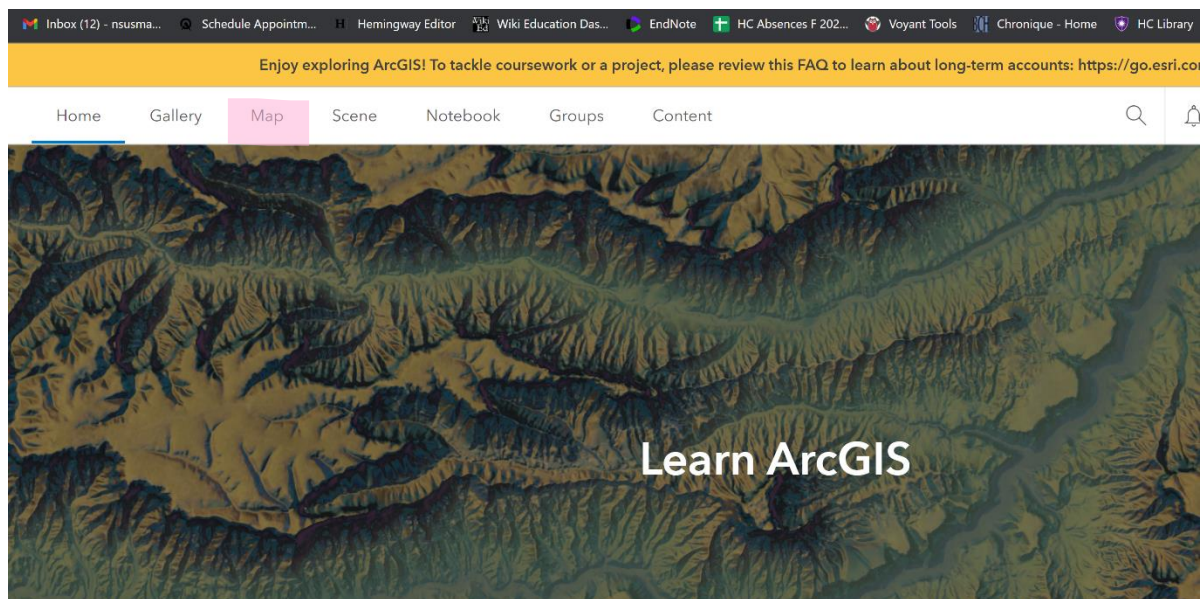
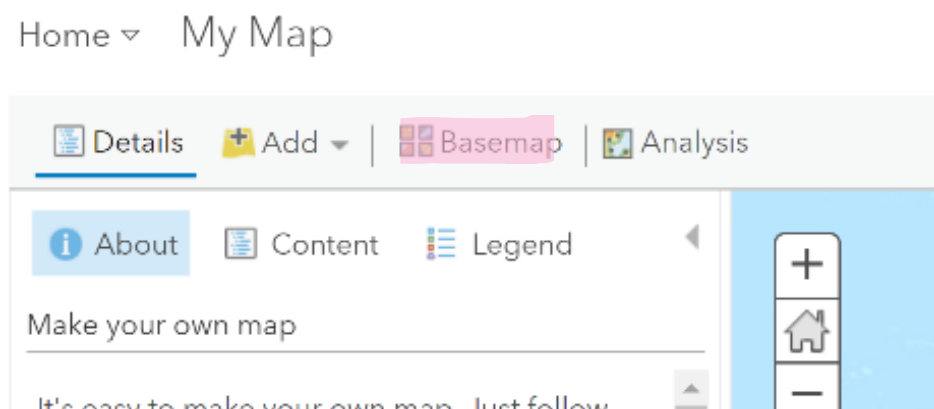


1. Setting Up

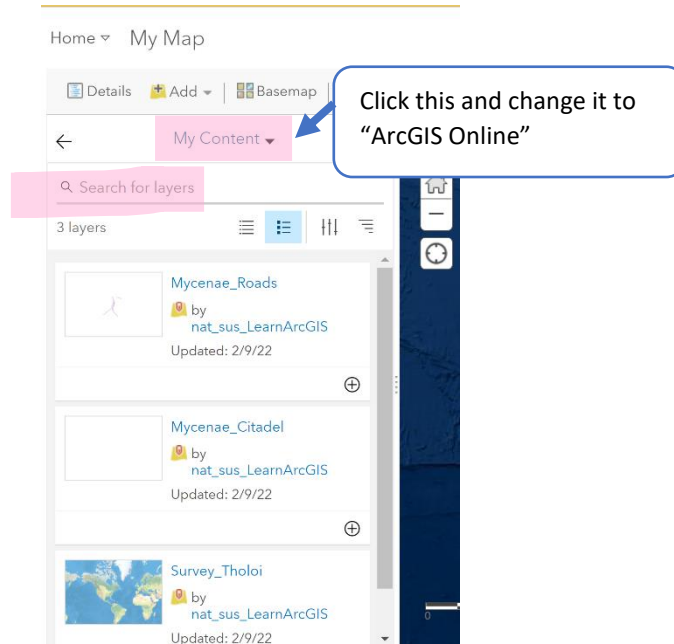
1. Go to <https://www.arcgis.com/index.html> and sign into your ArcGIS account. Remember – you need to use the username (not your email). If you can't remember, look at the confirmation email they sent you last week and it should be there. You can always make a new account if needed.
2. Click on **Map**.



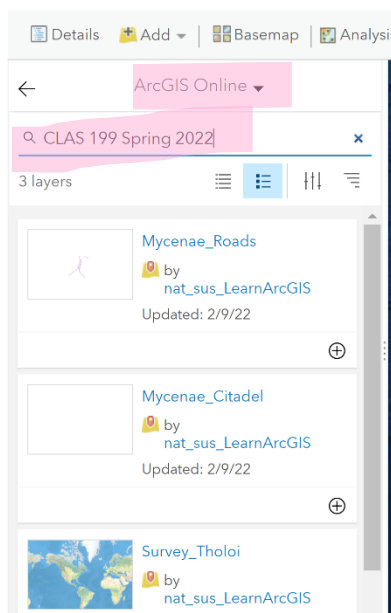
3. On the left, select **Basemap**. This is going to show you a variety of options for displaying the world (it's like a background). Choose **Imagery**.



4. Now, click on **Add → Search for Layers**. By default, ArcGIS will show you whatever data is stored in your account (which is nothing). We're going to use the same files as last week. Click on the **dropdown menu** and choose **ArcGIS Online**.



5. In the **Search for Layers** box, type **CLAS 199 Spring 2022**.



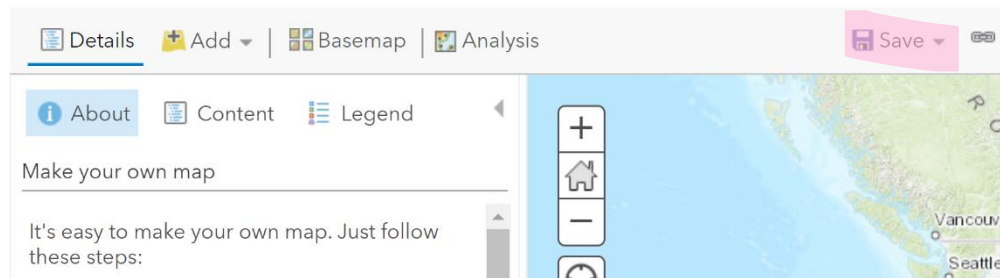
6. Click the + (add):
 - a. Argolid Settlements
 - b. Argolid Roads
 - c. Survey Tholoi
 - d. Mycenae Citadel

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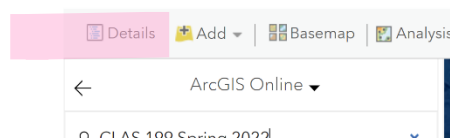
Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

They should all appear in your map.

7. **Save your map.** Name it **DIY CLAS 199 Map 2.**



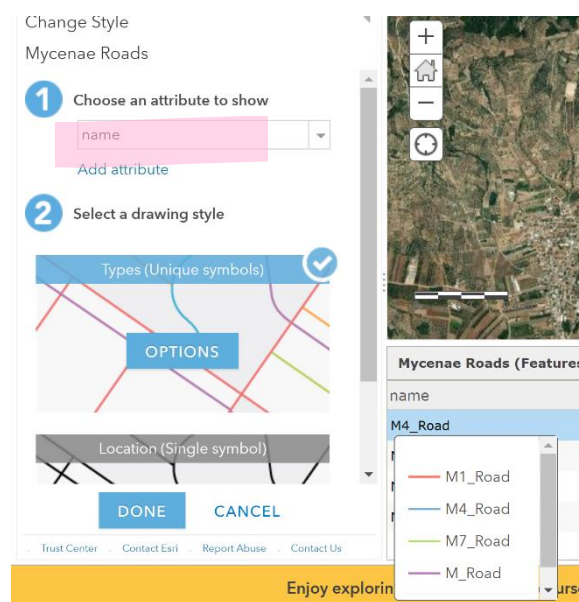
8. On the lefthand side of the screen, click **Details** on the **table of contents**.



