

Coastal Resilience 2.0 and Freshwater Assessment: Training Activities

Coastal Resilience 2.0

Background

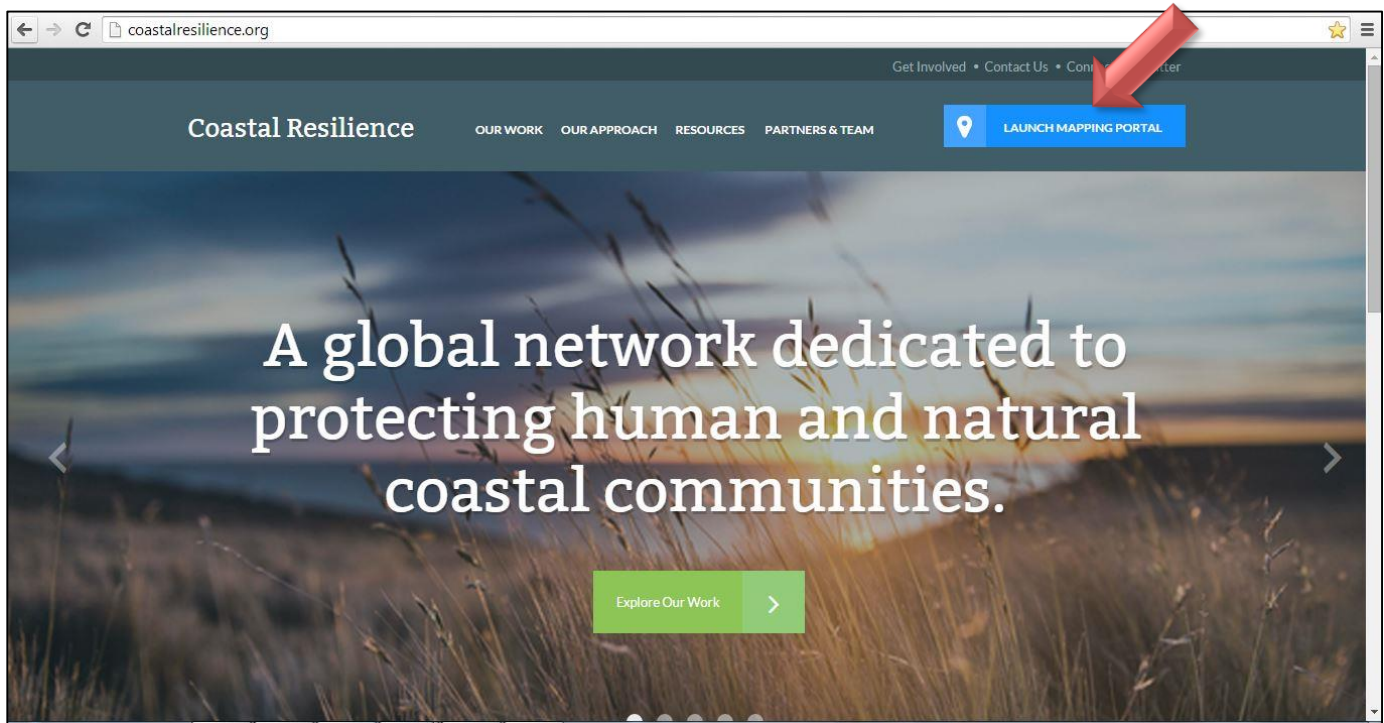
Governments and communities can enhance their resilience to coastal hazards and climate change by using a combination of built infrastructure and protecting, restoring, and effectively managing their marine and coastal ecosystems. When coastal habitats such as oysters, marshes, coral reefs, and mangroves are restored and protected for risk reduction they are called natural defenses or natural infrastructure. The Nature Conservancy is demonstrating the potential for nature to reduce risk through its Coastal Resilience program and project sites. The Coastal Resilience approach includes 4 critical elements: raise awareness, assess risk, identify choices, and take action.

With recent events like Hurricane Sandy, many coastal communities are now focused on reducing vulnerability and improving the adaptive capacity of their residents. Using the Coastal Resilience approach, anyone can design and implement solutions that integrate nature's infrastructure – mangroves, forests, wetlands, coral reefs – with socioeconomic needs to reduce risk and increase community resilience.

One of the most difficult barriers to overcome is empowering community decision makers, citizens, and neighborhood organizations with the data and mapping tools to engage in resiliency planning activities. These data and tools are critical to help local communities more fully recognize their exposure to potential hazards and the consequences of future decisions. The Nature Conservancy and partners have developed Coastal Resilience 2.0; a suite of applications for coastal communities, government agencies, and other stakeholders that informs hazard mitigation, risk reduction, climate adaptation, and conservation decisions. The applications start with visualizations of the current situation – socially, economically and ecologically. To these we add reasonable storm surge and sea level rise scenarios. Using these interactive apps backed by the best available science, we enable stakeholders to visualize current and future risk and help identify solutions that reduce social and economic risks while maximizing the benefits that nature provides. Solutions to date include: protecting or restoring area salt marshes as buffers; developing hybrid approaches that link natural and built defense structures; removing incentives to build in high-risk areas (i.e., often on top of low-lying wetlands); and even designing oyster reefs to reduce the impacts of waves and reduce coastal erosion. Coastal Resilience 2.0 has improved speed, is open source, works globally, operates on tablets, and makes sharing results and data easy. Core partners involved in the development of these tools include; The Nature Conservancy, University of Southern Mississippi, The Natural Capital Project at Stanford University, NOAA Coastal Services Center, and the Association of State Floodplain Managers.

This section provides details on the Coastal Resilience website and tools.

Figure 1: Coastal Resilience Home Page (www.coastalresilience.org)



The principle access point for the website is through www.coastalresilience.org –pictured in Figure 1. The user clicks on the “Launch Mapping Portal” button on the top right corner of the webpage.

The Coastal Resilience tools cover different regions including: a U.S. National and Global application, eight U.S. States (Florida, Alabama, Mississippi, Louisiana, Texas, New York, Connecticut, New Jersey), two specific U.S. locations (Puget Sound, WA, and Ventura County, CA), four countries in Latin America (Mexico, Belize, Guatemala, Honduras) and three island nations in the Caribbean (Grenada, St. Vincent and the Grenadines, U.S Virgin Islands). The following will provide a brief tour of the Gulf of Mexico Coastal Resilience Tool.

To access the tool, click on **United States**, then **Gulf of Mexico** and then click on **Map** (above in Figure2). Figure 3 shows the main Gulf of Mexico maps page. This webpage displays the different Apps (yes, just like on your phone) on the left side of the screen. These apps are used to simplify complex data or models, convey a specific ecological or social concept, or to compare different future scenarios. A **“Tour”** button is provided in the navigation bar for a brief description of other Coastal Resilience functionalities (Figure 3).

