University

Course Name: GIS

Final Project

Story Map for InterACTWEL

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Introduction:

A story map is a strategy that uses a graphic organizer to help people learn the elements of a project or story. By identifying story characters, plot, setting, problem and solution, people read carefully to learn the details. There are many different types of story map graphic organizers. The most basic focus on the beginning, middle, and end of the story. More advanced organizers focus more on plot or character traits. This project will prepare a story map for a research called InterACTWEL.

InterACTWEL (Interactive Adaptation and Collaboration Tool for managing Water, Energy and Land) is a secure and intelligent computer-aided decision support tool that is being developed by researchers at Oregon State University and Indiana University- Purdue University Indianapolis to aid adaptation planning in local communities. The aim of this decision support tool is to empower food, energy, and water sectors in communities to collaborate and coordinate their planning efforts in the face of an uncertain future. This highly flexible and navigable tool uses advanced scientific models and interactive interfaces to assist sectors in developing potential community-wide adaptation actions in response to specific disturbances. Community actions include strategies for modifying demand, allocation, storage, and distribution of water, energy, and land resources over time (also, called adaptation pathways). The intuitive graphical user interfaces can assist decision makers and policy makers to (a) customize InterACTWEL for their own community, (b) visualize costs, benefits, and impacts of their actions, and (c) communicate suggestions for and feasibility of potential actions to partners.

Story map Structure:

The basic folder structure to generate a story map should be as follows:

```
lab5
    |index.html
    |readme.md
    ├─css
    ├─js
    ├─img
    ├─assets
```

Required Libraries:

A library is a JavaScript file that contains a bunch of functions, and those functions accomplish some useful task for your webpage. We could look at the JavaScript file, if it's short, or better, we could look at the documentation. Most libraries have documentation with a list of available functions or a real-world example. In the head element we insert the required css and JavaScript libraries.

```
<head>
    <title>Food Energy Water Nexus</title>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <!--add favicon for the web page-->
    <link rel="shortcut icon" href="img/icon.ico" type="image/x-icon">
    <!--add required stylesheets-->
    <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.min.css">

    <link rel="stylesheet" href="https://unpkg.com/leaflet@1.3.1/dist/leaflet.css"/>

    <!--other required stylesheets-->
    <link href="https://api.tiles.mapbox.com/mapbox-gl-js/v0.35.1/mapbox-gl.css"
rel='stylesheet' />
    <link rel="stylesheet"
href="https://turban.github.io/Leaflet.Photo/examples/lib/cluster/MarkerCluster.css"
/>
    <link rel="stylesheet"
href="https://turban.github.io/Leaflet.Photo/Leaflet.Photo.css" />

    <!--add favicon for the web page-->
    <link rel="shortcut icon" href="img/logo1.png" type="image/x-icon">

    <!--facebook and info icons-->

    <link rel="stylesheet"
href="https://use.fontawesome.com/releases/v5.7.2/css/all.css" integrity="sha384-
fnmOCqbTlWIlj8LyTjo7mOUStjsKC4pOpQbqyi7RrhN7udi9RwhKkMHpvLbHG9Sr"
crossorigin="anonymous">

    <link rel="stylesheet" type="text/css" href="css/css/fontawesome.css"/>
    <!--animation-->
    <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/animate.css/3.5.2/animate.min.css">

    <!--Font-->
    <link href="https://fonts.googleapis.com/css?family=Cairo" rel="stylesheet">
    <link rel="stylesheet" type="text/css" href="css/storymap.2.3.css">
    <link rel="stylesheet" href="css/main.css" />


    <!--add required libraries-->
    <script src="https://unpkg.com/leaflet@1.3.0/dist/leaflet.js"></script>
    <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.1.1/jquery.min.js"></script>
    <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/js/bootstrap.min.js"></script>
```

```
    <script src="https://cdnjs.cloudflare.com/ajax/libs/leaflet-
ajax/2.1.0/leaflet.ajax.min.js"></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/chroma-
js/1.3.4/chroma.min.js"></script>

    <!--mini globle map-->
    <script src="https://cdnjs.cloudflare.com/ajax/libs/d3/3.5.5/d3.min.js"></script>
    <script
src="https://cdnjs.cloudflare.com/ajax/libs/topojson/1.6.19/topojson.min.js"></script>
    <script src="js/globeminimap.js"></script>

    <!--story map plugin-->
    <script src="js/storymap.2.3.js"></script>
    <script src="https://api.tiles.mapbox.com/mapbox-gl-js/v0.35.1/mapbox-
gl.js"></script>
    <script src="https://rawgit.com/mapbox/mapbox-gl-leaflet/master/leaflet-mapbox-
gl.js"></script>
    <script src="js/leaflet.markercluster-src.js"></script>
    <script src="https://turban.github.io/Leaflet.Photo/Leaflet.Photo.js"></script>
    <script src="js/leaflet-d3.js"></script>
    <script src="js/colorbrewer.js"></script>
    <!--<script src="js/storymap.js"></script>-->
    <script src="js/jqcloud.js"></script>
    <script src="assets/data.js"></script>
    <script src="assets/post-contents.js"></script>

</head>
```

In continue, some of the important libraries will be explained.

Bootstrap:

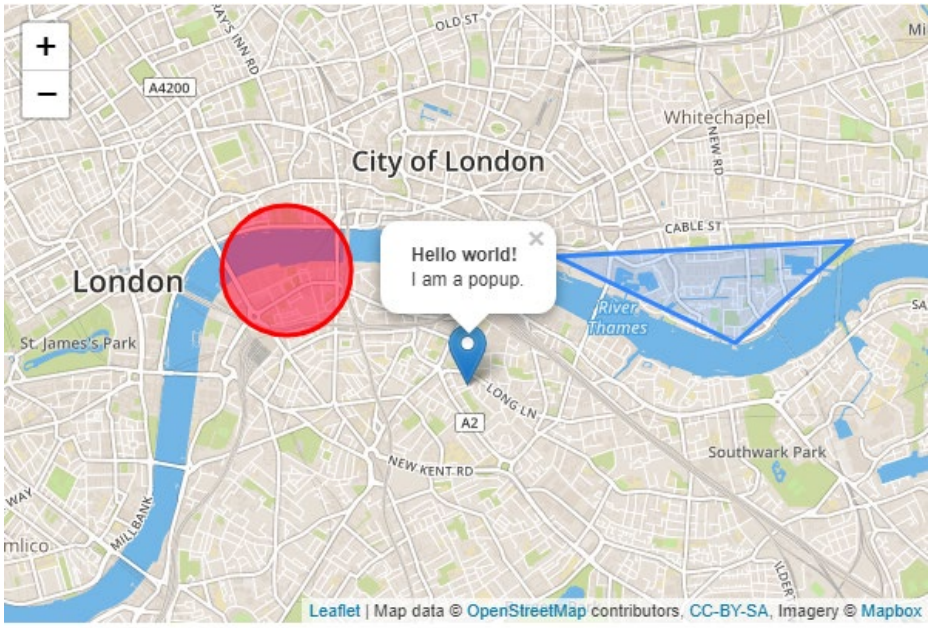
Bootstrap is an open source toolkit for developing with HTML, CSS, and JS. Quickly prototype your ideas or build your entire app with Sass variables and mixins, responsive grid system, extensive prebuilt components, and powerful plugins built on jQuery.

https://getbootstrap.com/

Leaflet:

Leaflet is the leading open-source JavaScript library for mobile-friendly interactive maps. Weighing just about 38 KB of JS, it has all the mapping features most developers ever need. Leaflet is designed with *simplicity*, *performance* and *usability* in mind. It works efficiently across all major desktop and mobile platforms, can be extended with lots of plugins, has a beautiful, easy to use and well-documented API and a simple, readable source code that is a joy to contribute to.