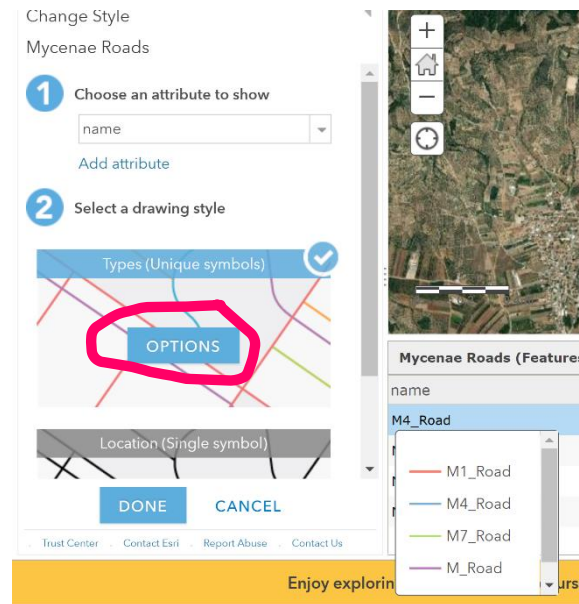
9. You should see all of the shapefiles listed there.

10. Choose **Argolid_Road's Symbol** tab (this is the 3rd option from the left and has a bunch of shapes). Reminder: Symbolology allows you to change the appearance of **Argolid_Roads** based on what's recorded in its **attribute table**.

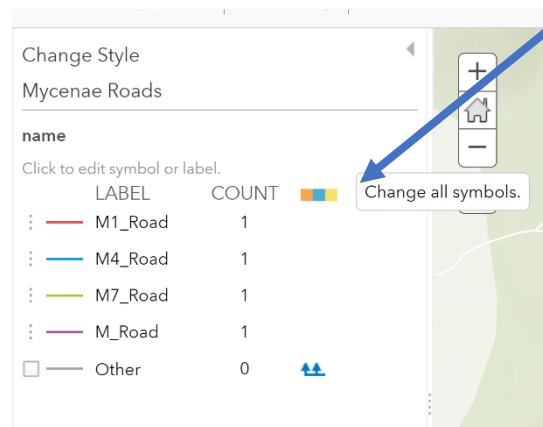
11. Click the **Choose an attribute to show** → **Name**



12. Under **Choose a Drawing Style** click the **Options** for **Type (Unique Symbols)**.

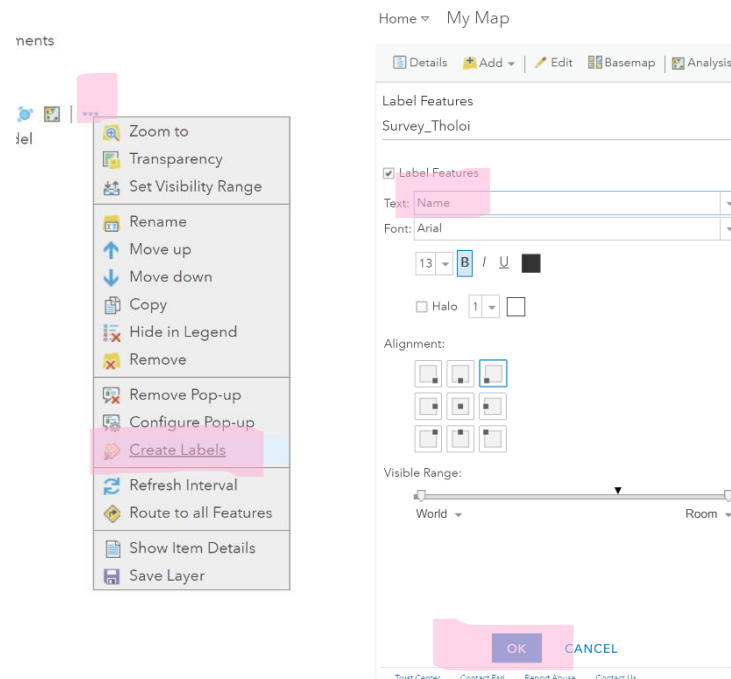


13. Click on the **Choose Options for All Symbols** button. Reminder: this button lets you change settings for each Road Name at once. Change your roads to have thicker lines that are differently colored based on name.



14. Click **OK** to save your settings. Click **Done**.
15. Using the same procedure, change the symbology of **Argolid_Settlement + Survey_Tholoi**. At minimum, make these files distinctive from one another on the screen. It might be useful to symbolize **Survey_Tholoi** by date, like you did last class.

16. Back in your **Table of Contents**, click once on **Survey Tholoi**. Open the **3-button menu** that appears underneath its name. Choose **Create Labels**. In the new menu, choose **Name** as the text field. Feel free to change around any fonts/sizes. Click **OK**. Notice that your tombs all have labels.



17. Use that same procedure to **label features** in **Argolid_Roads**. Choose **Name** in the **Type** field.

Save your map!

2. Developing your Study

Working with a partner(s) you are going to develop a hypothesis about the Treasury of Atreus.

Here's some background information. Feel free to zoom around your map (*DIY CLAS 199 Map 2*) as you read.

Datasets:

- **Argolid Settlements** shows you all of the different settled areas in the Argolid (a region) between 1700 – 1100 BCE. Depending on the period, certain settlements had more or less power.
- **Argolid Roads** shows you the various ancient roads connecting these settlements. These are major highways we know about. There were most definitely smaller, localized pathways but we don't know where they are. In other words, people would walk in other areas too!
- **Survey Tholoi** shows you all of the tholoi tombs (elite tombs) near the Citadel of Mycenae. Tholoi are elite tombs. Though this GIS file doesn't show it, there were tholoi located throughout the Argolid and these were owned by royalty/elite officials tied to the other places recorded in **Argolid_Settlements**.
- **Mycenae Citadel** is the fortress tied to the settlement of Mycenae. You would enter it from the west side (see image). Some of the other settlements in the Argolid also had citadels (for example, Tiryns). Just because a settlement didn't have a citadel doesn't mean they weren't powerful.

Background:

Based on grave goods, some of Mycenae's tholoi were tied to royalty: the Treasury of Atreus, Lion Tomb, Grave Circle B, Grave Circle A, and the Tomb of Clytemnestra. Some of the tholoi were not royal: Kato Phournos, Tomb of the Genii, Cyclopean, Tomb, Epano Phournos, and Panagia. Based on grave goods, we know these tombs were used for elite officials. In other words, there is a distinctive boundary: royal tombs are close to the citadel and are east of the M4 roadway. Non royal, elite tholoi are further away and west of the citadel.

There's an exception: the Treasury of Atreus/Tomb of Agamemnon. This tomb was built during 1400 BCE and belonged to the wanax (king) at the time. It is the largest and most ornate tholos ever found at Mycenae. Based on the spatial pattern we see, this tholos **should be near the other royal tombs – close to the citadel, east of M4**. But it's not: it's the farthest south and located on the west side of M4.

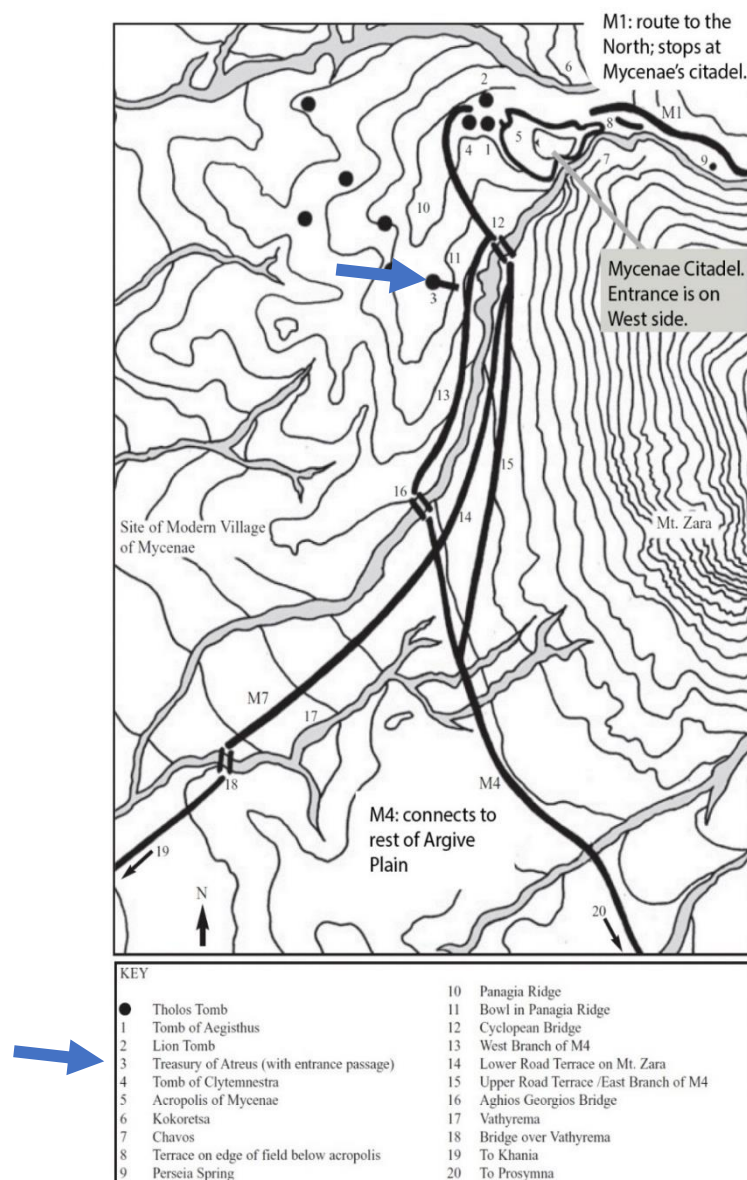
Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

Archaeologists want to know why. Why is this royal tomb placed in a different location? What was special about its location? Did it relay some visual message to passersby? What could it be? Where would these observers be standing when that message was conveyed?

