Title: Mapping Weeds with GIS

Lessons Summary: Students will identify the factors that make a site susceptible to weed infiltration. The existence of specific weed regions will be examined to see if they are associated with historical fire sites and students may make connections to population centers, roads, etc as areas of disturbance. Students will search for patterns of weed infiltration and use this to develop a potential management practice to limit the amount of invasive species.

Lesson Objective: Students will use ?GIS technology to identify relationships between weed and fire history. The will use GIS plan and develop management practices**.**

Before you begin using this module, you will need to know about using a Web-based GIS viewer. You can do this by watching the tutorial video or working through the tutorial. The tutorial video, student activity, and Web-based GIS Tutorial Viewer can be found at http://gis.lanecc.edu → "Modules" tab → "Tutorial" link. The activity works best with a high speed Internet connection.

Prior Skills: You will need to know how to turn layers on and off, use the ID tool and, zoom in and out of the map, toggle from layers to the legend, and perform a search (Boolean) query.

Remember: Computer steps are indicated by a ► symbol and questions you need to answer are numbered.

► Begin by connecting to the MAPS-GIS Web page at http://gis.lanecc.edu
► Click on the Modules Tab
► Click on the link to GeoSTAC Modules. Then find the lesson called Mapping Invasive species. .
► Or go directly to the map at http://arcgis.lanecc.edu/website/fire/viewer.htm
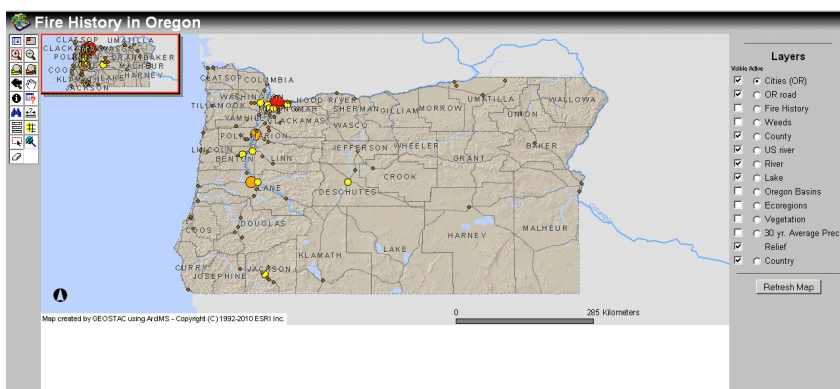
On the left side of the map is a list of **tools** and on the right is a list of data **layers.**

Currently you see some topographical information, cities, and county information in Oregon.

In the upper left hand corner is a small inset map.

► Turn the inset map off by clicking the inset icon located at the top of the tool bar.

Look at the data layers on the right. You should see a map of Oregon with a list of different layers of information or data. Each layer has a **Visible** check box beside it. Some are checked and some are not. You can on view the data 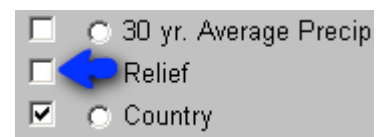layer if the box is checked. Next to the check box is a circle called a radio button. This makes a data layer **Active**. Only one layer can be active at a time.
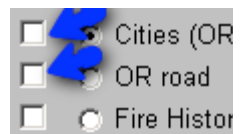
► Uncheck "Relief," "OR Roads," and "Cities (OR)" by clicking on the box that is checked. It will look like ☑ before you click it. After you click it, it should look like this ☐.

► Then click on the "Refresh Map" button. [Refresh Map]

► The layers menu should look like the example on the right.

   1) What happened to the map? What do you think these data layers were showing on the map?

► Make the "Ecoregions" layer visible the same way that we turned off the "Relief" and "30 yr. Average Precip" layer. Click on the ☐ box and when you hit refresh it should look like this ☑ .

   REMEMBER: You can have multiple layers visible, but only one layer active at one time.

► Make "Ecoregions" the **Active** layer, click on the radio button (the ○ button, should change to ◉). It will be visible and active. ☑ ◉ Ecoregions .
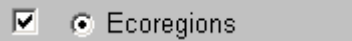
► **Refresh Map**

► Click on the **Legend** Tools button 🔲 Legend Tool

The **Layer** menu changed to a **Legend**. This Legend shows Ecoregions based on the color that represents them on the map.

   2) What are the "Ecoregions" found in Lane County

Ecoregions
Ecoregions
   Basin and Range
   Blue Mountains
   Cascades
   Coast Range
   Columbia Plateau
   Eastern Cascades Sl
   Klamath Mountains
   Snake River Plain
   Willamette Valley
   Country
   Ocean

► Click on the **Identify** tool. 🛈 | Identify Tool

► Click on any of the "Ecoregions" in Lane County and you will see the information for the active layer at the bottom of the map.