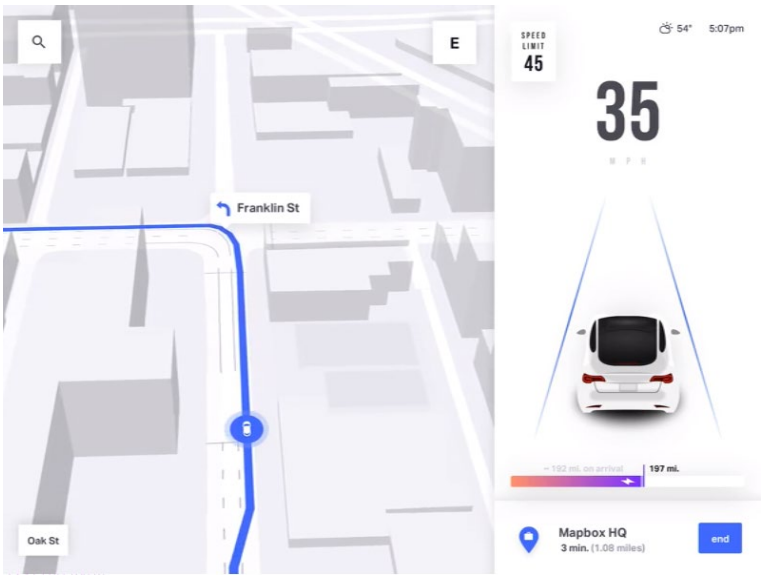
Figure 1. Edited map wit leaflet



Mapbox:

Mapbox Is The Location Data Platform For Mobile And Web Applications. Customizable. Flexible building blocks. Cross-platform. Beautiful visualizations. Developer friendly. Try for free. Products: Maps, Search, Navigation, Studio.

Figure 2. Sample map on mapbox



Fontawesome:

Font Awesome is designed to be used with inline elements and we recommend sticking with a consistent HTML element to reference them by in your project. We like the tag for brevity and for the fact that most folks are using for emphasized/italicized semantic text these days. If that's not your cup of tea, using a is more semantically correct. You can place Font Awesome icons just about anywhere using a style prefix and the icon's name. We've tried to make it so that icons will take on the characteristics and appear alongside text naturally.

Figure 3. Fontawsome

Style	Availability	Style Prefix	Example	Rendering
Solid	Free	fas		
Regular	Pro Required	far		
Light	Pro Required	fal		
Brands	Free	fab		

Storymap.js:

Storymap is a javascript library for storytelling with web maps. This library aims to enable individuals, especially those who have little web programming background, to effectively create story map applications over the Internet. Three major tasks would be dealt with, including web interface design, map design and storytelling structure. To develop these functions, this library is written in a combination of several web programming languages, like HTML, Cascading Style Sheets (CSS) and Javascript, and builds upon several prerequisite libraries and web services. To make the story map library robust and lightweight, we select as fewer prerequisite libraries as possible, and prioritize the use of open source or free libraries. This library is currently maintained by Cartography and Geovisualization Group at Oregon State University, and has been used in multiple geovisualization related courses (e.g., GEOG 371: Web Mapping, GEOG 571: Advanced Web Mapping, GEOG 472/572: Geovisual Analytics) and projects. In addition, a lot of universities began to choose storymap.js instead of ESRI storymap platform.

JQuery:

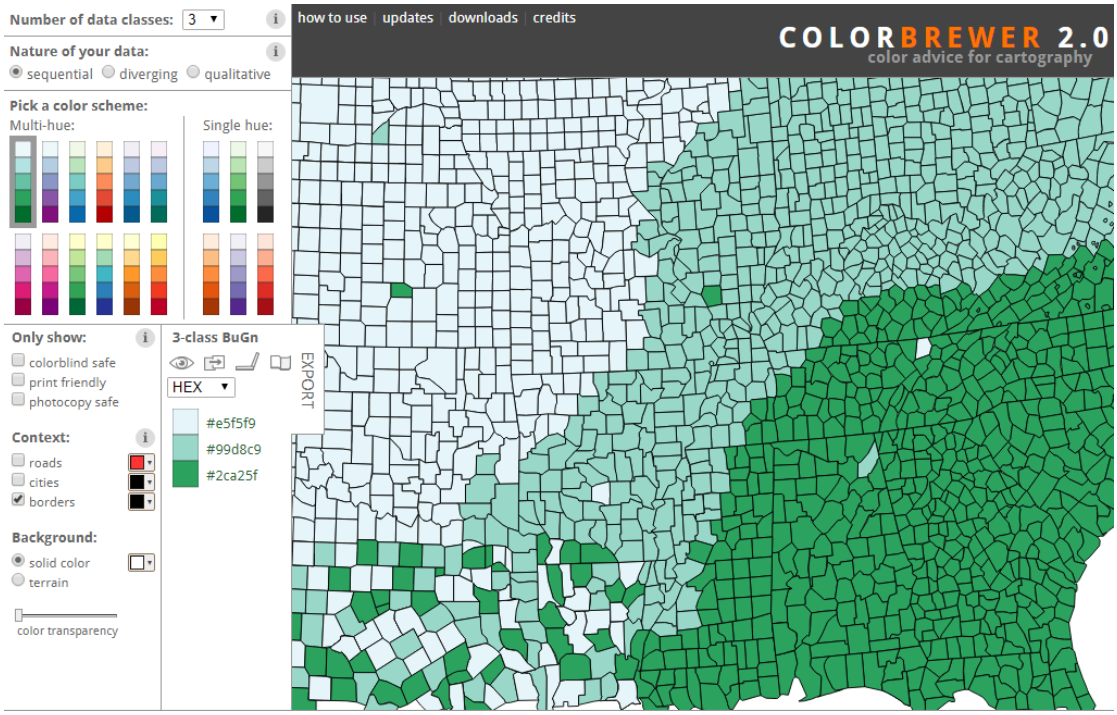
jQuery is a JavaScript library designed to simplify HTML DOM tree traversal and manipulation, as well as event handling, CSS animation, and Ajax. It is free, open-source software using the permissive MIT License. Web analysis (from 2017) indicates that it is the most widely deployed JavaScript library by a large margin.

JQuery's syntax is designed to make it easier to navigate a document, select DOM elements, create animations, handle events, and develop Ajax applications. JQuery also provides capabilities for developers to create plug-ins on top of the JavaScript library. This enables developers to create abstractions for low-level interaction and animation, advanced effects and high-level, theme able widgets. The modular approach to the jQuery library allows the creation of powerful dynamic web pages and Web applications.

ColorBrewer:

ColorBrewer is an online tool designed to help people select good color schemes for maps and other graphics. It is free to use, although we'd appreciate it if you could cite us if you decide to use one of our color schemes.