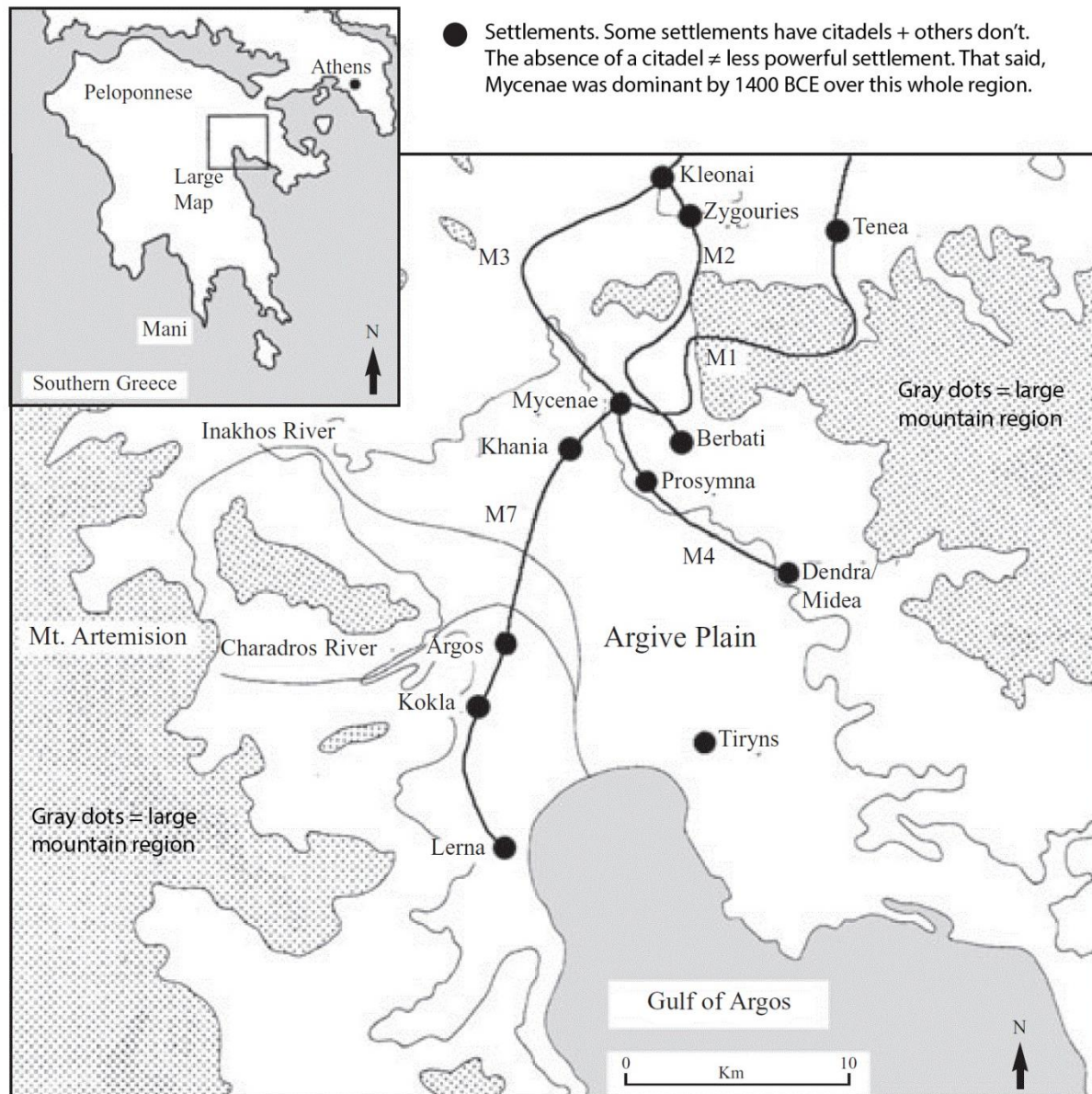
Additional Data:

As previously mentioned, there were tholoi throughout the Argolid – all of the elites living in the settlements would have used them. That said, beginning in **1400 BCE**, burial practices shifted. Tholoi stopped being used and no new tholoi are built -- **except at Mycenae**. Based on archaeological evidence, we know that 1400 BCE also marks when Mycenae became the most powerful settlement in this area. When this happens, it is feasible that Mycenae began restricting the use of tholoi, reserving this practice for their elite. Everyone else is going to be built in cist or shaft graves – dug into the ground, and if you're wealthy, you get a 4-5-foot-tall stone markers. All of the tholoi – royal and non-royal – are built on the same type of stone and it's available throughout the region. Theoretically, they could have placed the Treasury of Atreus anywhere.



Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.



Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

Questions:

Working with your group, discuss all of this evidence.

#1 What are some potential factors that impacted where the Treasury of Atreus was located?

Make sure you consider the background info + look at your ArcMap screen + you can also check out the 3D topography on Google Earth.

#2 If you were an average, non-royal person, what message(s) is this tomb conveying to you? In order to be impacted by this message, where would you physically need to be? Hint: think about the tomb's architecture. Can you see these tombs from really far away?

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Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." *Oxford Journal of Archaeology* 26(1): Figure 1.

#3 Based on your conversations, you are going to develop a viewshed study. You are going to measure "if a person was standing at X location, could they see the Treasury of Atreus?" Come up with around 10 potential locations to test. Mark them on the paper maps.

Why did you choose these locations?

3. How to Create Observer Points

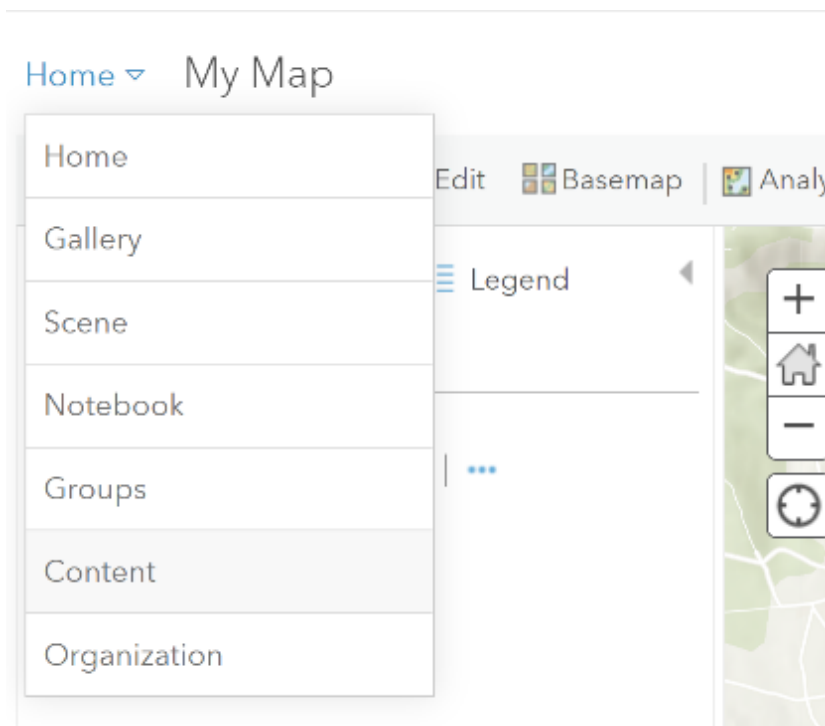
What are observer points? In order to measure a viewshed, you need to create observer points. This point shapefile will represent feasible locations where someone could stand and look at the landscape. The viewshed tool will measure what's visible from these locations.

Overview:

- Create a blank point shapefile called **Observers**
- Turn on the **Editor** toolbar
- Using the **Editor** toolbar you are going to click locations of viewpoints. These points will get stored in **Observers**
- Assign ID numbers to your observers

Instructions:

1. Save your map.
2. Tied to your ArcGIS account is your Cloud storage – this is where anything you save gets stored. On the lefthand side of the screen, click **Home** → **Content**. I recommend opening this in a separate window (just right click + open in another tab). This way, you can easily toggle between the **Content** and **Map** pages.



3. You'll see you maps stored in Content. You won't see individual files (i.e. Citadel) because I made them. Your maps link to those files.
4. On the lefthand side of the screen, choose **New Item** → **Feature Layer** → **Create a blank layer**
5. It's automatically named Layer_1. Change this to **Observers**. Notice that you have the option to change the shapefile type (point, line, polygon). Keep it to point. Click **Next**.
6. Add your tag: [LastName} CLAS 199 (so Susmann CLAS 199). We're adding last names to tags so that your files are separate from the rest of the class.