			Ecoregions		
Rec	FID	OBJECTID	LEV3_NAME	Shape_Leng	Shape_Area
1	7	8	Cascades	1885143.24505	40186448477.3

► Use this tool to verify your answer from above regarding the "Ecoregions" found in Lane County.
► Click on the **Legend** tab in the tool bar 🔲 Legend Tool to return to the **Layers** menu.

If at any time you become incorrectly zoomed in or out and are not sure where you are, you can get back to the original view.
  ► Make County the **active** layer. ☑ ◉ County
  ► Click the Zoom to **Active Layer** tool. 🔍
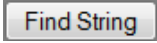
Here are some basic tools available for this GIS viewer. Spend a few minutes exploring the tools.

| **Basic Tools for Web-based GIS**			
🔍	Full extent – This will take you to the extent of the map. For this map the full extent is the world.	🔍	Zoom to Active Layer - This is zoom to a layer with the radio button selected
📏	Measure – A line is drawn between mouse click and the distance is shown at the top of the window.	🔭	Find– You can type in a text string (words) and a feature with that text will be located
🔍	Zoom out -You can click or draw a box around the area you want to back out to a larger area	✋	Pan – Push the map view around the screen
🔍	Zoom in -You can click or draw a box around the area you want to examine more closely.	✏	To erase the lines use the erase tool.
⊞	Buffer – This tool allows you to create an area around a feature.	⬚	Select by rectangle -This tool selects all the features in the rectangle you draw.
📝	Query – This tool is used to select specific data features		

► Use the **Measure** tool (📏) and click on the west central boarder of Lane County. Once this is completed, click on eastern central border of Lane County (this should draw a horizontal line across the county).

   3) What is the horizontal – west to east -distance across Lane County ? ***Don't forget your unit.***

► Once you have answered the question above, clear your selection with the **Erase** tool. ✏

➤ Now complete the same process for the vertical distance of Lane County (use the center of the county).

4) What is the vertical – north to south - distance across Lane County? ***Don't forget your units!***

➤ Make the Rivers layer both **visible** and **active**. Use the "Zoom to Active Layer" tool and **Refresh.**

➤ Use the **Find** tool and **type in** Willamette (exactly as shown here) in the box below the map. Select **"Find String."** Find String

┌───┐
│ **NOTE:** Text is called a string in a GIS   │
└───┘

If done correctly, a table should appear at the bottom of the screen that looks like this:

River

Rec	FID	Name
1	9	Willamette River

➤ Click on the number **"1"** beside the entry for Willamette River in the list. The map will zoom to the river. Notice that the river is highlighted in a different color to indicate that it is selected from all the Oregon rivers.

➤ Use the identification tool ( ) to ascertain what other river converges with the Willamette River in Lane County, in Linn County, and in Clackamas County?

5) Lane county is
6) Linn county is
7) Clackamas County is

➤ Use the same process to identify what river the Willamette eventually flows into.

8) The Willamette River flow into

The point at which two rivers converge is called the *confluence*.

Weeds, People, & Management Practices

It is likely that the first weeds arrived in the western US on the heels of the first homesteaders. It may very well have been Russian thistle inadvertently mixed with some flax seed from the Ukraine. But at the time they may not have seemed like much of a bane than disease or locusts. However today the types of weeds are more numerous and varied, including spotted knapweed, leafy spurge, cheatgrass, and yellow starthistle, to name a few. History has shown us that weeds tend to follow people and exploit disturbances in native ecosystems.

Now we will use the Web-based GIS platform to look at the presence of previously identified weeds here in Oregon. Before we do this, let us take a look at the current vegetation in Lane County and in a particular area where weeds are becoming an increasing problem.

▶ You will need to make begin by turning off all layers except County, Vegetation, and Country. Then you should make Vegetation the active layer. When finished, your layer menu should look like the one on the right.
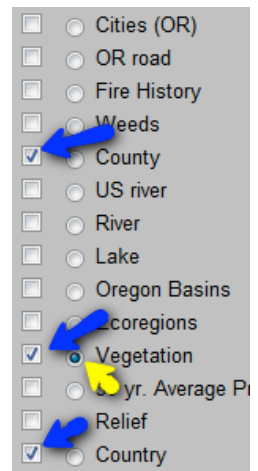
▶ Once you have completed the above steps use the **Identify** tool
ⓘ Identify Tool   to look at the vegetation in Harney County. One of the dominant forms of vegetation is sage-scrub dominated by Black Hawthorn. This ecosystem is a low water environment and very susceptible to human disturbance.

▶ Now turn on the weeds layer (and make it active) ☑ ⦿ **Weeds** and take a look at Harney County.

9) What do you see when you turn on the weeds layer?

▶ Now turn on the **Identify** tool **ⓘ Identify Tool**   as we will want to identify three different types of weeds that are present in Harney County. In order to find the types of weeds you will need to know how to read the info table that appears following selection. Let us use the following example as a guide.