Figure 2: Coastal Resilience network site maps.coastalresilience.org/network

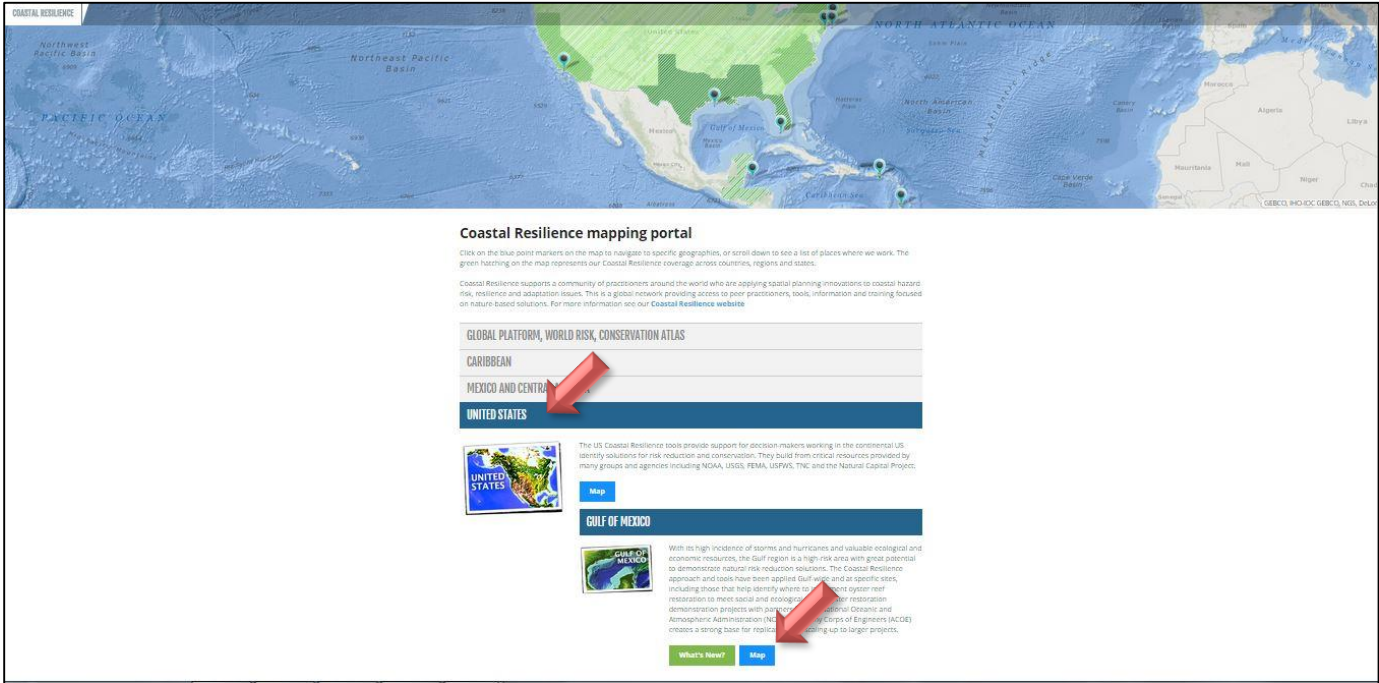
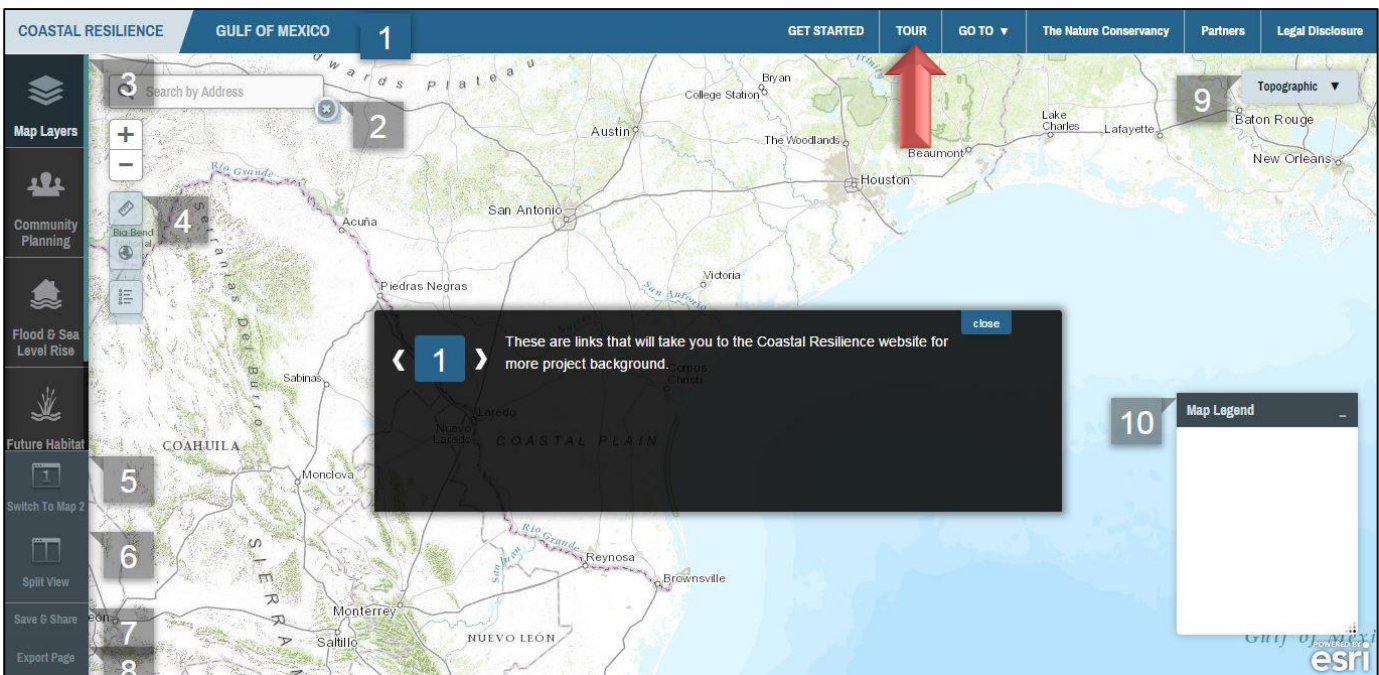


Figure 3: Coastal Resilience Gulf of Mexico www.maps.coastalresilience.org/gulfmex



[Map Layers](#)

Map Layers contains Gulf-wide and State information important for resiliency planning. You can use these map layers in combination with the other Apps to develop overlay scenarios and evaluate various solutions. When assessing your community it is important to look at its hazard exposures, ecological vulnerabilities, and social vulnerabilities in order to identify solutions that maximize social, ecological, and economic benefits.

[Community Planning – *not available in Louisiana*](#)

The Community Planning app is the location where resilient communities host their locally specific data to inform their decisions and track their successes. It is also where the community comes to view their information alongside and with the other Coastal Resilience data layers. This app provides information for a community-level engagement process over time.

[Restoration Explorer](#)

The Restoration Explorer allows stakeholders to examine ecological and socio-economic factors for restoration suitability. In this app an oyster reef index was compiled for restoration scenario planning where individual factors can be weighted for importance when identifying potential restoration sites.

[Future Habitat](#)

Certain ecosystems like coastal wetlands will change and may move landward as sea level rises. The app shows where and how coastal wetlands are likely to change and where they are likely to move landward over time as sea level rises. Coastal wetlands may become submerged, or may change from a type that is more protective from storm surge to a type that is less protective of storm surge (for example from forested wetlands to marsh). Whether coastal wetlands move landward in response to sea level rise depends on several factors including the rate of land accretion or the amount of sediment accumulating in the coastal area, the rate sea level is rising, and whether or not there are physical obstacles preventing wetlands from moving landward. The Future Habitat app categorizes various coastal habitat change scenarios from spatial model outputs.

[Flood and Sea Level Rise](#)

Flooding is increasing along the coast and certain rivers. Use this app to view areas affected today and in the future due to increased sea level rise, surge from storms and hurricanes, and inland flooding.

