-*R=Seasonal-Tidal
|-*T=Semipermanent-Tidal
|-*V=Permanent-Tidal
|- U=Unknown
|-*These water regimes are only used in tidally influenced, freshwater systems.
|- 1=Hyperhaline
|- 2=Euhaline
|--Coastal Halinity-------|- 3=Mixohaline (Brackish)
|- 4-Polyhaline
|- 5=Mesohaline
|- 6=Oligohaline
|- 0=Fresh
WATER CHEMISTRY-|
|- 7=Hypersaline
|--Inland Salinity-------|- 8=Eusaline
|- 9=Mixosaline
|- 0=Fresh
|--pH Modifiers for all Fresh Water----|- a=Acid
|- t=Circumneutral
|- i=Alkaline
SOIL----------|- g=Organic
|- n=Mineral
|- b=Beaver
|- d=Partially Drained/Ditched
SPECIAL MODIFIERS----------|- f=Farmed
|- h=Diked/Impounded
|- r=Artificial Substrate