▶ Look at the part of the table labeled "SPECCODE." This is the species code, which refers to national databases for the specific weed. We will use listing number 1, SPJU2. These codes can be deciphered using the list of weeds and weed codes at weedmapper.org (www.weedmapper.org/facts.html).

							Weeds								
Rec	FID	OBJECTID	SPECCODE	GIS_ID	SITE_ID	DIST_CD	COORD_SRC	ACC_FT	NUM_PLTS	UNIT_MEAS	OC_CD	DISC_DATE	REV_DATE	SHAPE_Leng	SHAPE_Area
1	540	533	SPJU2	1277	1277	11	MAP	40	2	TOTAL	C	1996	1996	0.000061385084492	0.000000000246173
2	544	1129	CIAR4	1285	1285	11	MAP	40	12	TOTAL	C	1996	1996	0.000112937659633	0.000000000940427
3	545	1130	SEJA	1288	1288	11	MAP	40	3	TOTAL	C	1996	1996	0.000061377443191	0.000000000246141
4	546	1131	CEDET	1290	1290	11	MAP	40	12	TOTAL	C	1996	1996	0.000097804067826	0.000000000705313

10) What is this weed? What is its scientific name? Notice that the code is based on the scientific name.

▶ Following the example above, find three different types of weeds in Harney County. List their species code (from the table), common name, and scientific name.

11) Harney County Weeds:

Species Code	Common Name	Scientific Name

▶ Now search for the city of Eugene. In order to do this you will have to make the City layer visible and active. Then use the **Find** tool 🔍 and type in exactly "Eugene." Then select Eugene in the selection box.

Cities (OR)			
Rec	FID	NAME	CLASS
1	67	Eugene	City

▶ Now, using what you have already learned list all of the Vegetation types within 10km of the city.

12) Eugene Vegetation Types:

▶ Make sure the Weeds layer is turned on.

13) What do you notice? Are there any weeds around Eugene? How does this compare with what you know about weeds around Eugene? Explain any differences.

Montana State University Associate Professor and weed specialist Roger Sheley has said that weeds dramatically increase following wildfires (definitely a disturbance) and is concerned about infestations in burnt areas.

▶ Zoom out to full extent and activate the Fire History layer. (HINT: To make this next section easier on yourself, you may want to turn off the Vegetation layer and turn on the Relief layer)

14) Do you think that fires have led to weed infestation? Explain.

Sheley performed several studies in the Pacific Northwest that showed an increase in the biomass of three invasive species following fire. One would expect weeds to spread after wildfires, but there is not enough data to support this claim. Invasive species did not overtake Yellowstone National Park following the well-publicized fires of 1988. This suggests that each situation is unique and factors - listed below - also play a role in weed colonization and spread.

- Soil types
- Land use
- Vegetation
- Management patterns
- Fire history
- Contents of seed bank
- Precipitation
- Other factors

▶ Now turn the Fire History layer back off and zoom in on an area where you can see a weed polygon. What weeds are found here (again include Species Code, Common Name, and Scientific Name).

15) Weeds found on Site:

► Using the tools that we have discussed, locate your weed site through triangulation (at least three). To do this you should use the **Measure** tool (⊞) we explained earlier.

16) Weed Site: (e.g. 10.6km from Prineville)

Community-based natural resource planning and management has become increasingly common in recent years. This move is driven largely by environmental concerns, economic impact, and availability of information (through technologies such as web-based GIS). One of the problems receiving attention in Oregon and much of the western United States is the growing presence and spread of weeds. GIS has been a valuable tool for collecting weed information and generating weed maps. This has allowed for increasingly rapid and complete cataloguing of weed existence and expansion. It has allowed scientists to create more up-to-date databases and detailed susceptibility models that predict the risk of a weed species becoming established and invading specific locations, if introduced. Scenarios of growing complexity can now be evaluated in more reasonable timeframes for progressively more informed decision making processes and management practices.

Use all you have learned about Web-based GIS and weeds to examine the many factors in your area. Again those outlined above were:

- Soil types
- Land use
- Vegetation
- Management patterns
- Fire history
- Contents of seed bank
- Precipitation
- Other factors

While you do not have access to all of these factors in this scenario, use the ones you do have (such as fire history, current vegetation, precipitation, proximity to cities and waterways, etc.) to identify where the weeds may have come from and why they were successful in setting up shop in this location. This will be an exercise in using the *program* as well as recalling the *factors*.

17) Reasons for Weed Success:

Now perform some internet research on weed management practices and think about what management practices you might want to employ if you were part of a community-based natural resource planning and management team. (**HINT**: Many of them will be vast and vague, so gather what you can from them and don't be afraid to ask your instructor for clarification)

18) My Management Strategies:

Career Extension:

► Go to the website http://esri.com/industries.html
► Find a career from the list that is of interest to you. For example: In the Natural Resources list, there is a link to forestry. In the forestry link, there are several job descriptions.
► List four ways GIS is used in the career you choose.
► Conduct an internet search to find information about salary ranges and possible job locations.