[Coastal Defense- *not available in Louisiana*](#)

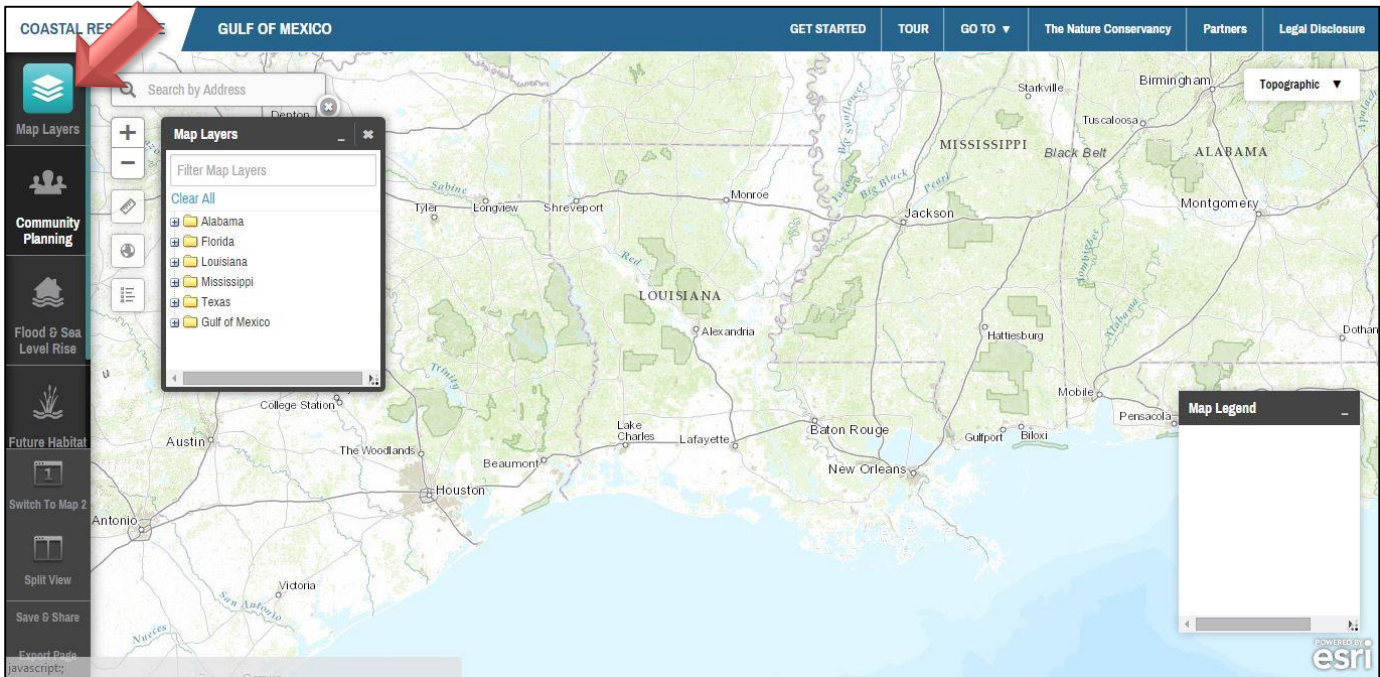
Coastal Defense quantifies how natural habitats (oyster reefs, tidal marshes, mangroves, coral reefs...) protect coastal areas by reducing wave-induced erosion and inundation. It uses standard engineering techniques to help you estimate how and where to restore or conserve critical coastal habitat, and increase the resilience of your community and infrastructure.

There is also a set of operative GIS tools that are located in the upper left hand corner, just to the right of the Apps. These tools include zoom in and out, a measurement tool and an address search bar. The buttons below the Apps offer

tools that allow the user to split screens to compare scenarios. One can also select the “Save and Share” button to create a link to the map which will retain whatever map layers are displayed or select the

The “Map Layers” App contains Gulf-wide and State information important for resiliency planning (Figure 4). Users can use these map layers in combination with the other Apps to develop scenarios and evaluate solutions to reduce risk and adapt to sea level rise. When assessing your community it is important to look at its hazard exposures, ecological vulnerabilities and social vulnerabilities in order to identify solutions that maximize social, ecological and economic benefits. We will take a closer look at how to spatially evaluate each piece.

Figure 4: Map Layers app



SESSION 1: ASSESSING RISK TO COASTAL HAZARDS

APPS: Flood & Sea Level Rise Explorer, Map Layers

The scale of impact from a disaster depends in part on a community's exposure to hazard elements. It is important to consider both natural hazards (Flood, Wind, Surge, Earthquake) and technological or man-made hazards. A first critical step is to identify the potential hazards your community may be exposed to and assess the likelihood of disaster impact. An effective way to get this conversation started is to visual your community's vulnerability to various hazards through mapping. Some examples would be to identify:

- Hurricane risk zones (surge zones)
- Flood zones (Flood insurance Rate Maps –FIRM)
- Coastal erosion/accretion
- Hazardous sites
- Wildfire
- Drought



Activity 1: Assess Risk to Storm Surge

1. In the Menu panel at left side of screen, click on the **Flood and Sea Level Rise** App. The first thing you will see is a box called an “infographic” (Figure 5). These are meant to provide users with a visualization of the functions of that app. To continue onto the app click the “continue” button. If you do want that infographic to pop up every time you open the app place a “✓” in the box “do not show on start”. If at any time you want to see the infographic again you can click on the (?) in the right top corner of the next box.
2. Click on the (+) beside the Coastal Flood Hazards Folder and then click on the (+) beside the Coastal Flood Atlas.
3. Expand the CFLA MOM Storm Surge Footprints by clicking on the (+). These layers represent a maximum potential storm surge footprint for each Hurricane Category. Click the boxes next to each Category to make them all visible (Category 1-5).
4. Now zoom to the City in which you work/live or an area of interest and identify which Category of Storm Surge your area of interest lies within.



Self-Check:

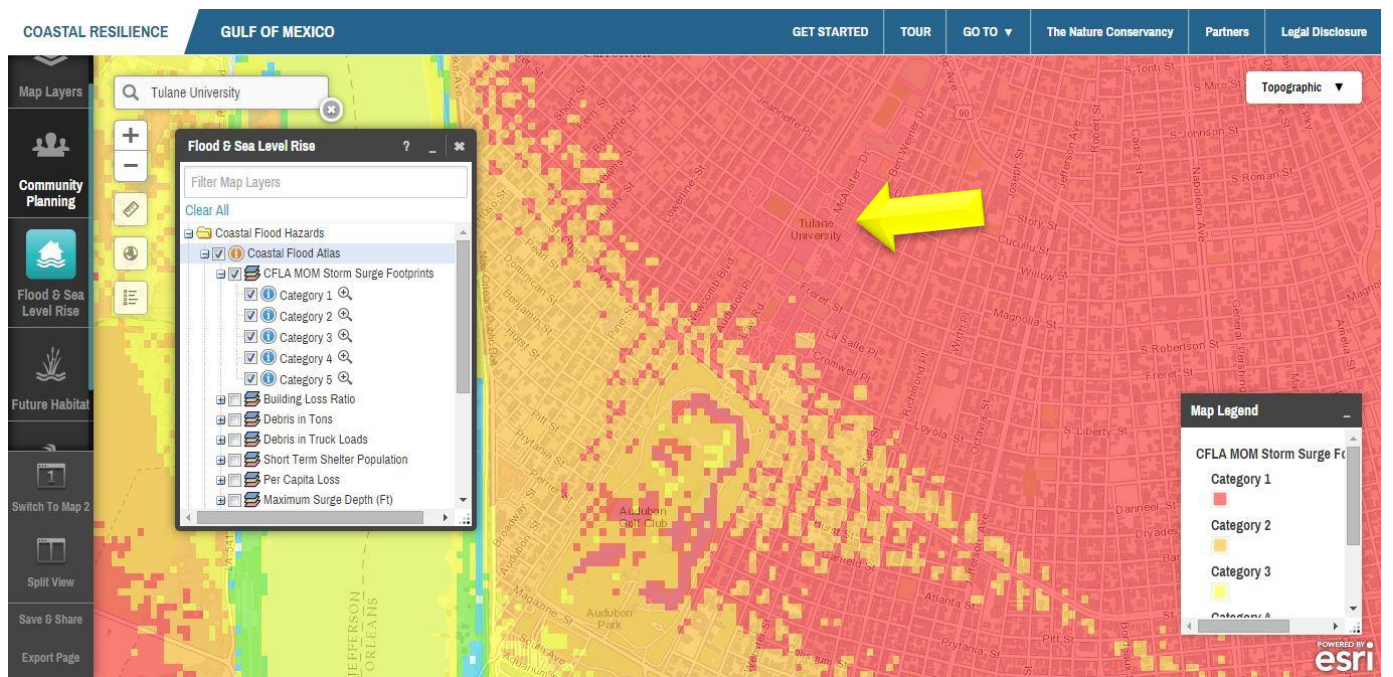
1. Most of my city/town or area of interest, _____, lies within a Category _____ Storm Surge.