Figure 4. ColorBrewer



A story map is organized as a sequence of scenes, and the scenes are associated with maps. Each map are mashed up by layers, and the layers can be any types of layers that leaflet.js or cesium support. Below shows the tree structure of this story map library.

```
A Story Map
|
|---Scene 1: Setup
|       |---- Script 1 (e.g., text, video, image, audio, etc.)
|       |---- Map 1
|               |
|               |---- Layer 1
|               |---- Layer 2
|               |---- Layer N
```

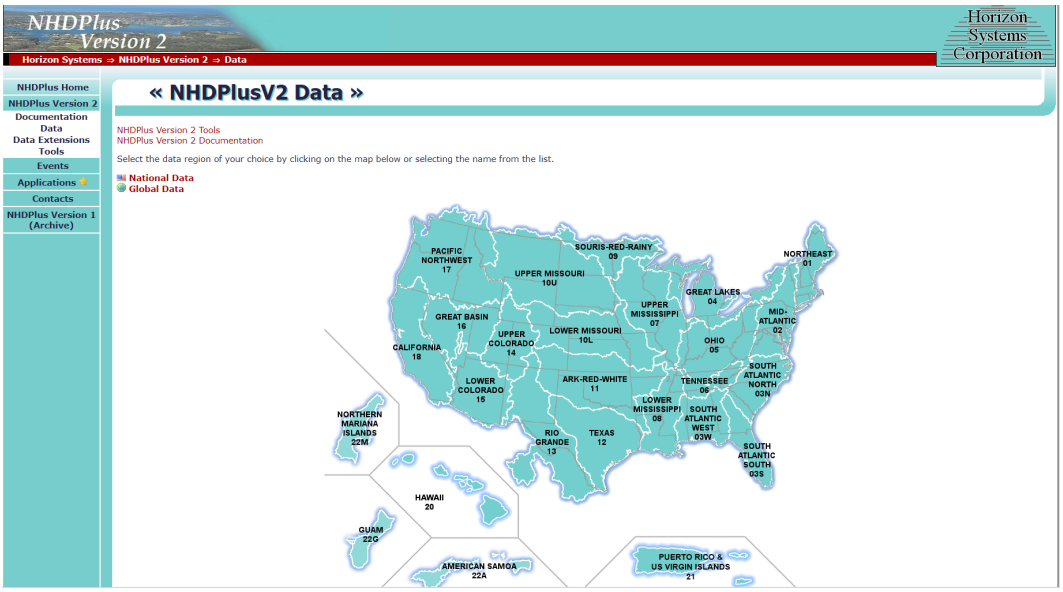
```
├──Scene 2: (section 2)
│... ... ... ... ... ... ...
│... ... ... ... ... ... ...
│... ... ... ... ... ... ...
├──Scene N: (section n)
│      ├─── Content 5
│      ├─── Map 5
│      │
│      │    ├─── Layer 1
│      │    ├─── Layer 2
│      │    ├─── Layer N
```

A storymap is organically integrated by several scenes. Each scene consists of a web map and a script. You can manipulate the map by zooming, panning, and even adding more thematic layers. This library embodies the concept responsive web design, meaning the story maps can be shown on either Desktop or mobile devices.

Data layers:

For downloading the watershed data, National Hydrology Data Plus were used and in next step QGIS were used to change the format of the shape files to Geojson.

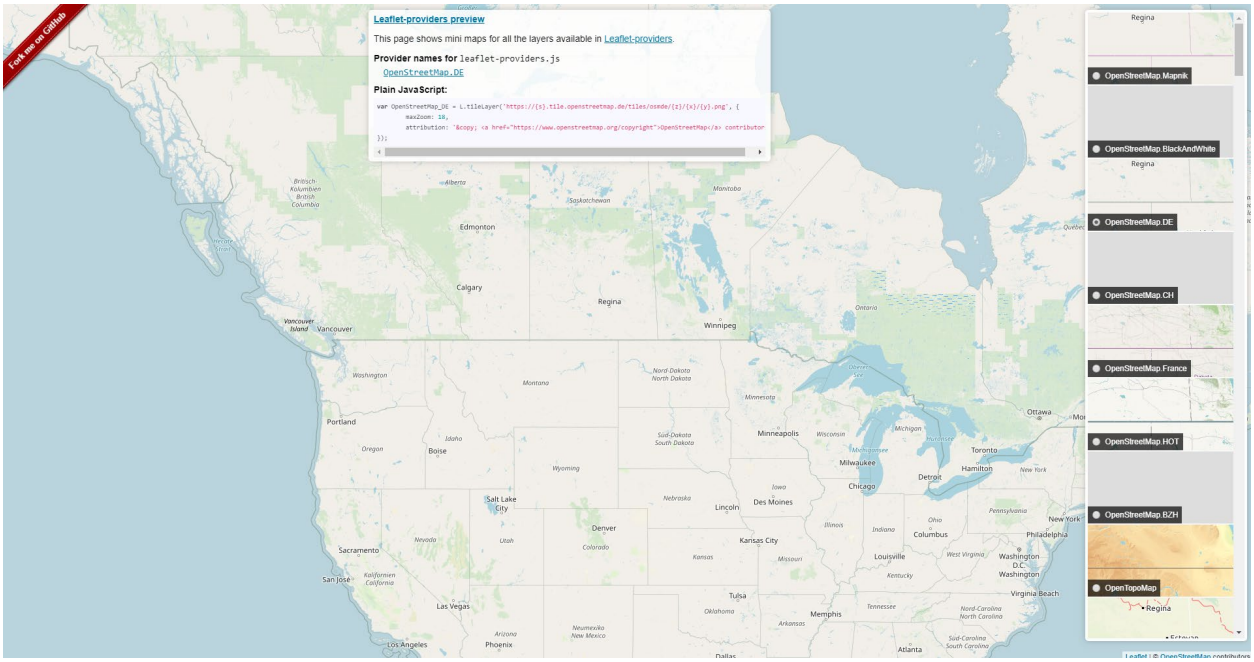
Figure 5. NHD Plus



Tile layers:

Leaflet provider was used for getting all the tile layers in this story map.

Figure 6. Leaflet provider



In continue some of the sample code for adding the tile layers and also data layers were showed.

```
var layers = {

    ESRI: {layer:
L.tileLayer('http://server.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServ
er/tile/{z}/{y}/{x}')},
    Umatilla: {
        layer: L.geoJson.ajax('assets/Umatilla.geojson', {

            onEachFeature: function (feature, layer) {
                layer.bindTooltip('<p><b>' + feature.properties.Subbasin+ '</b></p>',
{sticky: false, className: "feature-label",permanent: false, offset: [-1, -1]});
            },
            color: 'deepskyblue',
            weight: 2,
            opacity: 0.3
```

```
        }), legend: Umatilla
    },



    FoodPro: {
        layer: L.geoJson.ajax('assets/FoodPro.geojson', {

            onEachFeature: function (feature, layer) {
                layer.bindTooltip(feature.properties.company, {sticky: true,
className: "feature-label"  , permanent: false, direction: 'center'});
            },
            pointToLayer: function (feature, latlng) {
                var id = 0;
                if (feature.properties.company == "Hood River Cellular") { id = 0; }
                else if (feature.properties.company == "Oregon RSA")  { id = 1; }
                else if (feature.properties.company == "RCC Minnesota")  { id = 2; }
                else { id = 3;} // "Salem Cellular"
                return L.marker(latlng, {icon: L.divIcon({className: 'fa fa-city
marker-color-' + (id + 1).toString() })});
            },

            color: '#ff3831',
            weight: 15,
            opacity: 0.1
        }),
    },
```

The storyline:

For the story telling, 10 different sections were used for this projects

Section 1: overview

In this section the title of the projects on a tiff file was showed.

```
<section data-scene="overview" data-background="assets/1.gif">
    <div class="fullscreen text-center">
        <h1>InterACTWEL</h1>
        <h2>
            <small style="color: rgba(255,255,255,0.95)"> A key to resilient Food-
Energy-Water sectors in local communities
            </small>
        </h2>
    </div>
</section>
```