New item

Title: Observers

Folder: nat_sus_LearnArcGIS

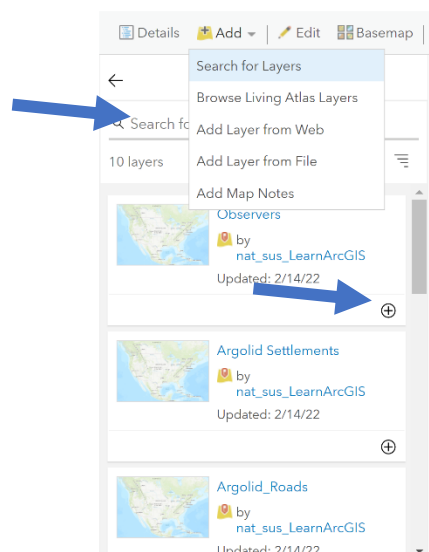
Tags: Susmann CLAS 199

Summary: Add a summary

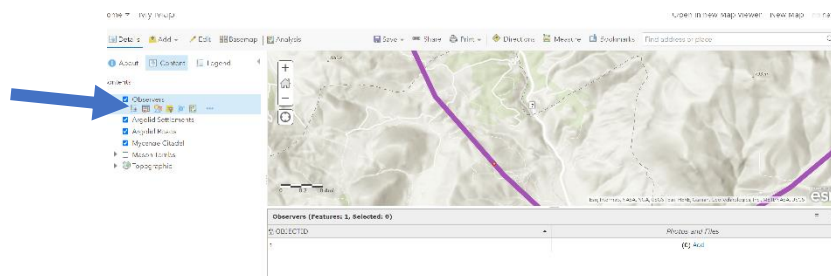
Characters left: 2048

Back Cancel Save

7. Go back to your map. Add your **Observers** shapefile by clicking **Add** → **My Content** → click the + next to **Observers**.



8. Now click on the **Details** tab and you will see **Observers** listed in the table of contents.
9. Your map will likely have zoomed back to the US. This is because **Observers** is blank – there are no locations recorded in it, so the program hovers over the US, where the program is made.
10. Click on the **3-button menu** next to **Mycenae_Citadel** (or any other shapefile besides **Observers**). Click on **Zoom to Layer**. The map will bring you back to Greece – these files have records (i.e. they have points, lines, or polygons) and those records are located in Greece.
11. It's time to start making observer points. Take a moment to situate yourself in the region, referring to your notes if needed.
12. First, change the **Symbology** of observers: **Click Observers** → little shape button underneath. The file is empty at the moment so it's not showing anything on the map. That said, it's a good idea to choose a distinctive symbology setting now. That way, as you make the points, they'll be clear + appear differently from the settlements and tholoi.
13. Open the **Attribute Table** of **Observers**. Do this by clicking once on the file and then on the little graph underneath its name.

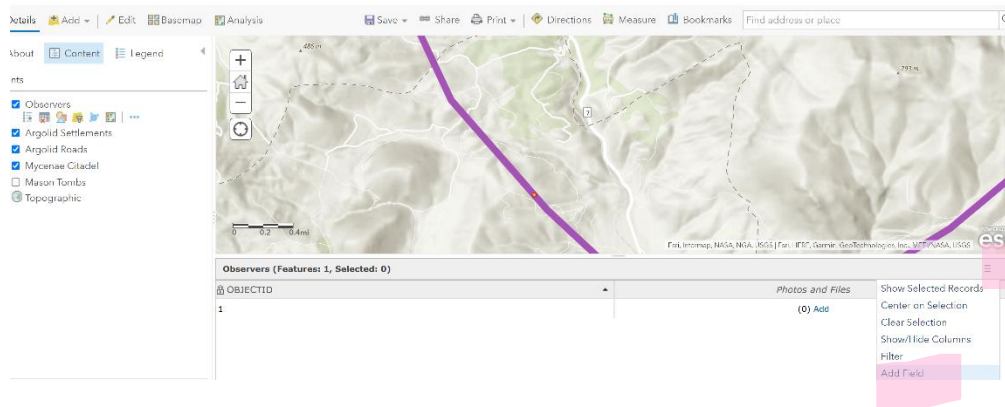


14. Unlike the other shapefiles you've seen, there's nothing in this attribute tablet. That's because there's no records (i.e no points). It's like this: you've opened word, saved a document, but there's no writing in it yet.

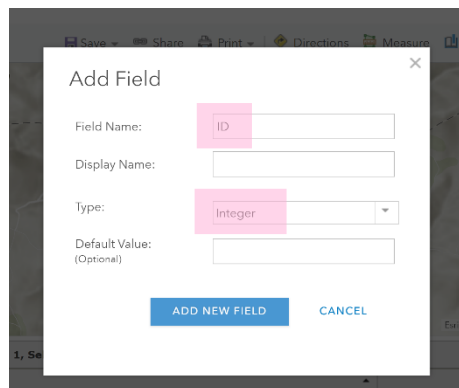
Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

15. There's a **3-bar** menu on the righthand side of the **Attribute Table**. Click it and choose **Add Field**.

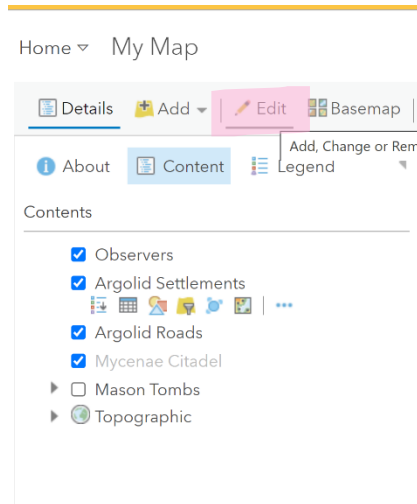


16. Make the **Field Name: ID** and make the **Type: Integer**

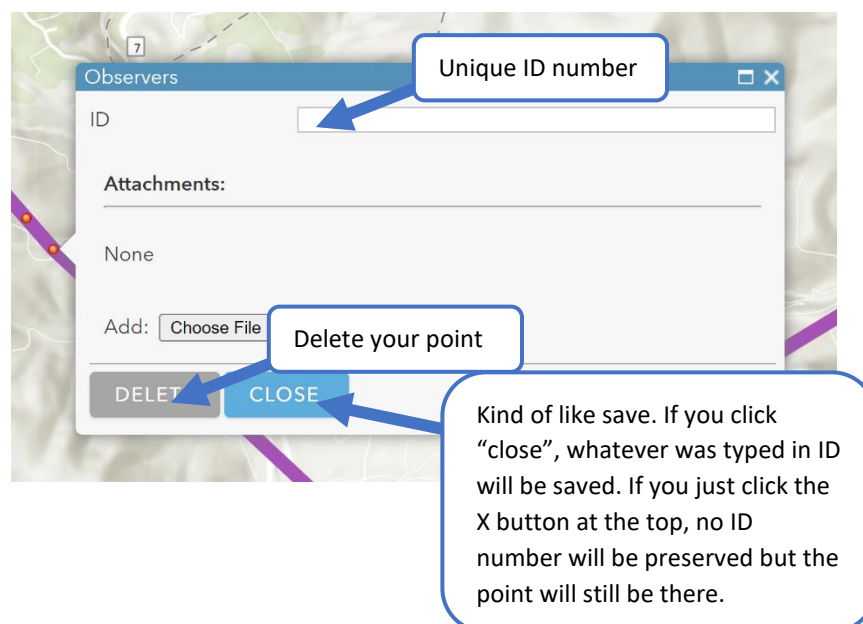


17. ArcGIS will tell you it's saving and then you should see a new column appeared. You've created a new column heading in the attribute table. As you add points, you'll be able to give them a numeric ID number.
 - a. Why you're doing this: you always should tie records (rows) in your shapefile with numeric ID numbers. You can still add a column with names (i.e. how **Argolid Roads** has M4, M7, etc.) but GIS analyses often require a unique numeric ID for each record (i.e. row).

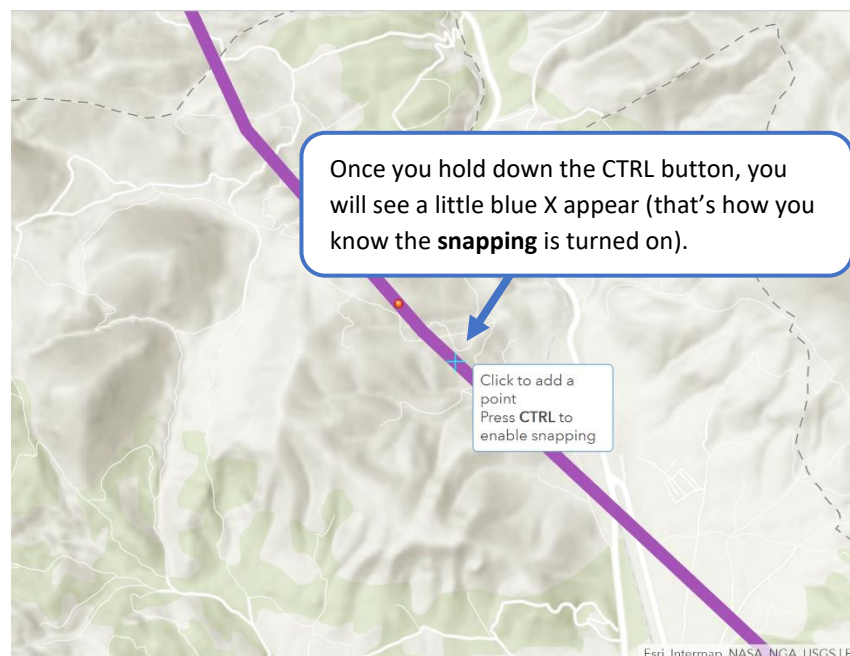
18. Above the **Table of Contents** click **Edit**. The **Edit toolbar** allows you to change a shapefile. For example: you could **Edit** one of the shapefiles I supplied – like deleting, adding roads, and/or renaming roads. In your case, you are going to **Edit** your **Observers** shapefile – you're going to actually point and click, recording locations of observers.