Figure 5: Storm Surge Exposure – Flood and Sea Level Rise app



Figure 6: Storm Surge Exposure – Flood and Sea Level Rise App (Self-check Example)

1. Most of my area of interest, Tulane University, lies within a Category 1 Storm Surge (yellow).





Activity 2: Social Vulnerability

Social vulnerability is much like physical vulnerability, except it is focused on social factors that generate vulnerability in terms of a person's or group's capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. These factors include: Race/ethnicity, gender, education, poverty, age, and housing tenure. We can incorporate this information into mapping tools to identify areas with higher concentrations of socially vulnerable populations. Socially vulnerable populations are more likely to suffer from the damaging effects of hazards.

1. Close the **Flood and SLR app**. Click the Zoom Out icon for a broader view of Louisiana.
2. Click on the **Map Layers App** and expand the "Louisiana" folder by clicking on the (+).
3. Check the box next to "Social and Economic" to expand the layer group. Check the box next to "Social Vulnerability Index." The Social Vulnerability Index is a composite indicator of social vulnerability and is based on a suite of social vulnerability indicators. (Figure 7)
4. Next click on the (_) at the top right of the Map Layers window to minimize it.
5. Then click on the Flood and Sea Level Rise App to open it. Click the (+) beside the Coastal Flood Hazards Folder, click on the (+) beside the Coastal Flood Atlas, click (+) to expand CFLA MOM Storm Surge Footprints, and check the box next to Category 2. The Storm Surge footprint is overlaid on top of the Social Vulnerability Index (Figure 8).

Figure 7: Social Vulnerability Risk

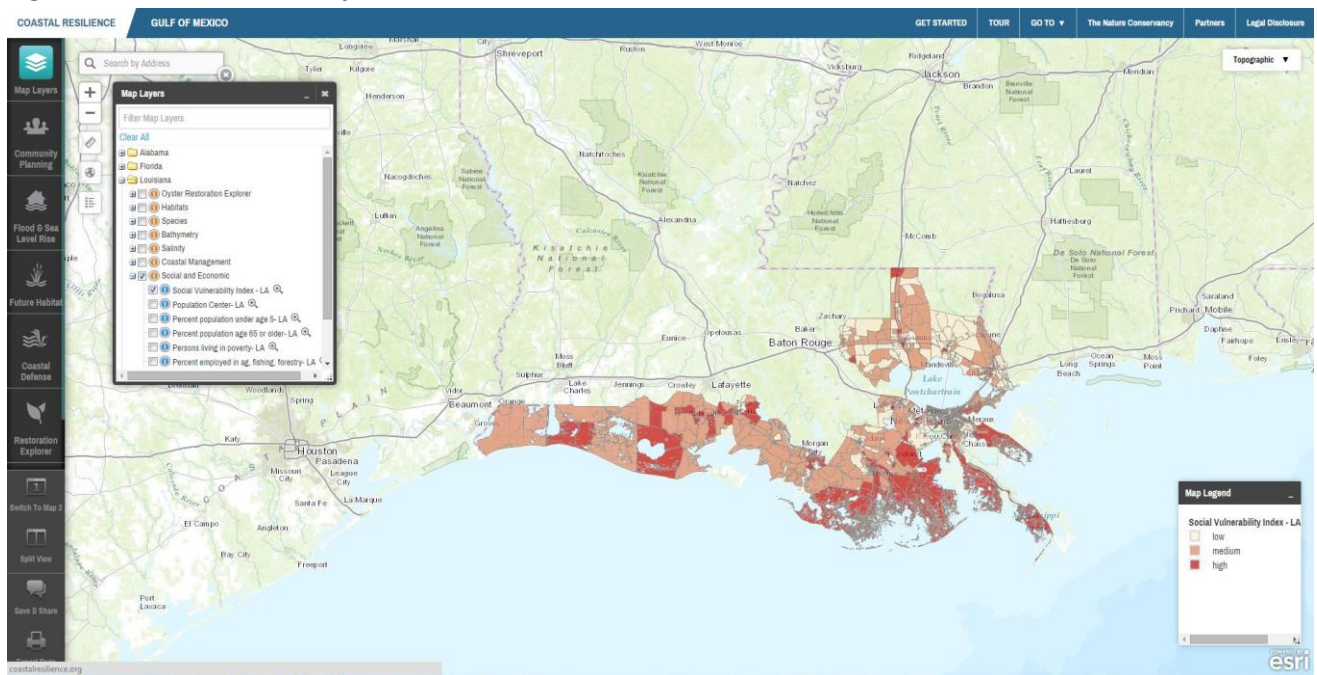
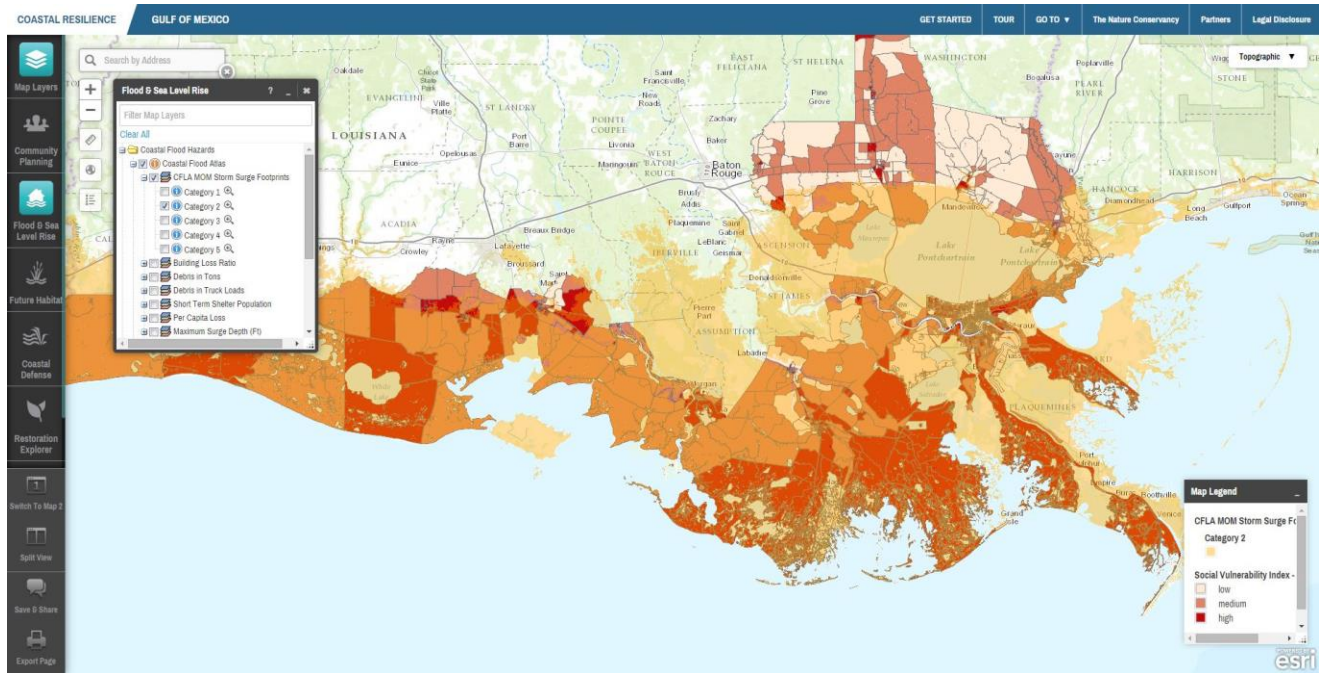


Figure 8: SOVI and Storm Surge



Self-Check:

2. Are there areas of high social vulnerability located in the Category 2 Storm Surge?
3. Do you see concentrations of social vulnerability in any particular areas? Why do you think that is?