Figure 7. section1

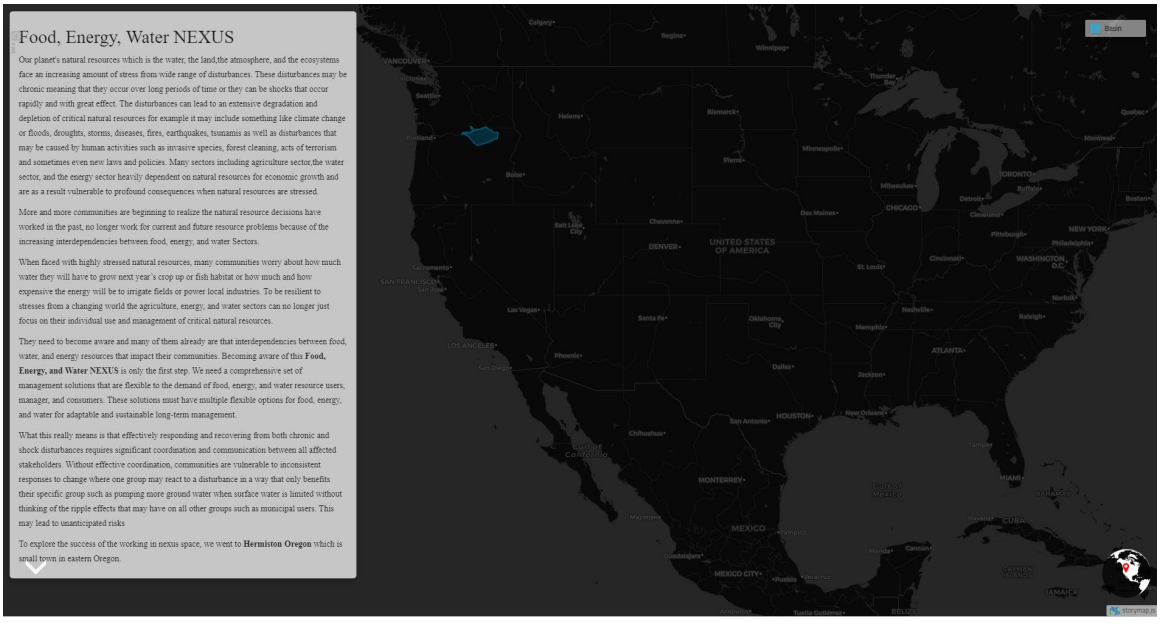
Section 2: Umatilla0

In this section a CartoDB.DarkMatter was used as a base map and also three basin layers were add to the map. The format of the layers is geojason to add to the storymap.

```
<section data-scene="Umatilla0">
    <h2>Food, Energy, Water NEXUS</h2>
    <p>
        Our planet's natural resources which is the water, the land,the atmosphere,
and the ecosystems face an increasing amount of stress from
        wide range of disturbances. These disturbances may be chronic meaning that
they occur over long periods of time or they can be shocks that
        occur rapidly and with great effect. The disturbances can lead to an extensive
degradation and depletion of critical natural resources for example
        it may include something like climate change or floods, droughts, storms,
diseases, fires, earthquakes, tsunamis as well as
        disturbances that may be caused by human activities such as invasive species,
forest cleaning, acts of terrorism and sometimes
        even new laws and policies. Many sectors including agriculture sector,the
water sector, and the energy sector heavily dependent on natural resources
        for economic growth and are as a result vulnerable to profound consequences
when natural resources are stressed.
    </p>
    <p>
        More and more communities are beginning to realize the natural resource
decisions have worked in the past, no longer work for current and future
    resource problems because of the increasing interdependencies between food,
energy, and water Sectors.
    </p>
    <p>
        When faced with highly stressed natural resources, many communities worry
about how much water they will have to grow next year's crop up or fish
```

```
        habitat or how much and how expensive the energy will be to irrigate fields or
power local industries. To be resilient to stresses from a changing
        world the agriculture, energy, and water sectors can no longer just focus on
their individual use and management of critical natural resources.
    </p>
    <p>
        They need to become aware and many of them already are that interdependencies
between food, water, and energy resources that impact their communities.
        Becoming aware of this <B>Food, Energy, and Water NEXUS</B> is only the first
step. We need a comprehensive set of management solutions that are flexible
        to the demand of food, energy, and water resource users, manager, and
consumers. These solutions must have multiple flexible options for food,
        energy, and water for adaptable and sustainable long-term management.
    </p>
    <p>
        What this really means is that effectively responding and recovering from both
chronic and shock disturbances requires significant coordination and
        communication between all affected stakeholders. Without effective
coordination, communities are vulnerable to inconsistent responses to change where
        one group may react to a disturbance in a way that only benefits their
specific group such as pumping more ground water when surface water is limited
        without thinking of the ripple effects that may have on all other groups such
as municipal users. This may lead to unanticipated risks
    </p>
    <p>
        To explore the success of the working in nexus space, we went to <B>Hermiston
Oregon</B> which is small town in eastern Oregon.
    </p>
</section>
```

Figure 8. section2

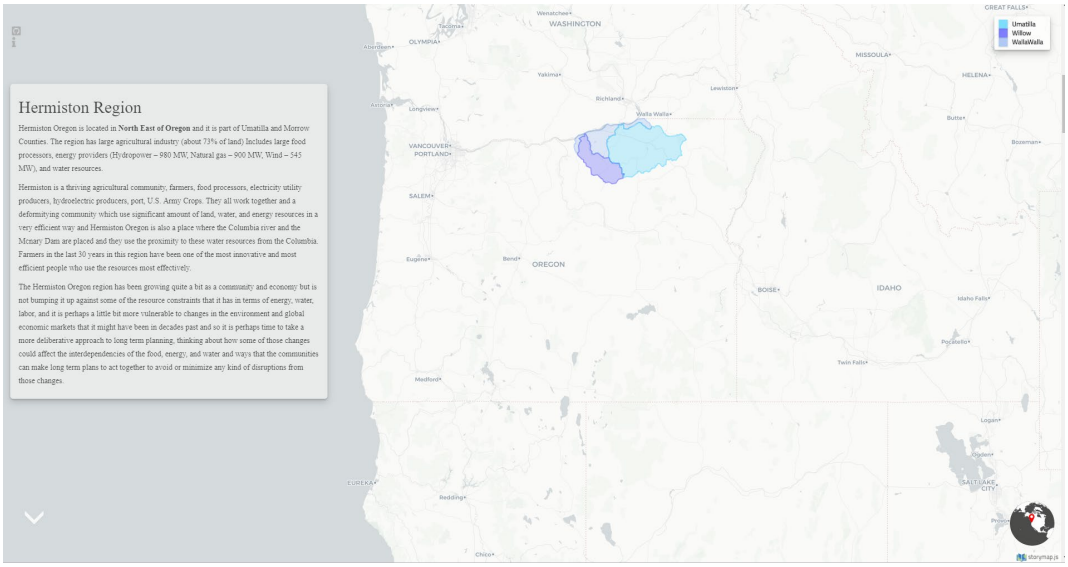


Section 3: Umatilla

In this section an Esri.WorldGrayCanvas was used as a base map and also three basin layers were add to the map with the different zoom level.

```
<section data-scene="Umatilla">
    <h2>Hermiston Region</h2>
    <p> Hermiston Oregon is located in <b>North East of Oregon</b> and it is part of
Umatilla and Morrow Counties.
        The region has large agricultural industry (about 73% of land) Includes large
food processors, energy providers (Hydropower – 980 MW, Natural gas – 900 MW, Wind –
545 MW),
        and water resources.
    </p>

    <p>
         Hermiston is a thriving agricultural community, farmers, food processors,
electricity utility producers, hydroelectric producers, port, U.S. Army Crops. They
all work
        together and a deform tying community which use significant amount of land,
water, and energy resources in a very efficient way and Hermiston
        Oregon is also a place where the Columbia river and the McNairy Dam are placed
and they use the proximity to these water resources from the Columbia.
         Farmers in the last 30 years in this region have been one of the most
innovative and most efficient people who use the
        resources most effectively.
    </p>

    <p>
        The Hermiston Oregon region has been growing quite a bit as a community and
economy but is not bumping it up against some of the resource constraints
        that it has in terms of energy, water, labor, and it is perhaps a little bit
more vulnerable to changes in the environment and global economic
        markets that it might have been in decades past and so it is perhaps time to
take a more deliberative approach to long term planning, thinking
        about how some of those changes could affect the interdependencies of the
food, energy, and water and ways that the communities can make long
        term plans to act together to avoid or minimize any kind of disruptions from
those changes.
    </p>
</section>
```