19. How to **MAKE** a point. Read this whole step before you begin:
- You need to choose the shapefile that you will edit. Click on **New Feature** under **Observers**. Make sure the box turns highlighted/outlined.
 - As you move your cursor, a little box will give you instructions. Click and a point appears. Click while holding down the CTRL button and the point will **snap** (keep reading).
 - A box appears: here you can fill out this point's **attributes**. The only attribute we have is **ID**, so you just need to fill out that. It doesn't matter what number you assign each point, provided that it's unique. If you mess up, you can fix it later.



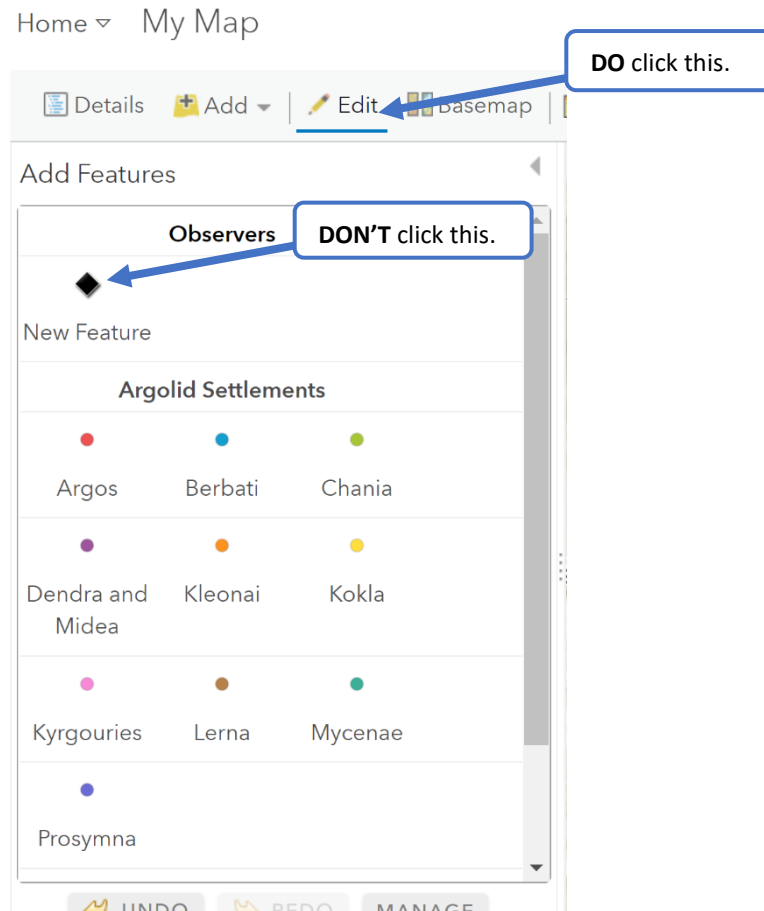
- d. Every time you make another point, you need to redo step "A" (i.e. click "New Feature" on the left side of the screen). It's repetitive but verifies that you're changing the correct file.
- e. If you want to turn on/off other shapefiles to reference, just go back to the **Details** tab + change whatever you need, then back to **Edit**.
- f. You can move around the map as you work (zoom and pan). If you click and drag, the map will pan around. This helps if you need to move instead of making a point.
- g. **How to place a point directly on top of another shapefile:** If you hold down CTRL before you click, ArcMap will **snap**. **Snapping** makes sure your cursor is aligning perfectly over another shapefile. Without snapping, you might think you're placing a point on top of a roadway, but if you zoomed in really far you'll see it's not.
- h. You can't snap to features on the basemap (background image), only shapefiles you've added like **Argolid_Roads** and **Argolid_Settlements**.



20. Go ahead and create all of your observer points. Aim for around 10 points. Too few and you won't have much comparison. Too much and your analysis will crash before it's done (a big viewshed analysis like that requires a shared computing cluster).

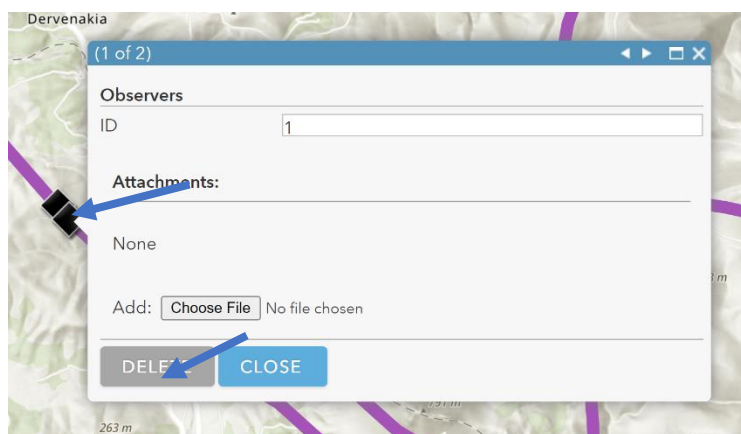
21. If you need to **MOVE** a point:

- Go to **Edit**.
- Do **NOT** click **New Feature**. Instead, go straight to the map screen, click on the point and drag it. **Be careful** – make sure you don't move one of the towns or tombs!



22. If you need to **DELETE** a point:

- Turn on **Edit**. Unlike what you do to make a point, do **NOT** select **New Feature**.
- Click on one of your **Observers**.
- The dialogue box appears. Click **DELETE**.

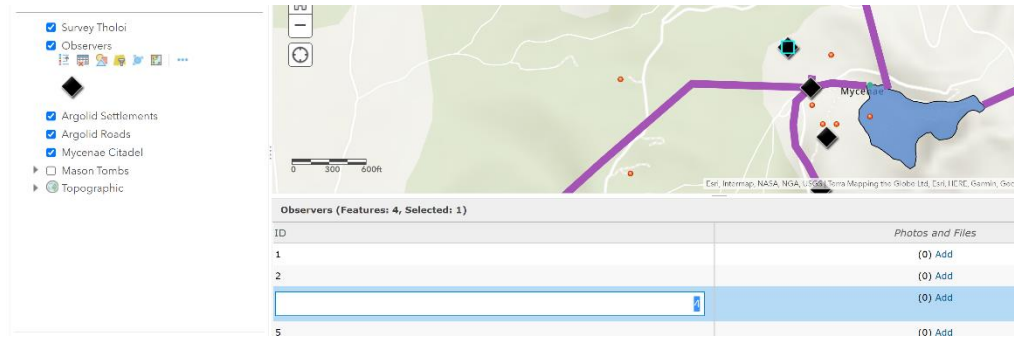


Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

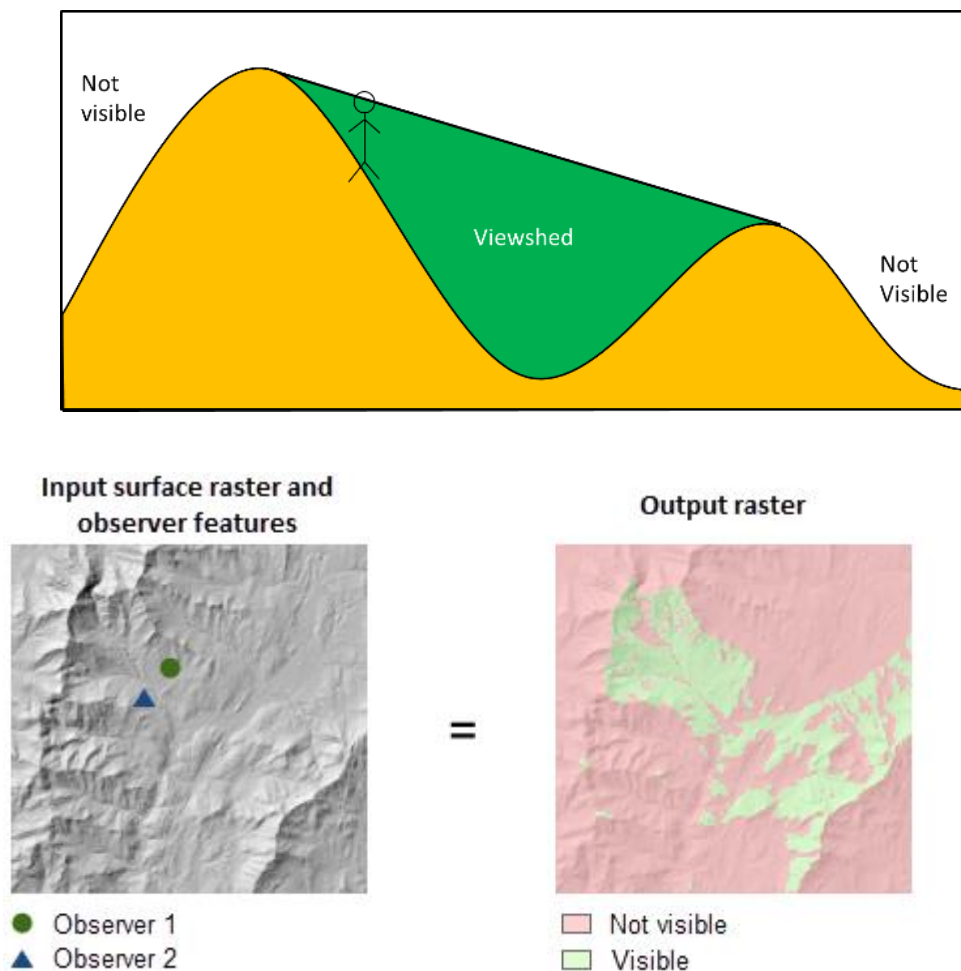
23. When you're satisfied with the location of your points, go back to the **Details** tab → **Observers** → **Attribute Table**