SESSION 2: ASSESSING ECOLOGICAL VULNERABILITY

APP: Future Habitat

Sea level is rising and the rate of this change is projected to accelerate over the next century. Both natural and human communities along the coast will be impacted. The Future Habitat app illustrates predicted future changes to coastal wetlands and adjacent uplands. The maps were created through application of the Sea Level Affecting Marshes Model (SLAMM) using three sea level rise scenarios through the year 2100. These maps can assist coastal managers with identifying which habitats are disappearing most rapidly, which areas of natural and human communities are most vulnerable to SLR, and which species may be especially vulnerable to these changes. This information will be useful during development of land acquisition, species management, shoreline management, and restoration plans.



Activity 3: Future Habitat Change – Louisiana – Barataria – Breton Sound

1. Close out of all previous apps and clear data layers. Click on the **Future Habitat App**. Expand the Louisiana - Barataria – Breton Sound list by clicking on the (+). This is the “current condition” for the area. (Figure 9)
2. To compare different SLR scenarios side by side, click on the “Split View” button below the Apps. (Figure 10)
3. Click on the “Link Maps” button between the two maps. Change the background of the second map from Topographic to Imagery. Click and drag the legends out of the way if needed or minimize each one by clicking on the (_) at the top right of each box.
4. Open the **Future Habitat app** on the second map, move the slider bar to a SLR scenario and a scenario year. You can scroll around each map simultaneously to explore the two future sea level scenarios (Figure 10).
5. To explore the other features of the **Future Habitat app**, click on “Switch to map 2” on the left side under the apps. This will bring up in, full screen, the map on the right-hand side.
6. If you have minimized the **Future Habitat app**, click on the blue highlighted app button to bring up the app again. You can now click on the “Results & Chart” tab. Here you can hover over the pie chart to see the acreage of each habitat type and the percentage of that habitat in to the overall study area. (Figure 11)

Note: You may have to increase the size of your app box to see the entire pie chart. To do this click and drag the right lower corner of the box.

7. Next click on the “Compare & Chart” tab. Here you can see a bar chart with the percent change from the current condition to the scenario you have chosen.
8. Go back to the “Choose Parameters” tab and click in the box next to “Marsh” under the “Filter Results by Habitat/s of Interest”. Choosing one of these groups will filter your results by different habitat types that are listed under that group. In this case, 4 different marsh layers are encompassed within the “marsh” block group (see Legend). Once you have selected a habitat group you can go to the “Results & Chart” or “Compare & Chart” tabs to view the numbers for the habitat group you have chosen. (Figure 12)
9. Uncheck the “Marsh” habitat group. Under “Filter Results by a User Defined Area”, select the “click to draw an area” button. This feature allows the user to identify their desired area of interest by drawing a polygon. You can then perform all of the above comparing and filtering functions listed above for the defined area.