Figure 9. section3

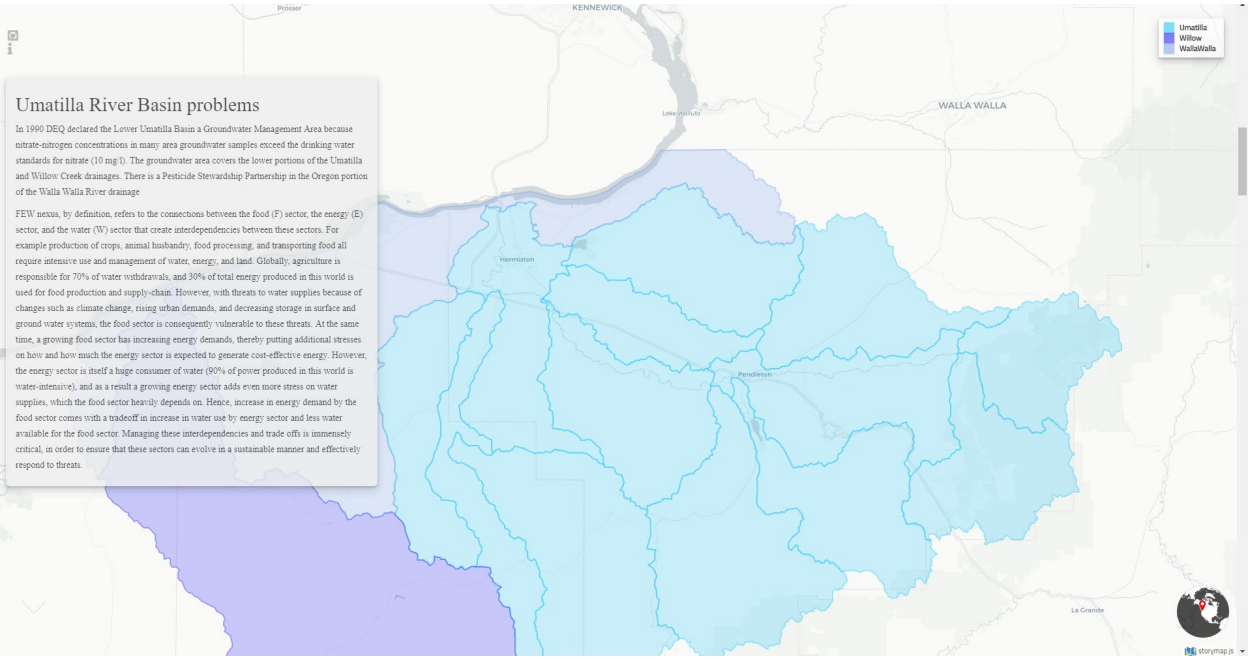


Section 4: Umatilla

Section 4 talks about Umatilla river basin problems.

```
<section data-scene="Umatilla2">
    <h2>Umatilla River Basin problems</h2>
    <p>
         In 1990 DEQ declared
        the Lower Umatilla Basin a Groundwater Management
        Area because nitrate-nitrogen concentrations in many area
        groundwater samples exceed the drinking water standards
        for nitrate (10 mg/l). The groundwater area covers the lower
        portions of the Umatilla and Willow Creek drainages.
        There is a Pesticide Stewardship Partnership in the Oregon
        portion of the Walla Walla River drainage</p>
    <p>FEW nexus, by definition, refers to the connections between the food (F)
sector, the energy (E) sector, and the water
        (W) sector that create interdependencies between these sectors. For example
production of crops,
        animal husbandry, food processing, and transporting food all require intensive
use and management of water, energy,
        and land. Globally, agriculture is responsible for 70% of water withdrawals,
and 30% of total energy
        produced in this world is used for food production and supply-chain. However,
with threats to water supplies
        because of changes such as climate change, rising urban demands, and
decreasing storage in surface and ground water systems,
        the food sector is consequently vulnerable to these threats. At the same time,
a growing food sector has increasing energy demands,
        thereby putting additional stresses on how and how much the energy sector is
expected to generate cost-effective energy. However,
        the energy sector is itself a huge consumer of water (90% of power produced in
this world is water-intensive), and
        as a result a growing energy sector adds even more stress on water supplies,
which the food sector heavily depends on. Hence,
        increase in energy demand by the food sector comes with a tradeoff in increase
in water use by energy sector and less water
        available for the food sector. Managing these interdependencies and trade offs
is immensely critical, in order to ensure that
        these sectors can evolve in a sustainable manner and effectively respond to
threats.   </p>
</section>
```