24. Check that you are satisfied with your ID numbers. If you need to fix anything, just double click on an ID number. You'll be able to change the number:



4. Run Viewshed

What is a viewshed? Viewshed is an area visible from a certain point(s). Accounting for the height of the observer(s) and the elevation of the topography, it produces a **raster** file showing you what that observer can see.

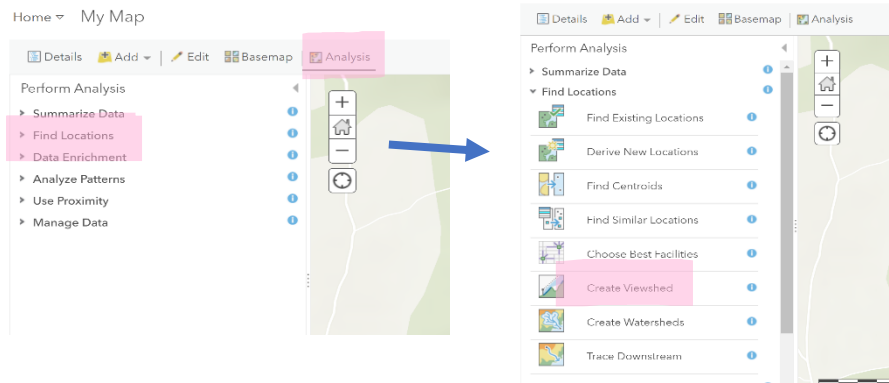


Overview:

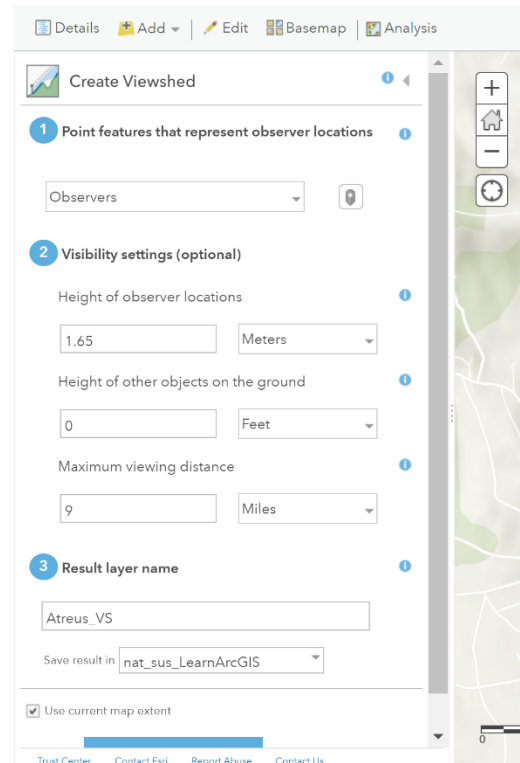
- Open the **Viewshed** tool
- Tell ArcGIS to use your **Observers** file
- Tell ArcGIS these observers are a certain height
- Run the tool

Instructions:

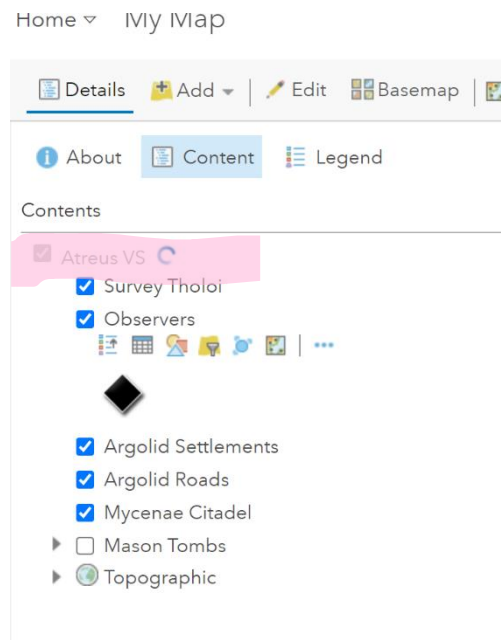
1. Open the **Analysis toolbar**. This opens a variety of toolboxes. Feel free to explore and see the different types of analyses you can do.
2. Click **Find Locations** → **Analyze Location**



3. Input these settings:
 - a. **Point features that represent observer locations:** Observers
 - b. **Height of observer locations:** 1.65 meters
 - c. **Result layer name:** Atreus_VS

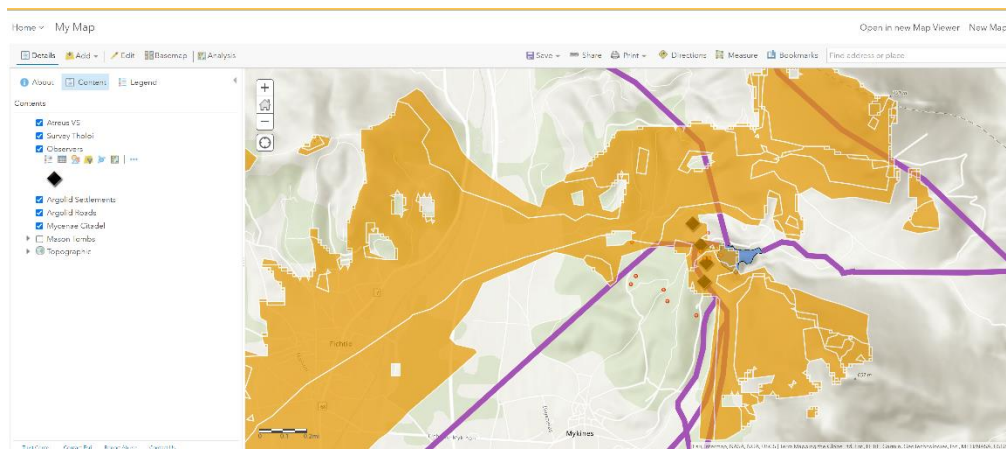


4. **Before you click Run:** Look at the preset **Maximum viewing distance**. This is automatically set for 9 miles. Keep it there. Choosing a max viewing distance is tricky and requires thinking about:
 - a. Are you trying to measure whether a certain location is visible?
 - b. If yes, how noticeable is that feature? Is it a giant building that could be seen for miles? Or is it more or less concealed?
 - c. At maximum, ArcGIS online will measure a 31-mile radius, which I don't recommend doing for this particular activity. A large radius takes time and depending on your internet connection + processor, could freeze your computer.
5. Click run.
6. ArcGIS will switch to the **Content** tab and show a spinning wheel. This part could take some time, depending on your connection + processor + number of observer points. I recommend that you avoid streaming while it's running.