Figure 9: Existing habitat layer for Barataria – Breton Sound

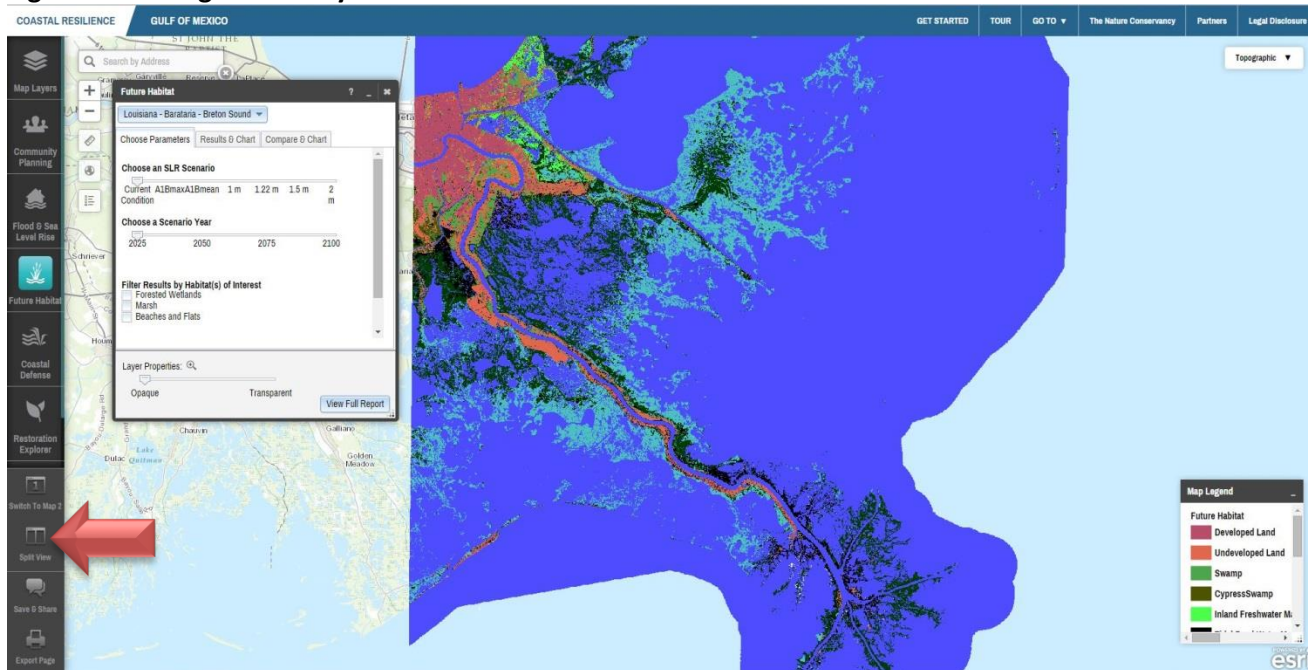


Figure 10: Future Habitat comparison – split screen view

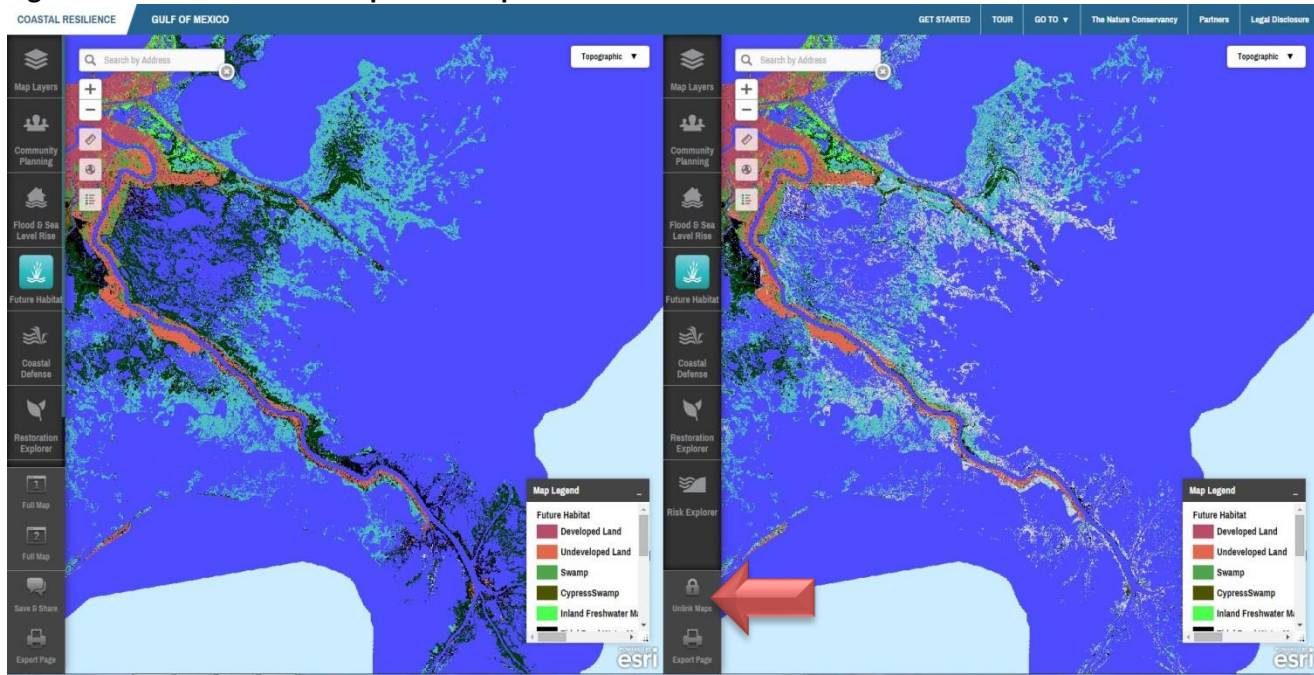


Figure 11: Future Habitat – Charting

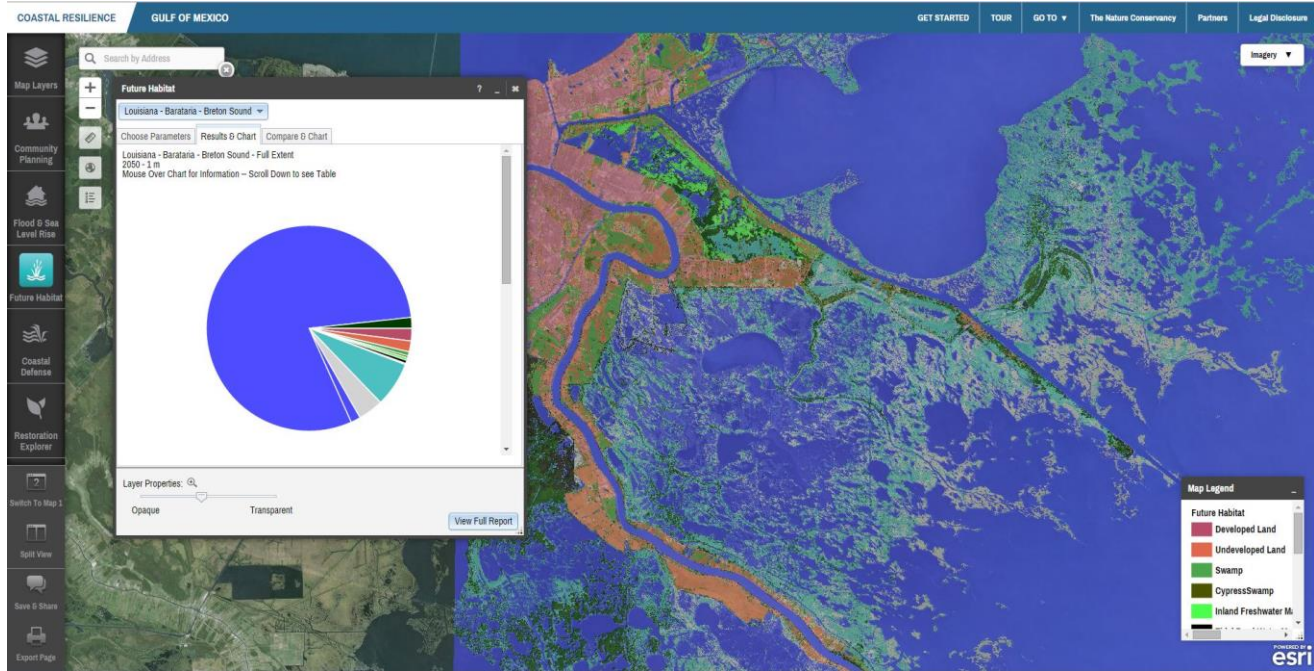
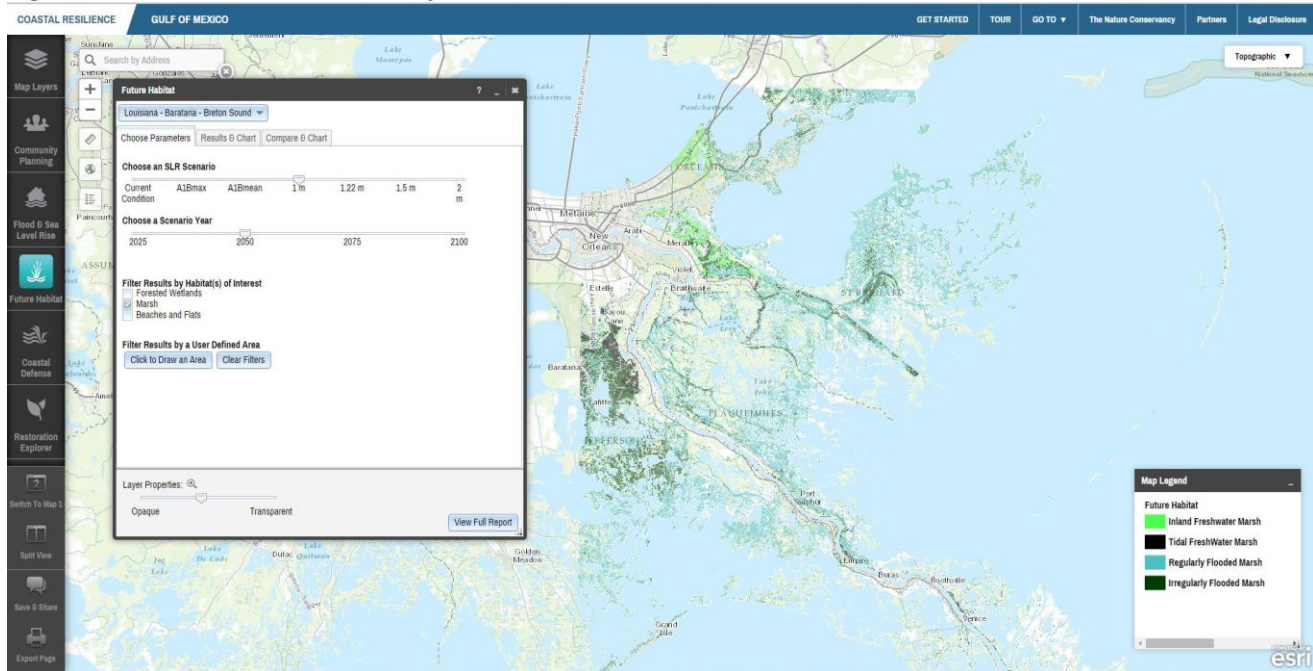


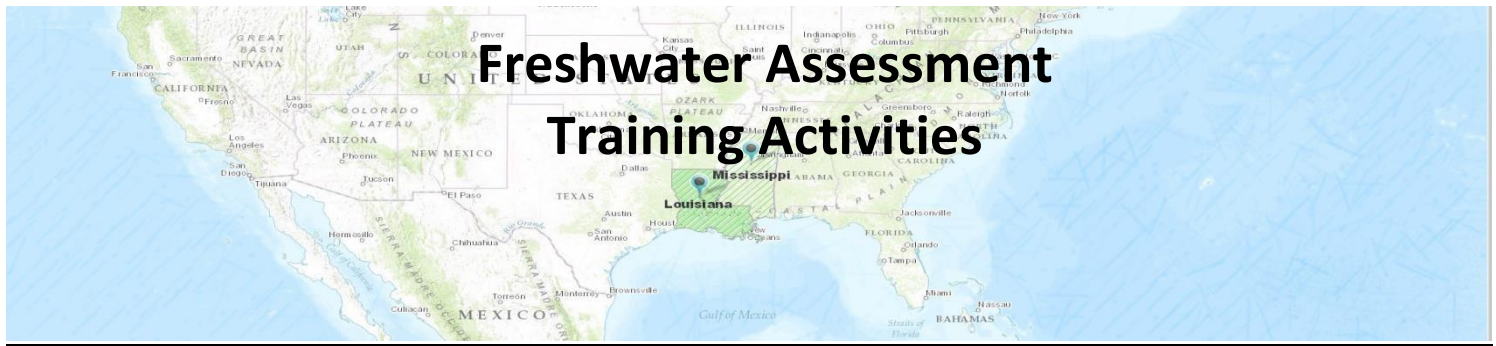
Figure 12: Future Habitat – Filter by Habitats of Interest



Self-Check:

4. With the change in wetland habitats shown in a simulation of 1 meter of sea level rise, which area is most likely to be vulnerable to economic loss from SLR?
5. Which coastal habitat appears to change the most in the area under a 1 meter sea level rise scenario by 2050?