Figure 10. section4

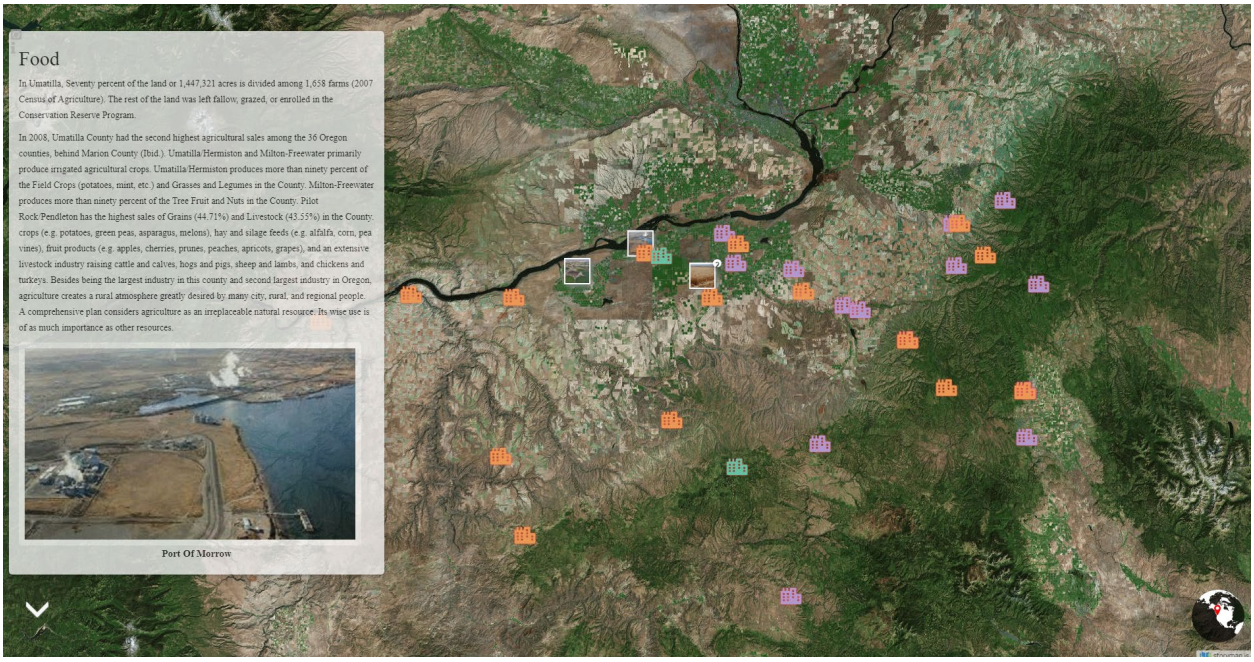


Section 5: Food

```
<section data-scene="Food">
    <h2>Food</h2>
    <p>In Umatilla, Seventy percent of the land or 1,447,321 acres is divided among
1,658 farms (2007 Census of Agriculture).
        The rest of the land was left fallow, grazed, or enrolled in the Conservation
Reserve Program.</p>
    <p>
        In 2008, Umatilla County had the second highest agricultural sales among the
36 Oregon counties, behind Marion County (Ibid.).
        Umatilla/Hermiston and Milton-Freewater primarily produce irrigated
agricultural crops. Umatilla/Hermiston produces
        more than ninety percent of the Field Crops (potatoes, mint, etc.) and Grasses
and Legumes in the County. Milton-Freewater
        produces more than ninety percent of the Tree Fruit and Nuts in the County.
Pilot Rock/Pendleton has the highest sales
        of Grains (44.71%) and Livestock (43.55%) in the County. crops (e.g. potatoes,
green peas, asparagus, melons), hay and
        silage feeds (e.g. alfalfa, corn, pea vines), fruit products (e.g. apples,
cherries, prunes, peaches, apricots, grapes),
        and an extensive livestock industry raising cattle and calves, hogs and pigs,
sheep and lambs, and chickens and turkeys.
        Besides being the largest industry in this county and second largest industry
in Oregon, agriculture creates a rural
        atmosphere greatly desired by many city, rural, and regional people. A
comprehensive plan considers agriculture as an
        irreplaceable natural resource. Its wise use is of as much importance as other
resources.
    </p>
    <div class="embeded-photo img-responsive"></div>
```

```
</section>
```

Figure 11. section5

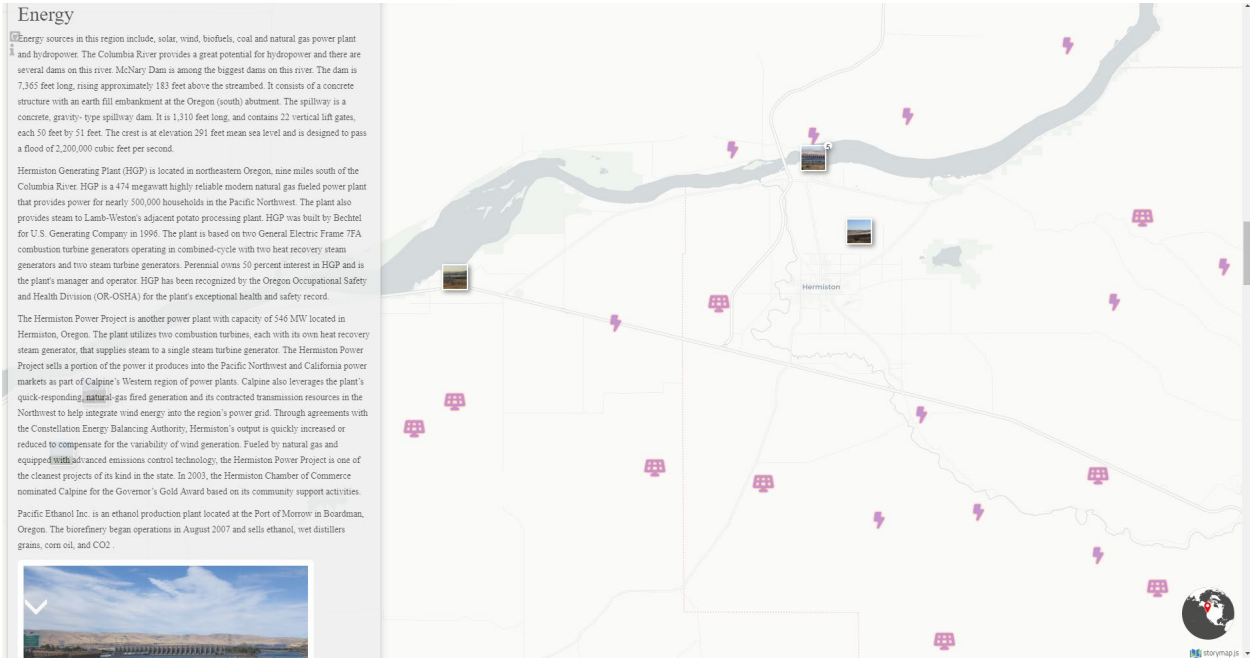


Section 6: Energy

```
<section data-scene="Energy">
    <h2>Energy</h2>
    <p>Energy sources in this region include, solar, wind, biofuels, coal and natural
gas power plant and hydropower.
        The Columbia River provides a great potential for hydropower and there are
several dams on this river.
        McNary Dam is among the biggest dams on this river. The dam is 7,365 feet
long, rising approximately 183
        feet above the streambed. It consists of a concrete structure with an earth
fill embankment at the Oregon
        (south) abutment. The spillway is a concrete, gravity- type spillway dam. It
is 1,310 feet long, and contains
        22 vertical lift gates, each 50 feet by 51 feet. The crest is at elevation 291
feet mean sea level
        and is designed to pass a flood of 2,200,000 cubic feet per second.</p>

    <p>Hermiston Generating Plant (HGP) is located in northeastern Oregon, nine miles
south of the Columbia River.
        HGP is a 474 megawatt highly reliable modern natural gas fueled power plant
that provides power for nearly
        500,000 households in the Pacific Northwest. The plant also provides steam to
Lamb-Weston's adjacent potato
        processing plant. HGP was built by Bechtel for U.S. Generating Company in
1996. The plant is based on two
        General Electric Frame 7FA combustion turbine generators operating in
combined-cycle with two heat recovery
        steam generators and two steam turbine generators. Perennial owns 50 percent
```

```
interest in HGP and is the
        plant's manager and operator. HGP has been recognized by the Oregon
Occupational Safety and Health Division
        (OR-OSHA) for the plant's exceptional health and safety record.</p>
    <p>The Hermiston Power Project is another power plant with capacity of 546 MW
located in Hermiston, Oregon.
        The plant utilizes two combustion turbines, each with its own heat recovery
steam generator, that supplies
        steam to a single steam turbine generator. The Hermiston Power Project sells a
portion of the power it
        produces into the Pacific Northwest and California power markets as part of
Calpine's Western region
        of power plants. Calpine also leverages the plant's quick-responding, natural-
gas fired generation
        and its contracted transmission resources in the Northwest to help integrate
wind energy into the
        region's power grid. Through agreements with the Constellation Energy
Balancing Authority, Hermiston's
        output is quickly increased or reduced to compensate for the variability of
wind generation. Fueled by
        natural gas and equipped with advanced emissions control technology, the
Hermiston Power Project is one
        of the cleanest projects of its kind in the state. In 2003, the Hermiston
Chamber of Commerce nominated
        Calpine for the Governor's Gold Award based on its community support
activities.</p>
    <p>Pacific Ethanol Inc. is an ethanol production plant located at the Port of
Morrow in Boardman, Oregon.
        The biorefinery began operations in August 2007 and sells ethanol, wet
distillers grains, corn oil, and CO2 . </p>
    <div class="embeded-photo img-responsive"></div>
</section>
```