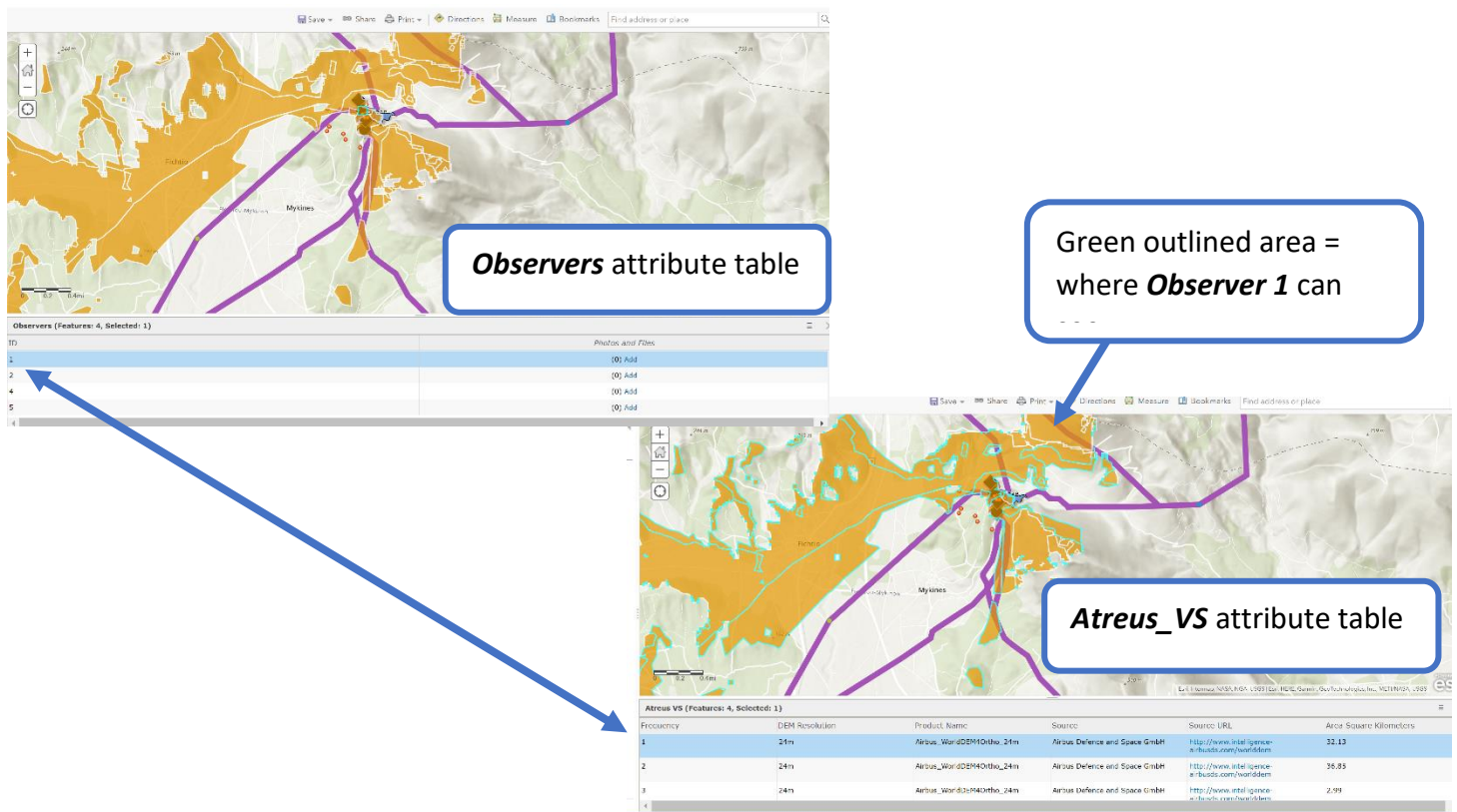
5. Analyzing the Results

1. When Viewshed is done running, you'll see a bunch of polygons appear on the map screen and **Atreus_VS** will be listed in the table of contents.



2. Open the **Attribute table** of **Atreus_VS**.
3. There are some new attribute fields listed that you're not used to, and this is because **Atreus_VS** is a raster.
4. **Frequency** most important field for us. Notice that the numbers in frequency match your **Observers** ID numbers. Click on the first row. Part of the viewshed is selected on your map.

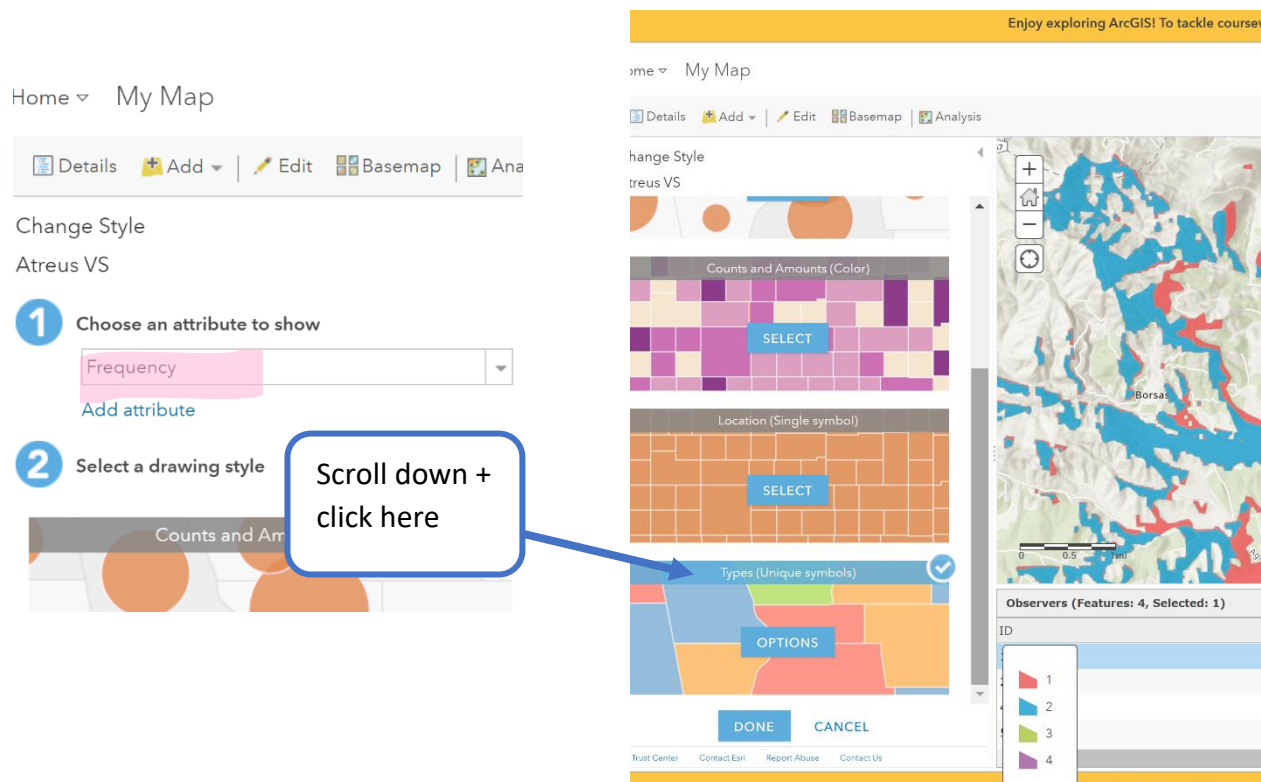
5. Think about **Frequency** this way: **Frequency = Observer ID**. For example:
 - a. I made an **Observers** point file with 4 records: 1, 2, 3, and 4.
 - b. When I select **Frequency → 1** in **Atreus_VS** the highlighted map area is **what is visible to Observer #1**.



Remember:

ID in **Observers**
=
Frequency in **Atreus_VS**

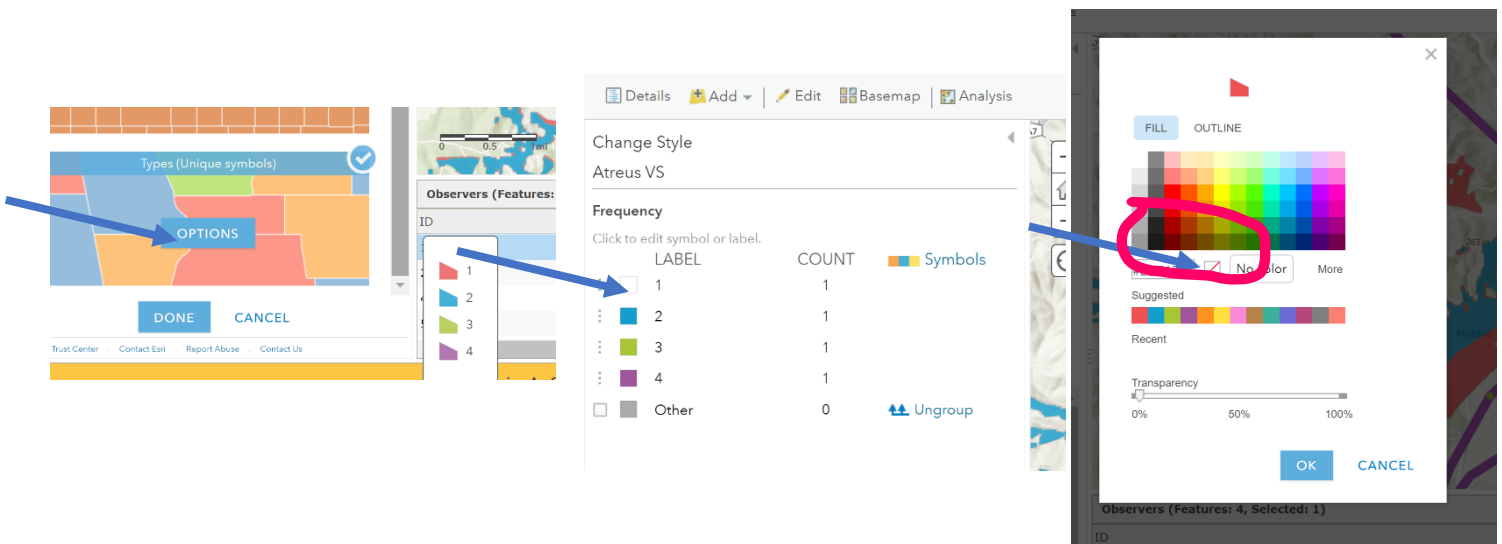
6. We can color-code the viewshed with Symbology and this will make it easier to discern different areas. Click on **Atreus_VS** → **Symbology** →
 - a. Choose **Frequency** as the attribute to show
 - b. Scroll all the way to the bottom and choose **Types (Unique symbols)** as the drawing style
 - c. Each Frequency # (i.e. each **Observer's** viewshed) will be uniquely colored



Now the viewshed is color coordinated to distinguish between what different observers could see.