Hint!!! To help you answer the self-check question #1, move your mouse to the upper right portion of the map and hover over the button that says "Topographic". From the Drop down menu, click on "Imagery." You will also have to change the opacity (transparency of your future habitat layer) by moving the slider bar under "Layer Properties" in the app dialog box.



Freshwater Assessment **Background**

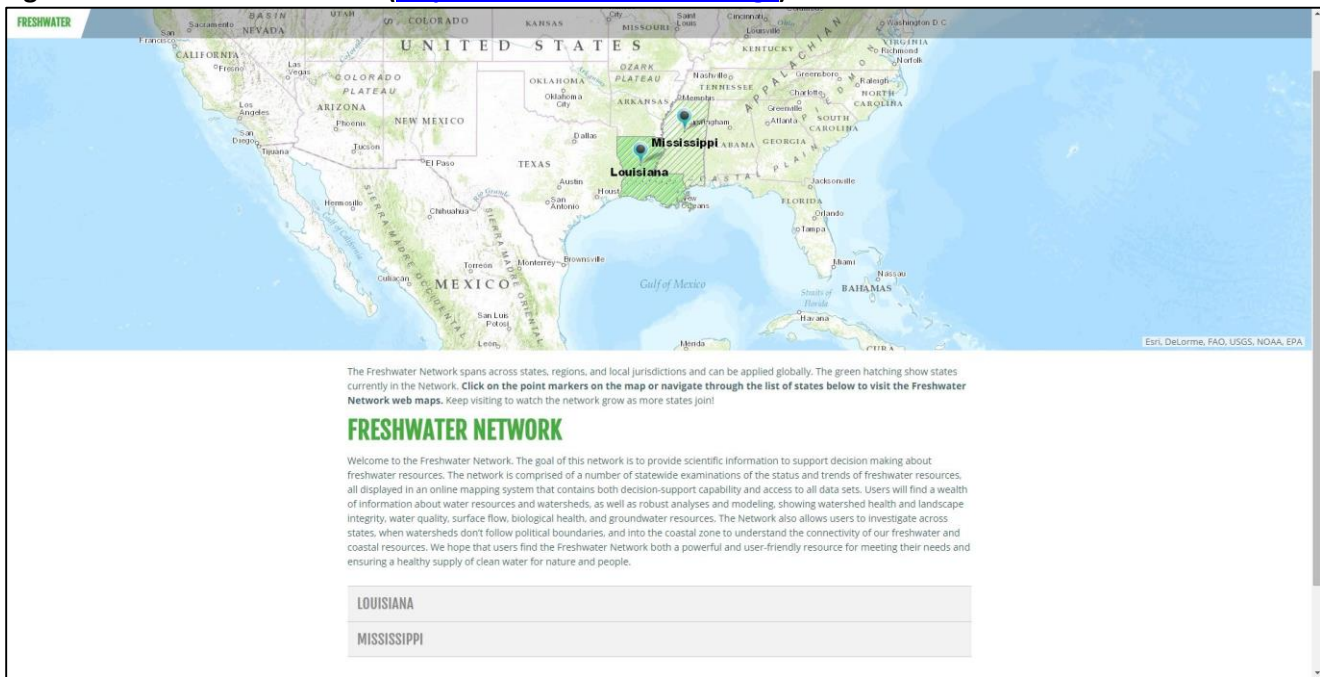
The goal of the Freshwater Network (<http://freshwaternetwork.org/>) is to provide scientific information to support decision making about freshwater resources (Figure 10). The network is comprised of a number of statewide examinations of the status and trends of freshwater resources, all displayed in an online mapping system that contains both decision-support capability and access to all data sets. Users will find a wealth of information about water resources and watersheds, as well as robust analyses and modeling, showing watershed health and landscape integrity, water quality, surface flow, biological health, and groundwater resources. The Network also allows users to investigate across states, when watersheds don't follow political boundaries, and into the coastal zone to understand the connectivity of our freshwater and coastal resources. We hope that users find the Freshwater Network both a powerful and user-friendly resource for meeting their needs and ensuring a healthy supply of clean water for nature and people.

This section provides details on the Freshwater Network and tools.

SESSION 3: FRESHWATER ASSESSMENT **APP: Watershed Comparison**

The size and shape of watersheds can vary widely depending on the terrain and river network of the area. In Louisiana for instance, the Coles Creek HUC 8 watershed is approximately 236,000 acres while the Toledo Bend Reservoir HUC 8 watershed is over 1,500,000 acres. This size disparity can make direct comparisons difficult without normalizing the data for watershed area. To be able to make logical comparisons between watersheds for planning and prioritization we have developed comparison metrics that account for the relative size of watersheds.

Figure 13: Freshwater Network (<http://freshwaternetwork.org/>)



Activity 4: Watershed Comparison

1. Go to <http://maps.freshwaternetwork.org/louisiana/#> in your standard web browser. (Figure 11)
2. Using the pan and zoom tools, zoom into your hometown or another area you would like to investigate.
3. Click the **Watershed Comparison app** to open the Watershed Comparison Tools dialog.
4. Click the dropdown menu and select one of the watershed or political feature types to compare. Once you have selected a feature type to compare, the units will be displayed in the map window. Depending on the feature type you choose, you may need to zoom in or out to an appropriate scale for that feature type. (Figure 12)
5. Now select three units in or around your area of interest by clicking inside each of the units. You will now see comparison metrics appear in the dialog window.