Figure 12. section6



Section 7: Water

In this scene a tile layer from Esri satellite image was added to the scene and also all the streams in the area.

```
<section data-scene="Water">
    <h2>Water</h2>
    <p>
        Water is hugely contentious in the state of Oregon and this region
unsuccessfully for many years tried to get water projects approved
        on state level and it was unsuccessful for many times.
    </p>
    <p>Water resources in the Umatilla sub basin include surface water, ground water
and waste water. Surface water is
        derived from Columbia River and its tributaries such as Umatilla River, ponds
and water reservoirs. Groundwater
        is an important resource to the economy of Umatilla County by providing the
bulk of the water used for agriculture,
        as well as for drinking water supplies for the many communities and nearly all
of the rural residences. The
        Umatilla Basin has more groundwater resource areas determined to be "Critical"
by the Oregon Water Resources
        Department than any other part of Oregon. Waste water is coming from
residential areas and food processing industries.
        According to Mucken and Bateman (2017) report, quality of surface water and
ground water is critical for
        residential, agricultural and industrial use and being monitored by Oregon
Department of Environmental Quality (DEQ).</p>
    <h3>Surface water quality</h3>
    <p>Temperature, sedimentation, and nutrients are the most common types of
pollution that impair Oregon's rivers and streams.
        Impaired water quality drives up the cost of water treatment and limits access
to clean water for fish, drinking water,
        agriculture, and recreation.</p>
    <h3>Ground water quality</h3>
    <p>Groundwater contamination is also a serious issue in some areas of Oregon.
Private domestic wells may face contamination
        issues from nearby failing septic systems. Industry and agriculture can also
be a source of pollutants for groundwater,
        as can surface water and groundwater interactions.</p>

    <p>Most of DEQ's groundwater monitoring efforts target vulnerable areas or areas
of known contamination (i.e., Groundwater
        Management Areas (GWMAs)). Nitrate is one of the most commonly analyzed
contaminants in these areas, with data showing
        that around 30 percent of groundwater samples detect nitrate at levels that
suggest a 22 Chapter 1 - Understand Water
        Resources Today pollution problem exists (7 mg/L), and around 20 percent
currently exceed health standards (10 mg/L).
        Bacteria are a commonly detected contaminant as well, with about 20 percent of
samples showing positive bacteria detections.
        Arsenic is not as commonly studied, but when sampled in vulnerable groundwater
areas, about 30 percent of samples
        show levels above health standards (10 ug/L). Other contaminants detected in
groundwater studies include Dacha
        manganese, lead, iron, aluminum, perchlorate, uranium and vanadium. There have
been few studies that investigate
        contaminants such as current use and legacy pesticides, herbicides,
pharmaceuticals, personal care products, and
        volatile organic compounds. Based on data collected in the past five years,
when detections of those contaminants are
        found, they are often far below health standards, if any standards exist.</p>
    <div class="embeded-photo img-responsive"></div>
```

```
    <p>Three major river systems make up the Umatilla Basin:</p>
    <p>The Umatilla River (100 miles in length)</p>
    <p>The Walla
        Walla River (61 miles in length)</p> <p> The Willow Creek (79
    miles in length)</p>

</section>
```

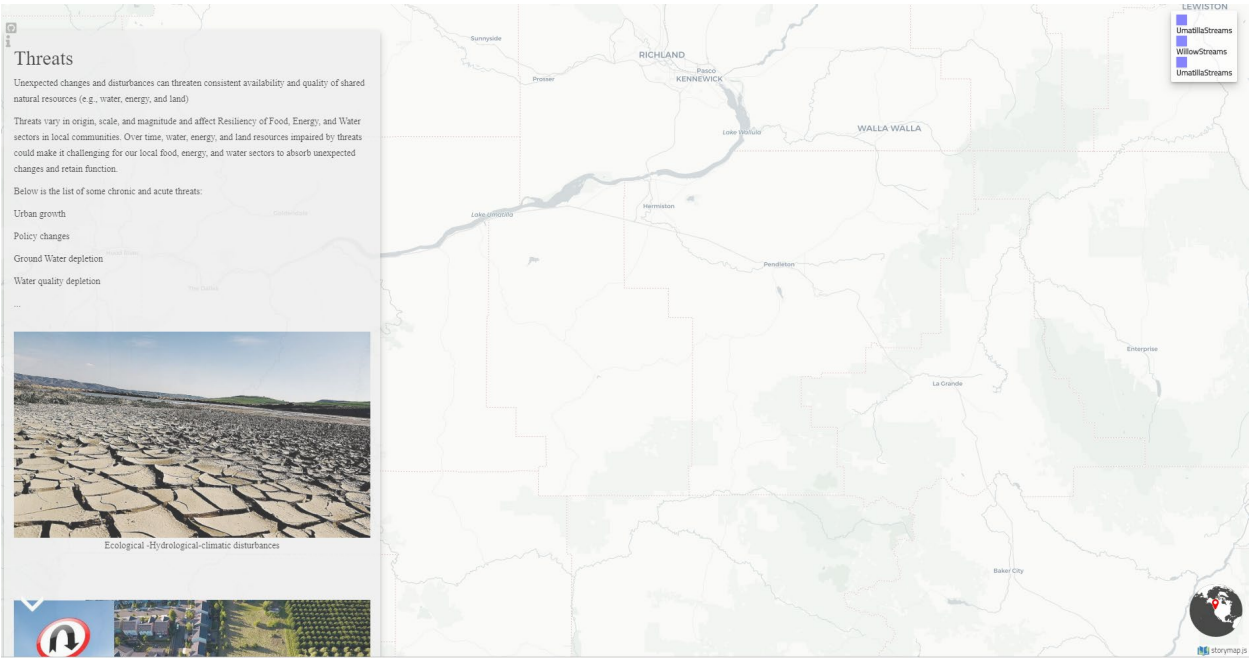
Figure 13. section7

Section 8: Threats

```
<section data-scene="Threats">
    <h2>Threats</h2>
    <p>Unexpected changes and disturbances can threaten consistent availability and
quality of shared natural resources (e.g., water, energy, and land) </p>
    <p>Threats vary in origin, scale, and magnitude and affect Resiliency of Food,
Energy, and Water sectors in local communities. Over time, water,
        energy, and land resources impaired by threats could make it challenging for
our local food, energy, and water sectors to absorb unexpected changes and retain
function.
    </p>
    <p>Below is the list of some chronic and acute threats:</p>
    <p>Urban growth</p>
    <p>Policy changes</p>
    <p>Ground Water depletion</p>
    <p>Water quality depletion </p>
    <p>...</p>
    <p></p>


    <br/>
    <img src="img/Drought_land.jpg" class="img-responsive" alt="responsive image" alt-
text="colombiaBasin"  >
```

```
    <p style="text-align: center">Ecological -Hydrological-climatic disturbances
    </p>
    <br/><br/>
    <br/>
    <img src="img/policychange.jpg" class="img-responsive" alt="responsive image" alt-
text="colombiaBasin" >
    <p style="text-align: center">Socio-economic changes

    </p>
    <br/><br/>

    <p></p>
</section>
```

Figure 14. section8



Section 9: Strategy

This section talks about adaptation strategies and in the map section all the layers was showed and also a learning video from YouTube about InterACTWEL was added to the story map.

```
<section data-scene="Strategy">
    <h2>Adoptation Strategy</h2>
    <p>
        How can we increase the capability of communities to visualize food, energy,
and water interdependencies over space and over time to create
        proactive planning strategies that engage all stakeholders and all sectors in
together developing solutions?
    </p>
    <p>
        How do we stop the day by day and sometimes even minute to minute chase for
water, energy, and food efficiency and help these communities
```

think about long term systemic changes to the critical natural resources and even use prior knowledge to fuel all of the solutions.

InterACTWEL is a computer-aided decision support system that is being developed to empower land, energy, and water managers and even food
producers to envision and plan towards a resilient future for their local communities.