7. **OPTIONAL:** If you want to see only one observer's viewshed at a time. Otherwise go to step 8.

Go to **Atreus_VS** → **Symbology** → Keep "Choose an attribute to show" as **Frequency**. Next, click on **Options**. You will see a screen where you can change colors for each of them. If you click on **No Color** you can essentially turn it off temporarily. Try doing this for all but one of the Frequency/Observer points.



For example: I opened up the attribute table of **Observers**. I selected ID + 4 (i.e. Observer #4). Next, I opened up the **symbology** for **Atreus_VS** and color coded by

Frequency (again, Frequency # matches up with Observer ID), and made all of the Frequency #'s invisible except for #4, which is teal. The teal blobs show me where Observer #4 can see.

8. Turn on the labels for your observer points. If you need help remembering, go to the first section of the lab, where you turned on labels for the tombs.
9. Save your map.
10. Take a **screen shot** of your map screen. Make sure **Atreus_VS** is visible. Paste the screen shot into a Word doc or save it as a jpeg.
11. Explore your results + answer these questions. Adjust your symbology settings as needed.

QUESTIONS:

#4 First, tell me:

What does **Observers** represent?

What does **Atreus_VS** show? How does it connect with **Observers** and **Survey_Tholoi**?

Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

#5 Interpret the results. Does the **Treasury of Atreus** fall inside of a visible area? If yes, which of your observer(s) can see it?

#6 Why did you choose these observer locations? If you could run the viewshed a second time, where else would you place observers? Why?

#7 If you were to go to Greece, you could walk around this region and find locations where the Treasury of Atreus is visible. You could use **the same steps as your cell phone survey** (take GPS points when you saw the tomb, record different attributes, and even take a photograph of the viewshed). All that said, why would it be beneficial to follow up this field survey with ArcGIS analysis? In your answer, think about all of the different skills you've learned in this unit:

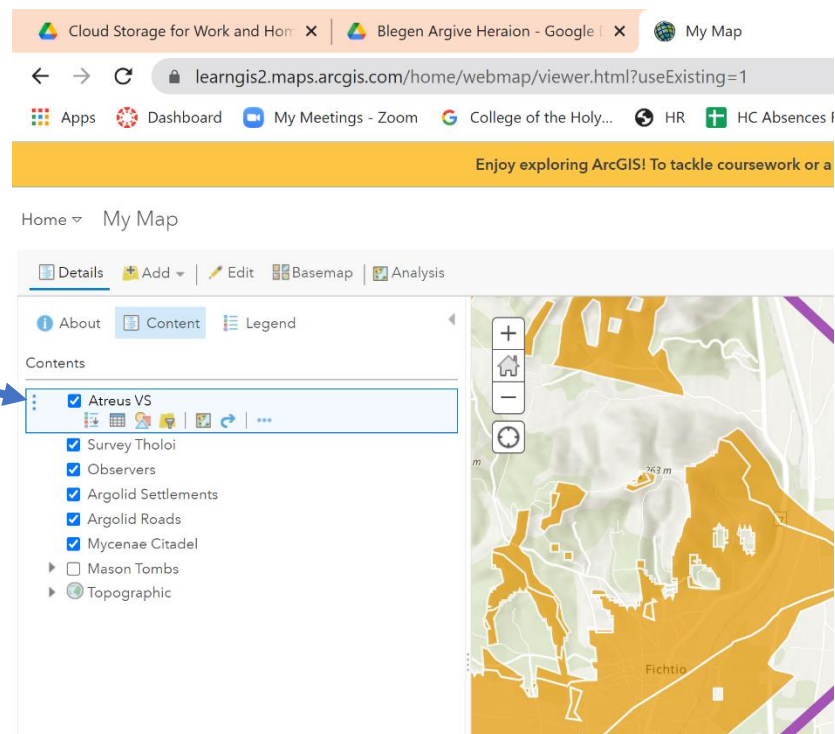
Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." *Oxford Journal of Archaeology* 26(1): Figure 1.

remotely surveying in Google Earth; recording archaeological sites with your cell phone; using GIS to analyze locations.

OPTIONAL: How to Make a Map

1. Let's make a map of these results. Go to your **Table of Contents**. Using the check marks next to each file name, make only these files visible:
 1. Observers
 2. Argolid Settlements
 3. Argolid Roads
 4. Survey Tholoi
 5. Mycenae Citadel
 6. Atreus VS
2. In the table of contents, hover your mouse to the left of a file name. You'll see that your cursor changes. Click and drag – you can change the order in which these files appear. Remember: GIS works like a stack of papers. You're going to change the order of your files so that **Atreus_VS** isn't on top of everything else.

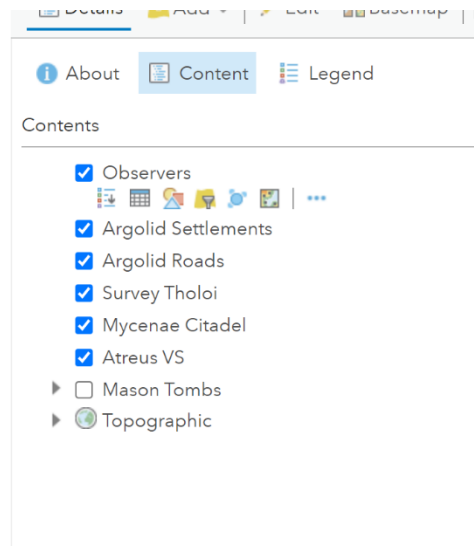


3. Change the order of your shapefiles so they match the order in #8 (above)

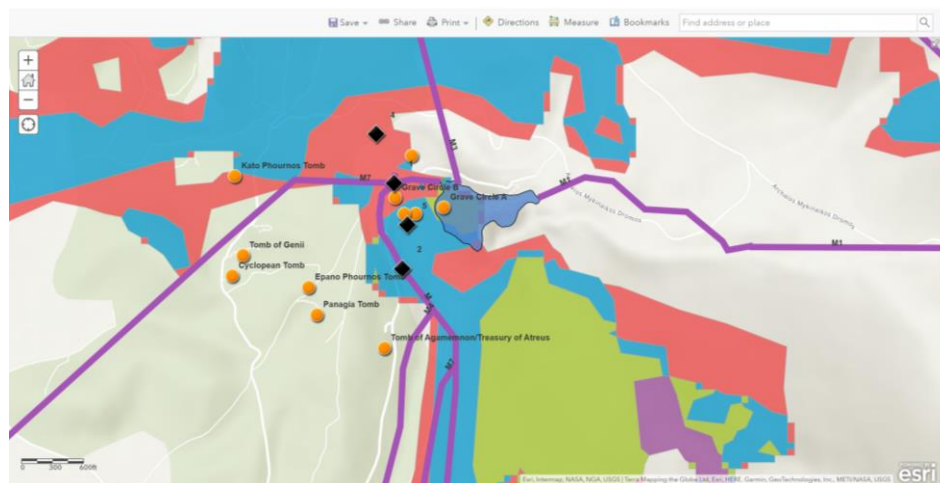
Written by Natalie M. Susmann. Spring 2022.

Image from: Mason, David J. 2007. "The Location of the Treasury of Atreus." Oxford Journal of Archaeology 26(1): Figure 1.

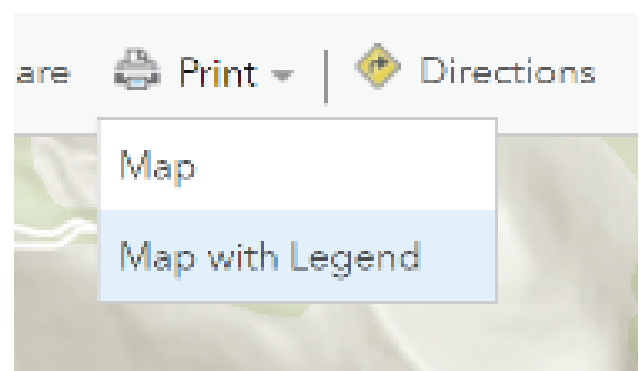
Match this
order



4. Again, **label features** in **Observers**. Choose **ID** in the **Type field**.
5. Zoom your screen in so we can clearly see the area of the citadel, the different tombs, as well as your observer points. See my example, but recognize your map will look a bit different based on your observer points + viewshed results.



6. Save your map.
7. Click on **Print** → **Map with Legend**



8. A new screen will appear with a preview of your map. Make sure all of the tombs are visible. If they aren't, go back to your map window, adjust the zoom level and click **Print → Map with Legend** again. Once you're satisfied, you have a few options:
 - i. Take a screenshot of that page
 - ii. File → Print → choose print to PDF.