Figure 14: Louisiana Freshwater Assessment

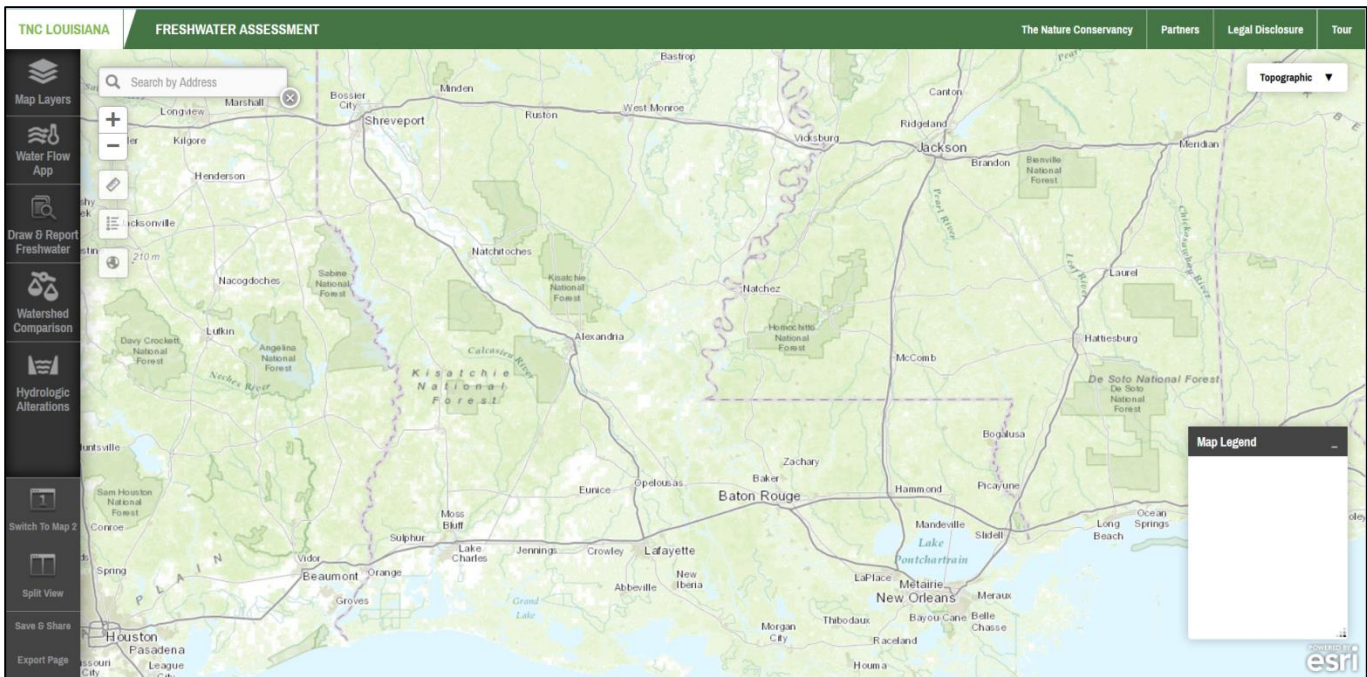


Figure 15: Watershed Comparison Tools

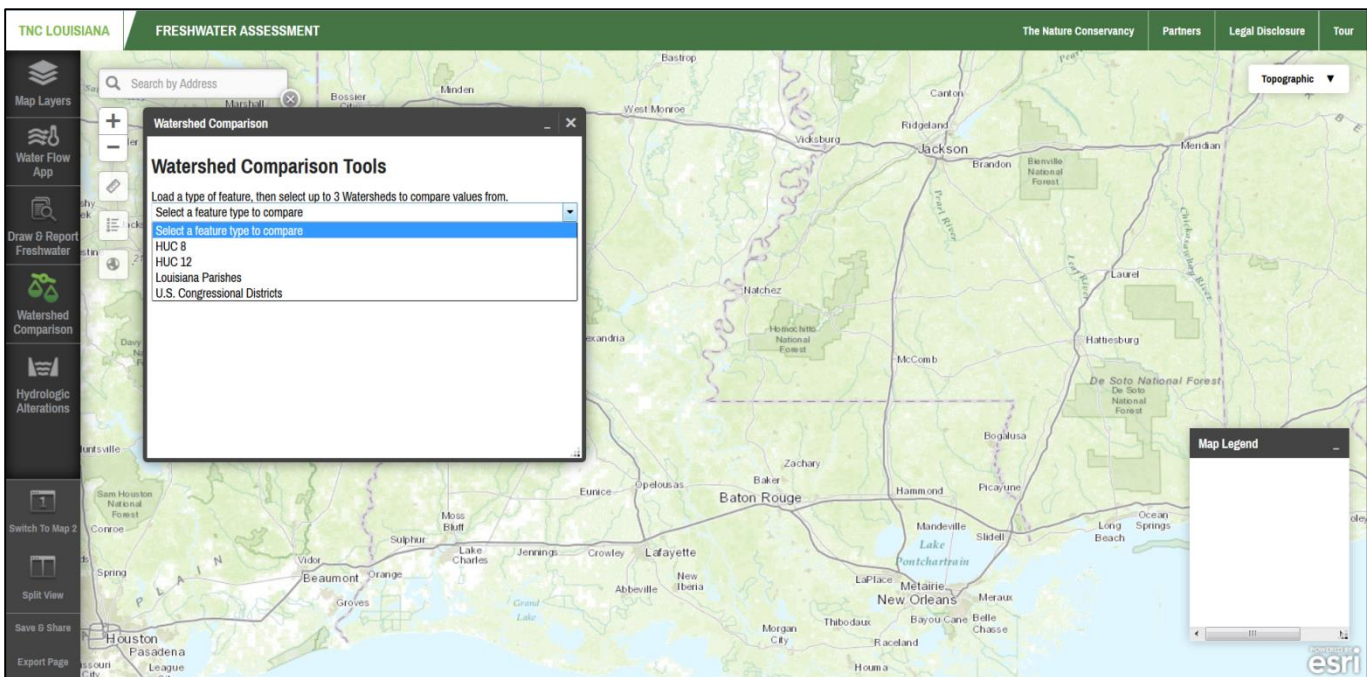
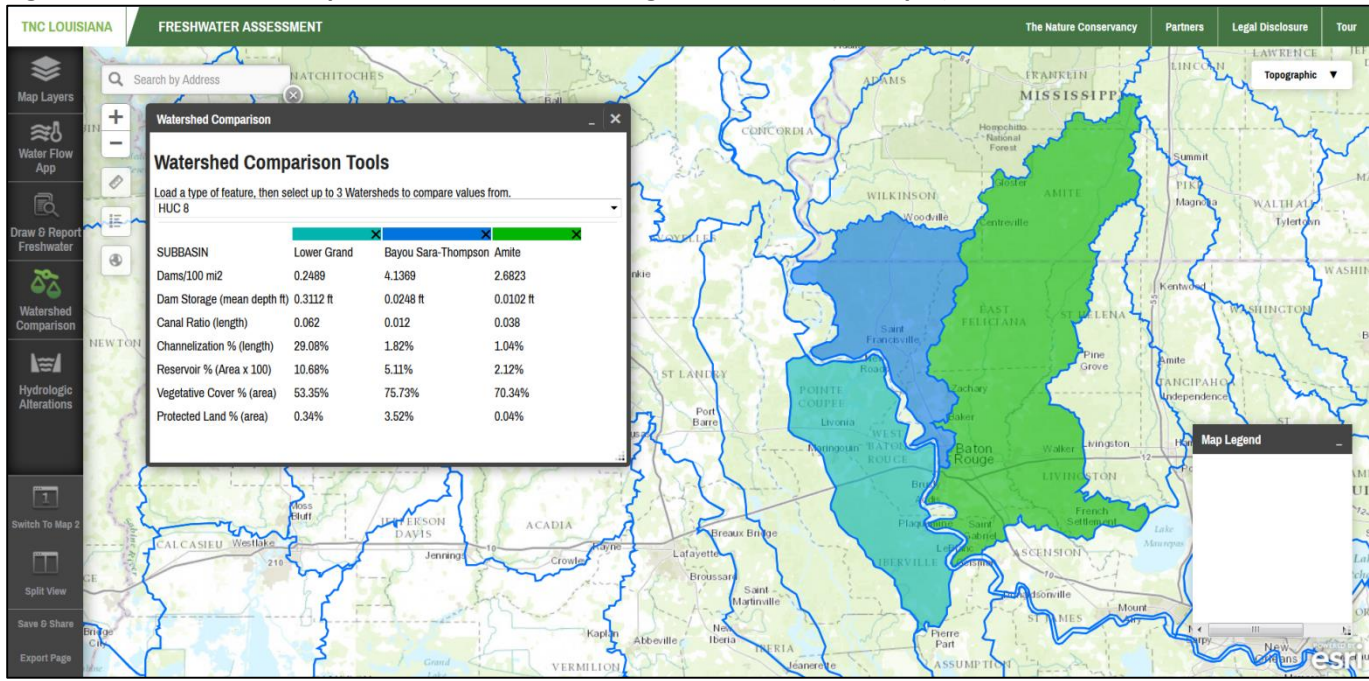


Figure 16: Watershed Comparison Tools – Baton Rouge watersheds (example)



Self-Check:

- Which of the three watersheds you selected has the highest Vegetative Cover percentage?
- Based on the metrics available in the dialog window, can you tell which watershed has the most dams? Which watershed has the lowest ratio of canals to streams?

Self-Check Example (Figure 16 above): Area of interest – Baton Rouge, LA

6. The watershed with the highest vegetative cover is Bayou Sara-Thompson.

7. The watershed with the most dams is also Bayou Sara-Thompson. The watershed with the lowest ration of canals to streams is also Bayou Sara-Thompson.

Congratulations!!

You've completed Training – Coastal Resilience 2.0 and Freshwater Assessment

For more information, please visit:

www.coastalresilience.org

www.freshwaternet.org