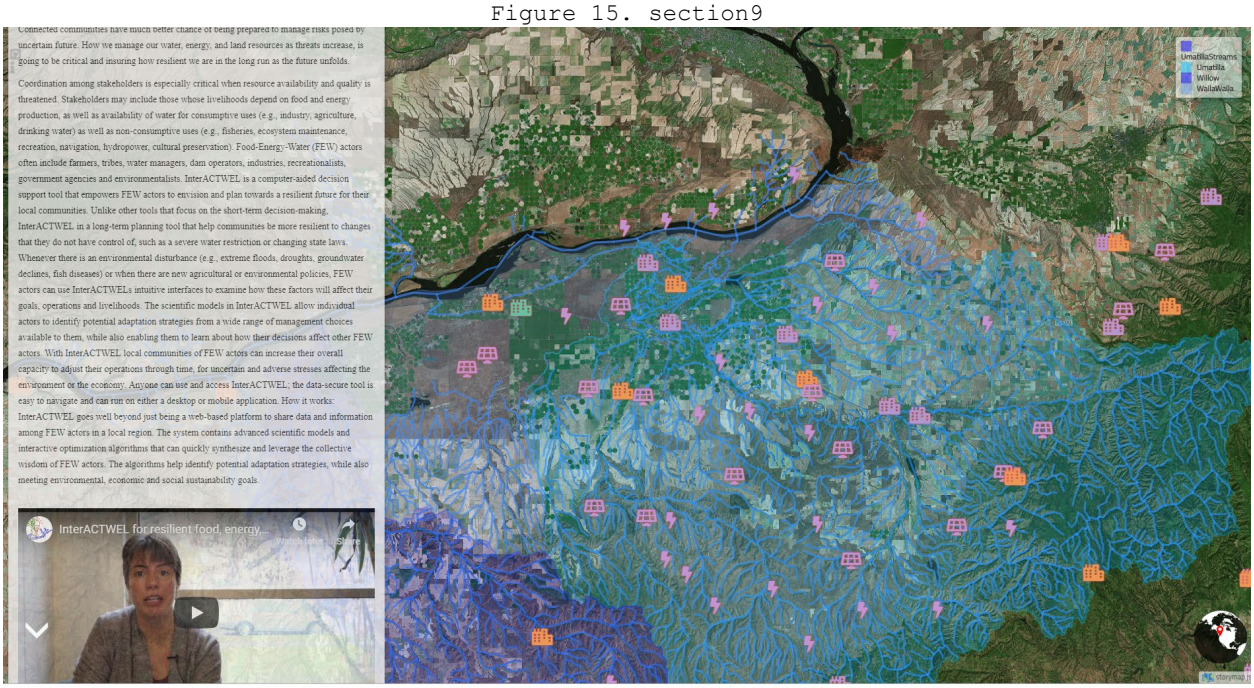
The decision support system is being designed to help local communities plan for range of environmental disturbances for example extreme
floods, droughts, ground water declines, and even changes to agricultural or environmental policies.

Connected communities have much better chance of being prepared to manage risks posed by uncertain future. How we manage our water,
energy, and land resources as threats increase, is going to be critical and insuring how resilient we are in the long run as the future unfolds.

 Coordination among stakeholders is especially
critical when resource availability and quality is threatened. Stakeholders may include those whose
livelihoods depend on food and energy production, as well as availability of water for consumptive
uses (e.g., industry, agriculture, drinking water) as well as non-consumptive uses (e.g., fisheries,
ecosystem maintenance, recreation, navigation, hydropower, cultural preservation). Food-Energy-Water
(FEW) actors often include farmers, tribes, water managers, dam operators, industries, recreationalists,
government agencies and environmentalists. InterACTWEL is a computer-aided decision support tool that
empowers FEW actors to envision and plan towards a resilient future for their local communities. Unlike
other tools that focus on the short-term decision-making, InterACTWEL in a long-term planning tool that
help communities be more resilient to changes that they do not have control of, such as a severe water
restriction or changing state laws. Whenever there is an environmental disturbance (e.g., extreme floods,
droughts, groundwater declines, fish diseases) or when there are new agricultural or environmental policies,
FEW actors can use InterACTWELs intuitive interfaces to examine how these factors will affect their goals,
operations and livelihoods. The scientific models in InterACTWEL allow individual actors to identify
potential adaptation strategies from a wide range of management choices available to them, while also
enabling them to learn about how their decisions affect other FEW actors. With InterACTWEL local communities
of FEW actors can increase their overall capacity to adjust their operations through time, for uncertain
and adverse stresses affecting the environment or the economy. Anyone can use and access InterACTWEL; the
data-secure tool is easy to navigate and can run on either a desktop or mobile application. How it works:
InterACTWEL goes well beyond just being a web-based platform to share data and information among FEW actors
in a local region. The system contains advanced scientific models and interactive optimization algorithms

```
        that can quickly synthesize and leverage the collective wisdom of FEW actors.
The algorithms help identify
        potential adaptation strategies, while also meeting environmental, economic
and social sustainability goals. </p>
    <br/>
    <!--<video controls width="540px" class="embeded-photo">-->
        <!--&lt;!&ndash;<source src="img/interactwel.mp4" />&ndash;&gt;-->
        <!--<source src="https://www.youtube.com/embed/os5Id_58rf4" />-->
    <!--</video>-->
    <iframe width="540" height="315" src="https://www.youtube.com/embed/os5Id_58rf4"
frameborder="0" allow="accelerometer; autoplay; encrypted-media; gyroscope; picture-
in-picture" allowfullscreen></iframe>

    <p></p>
</section>
```

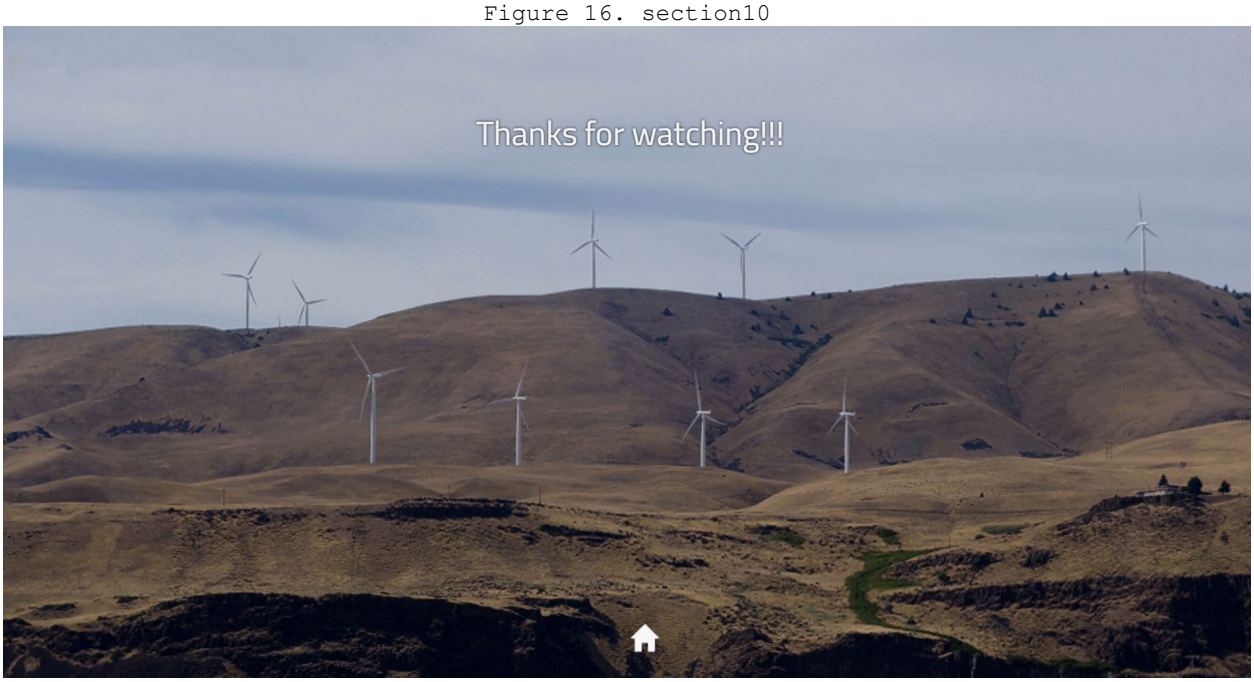
Figure 15. section9



Section 10: End

```
<section data-scene="end" data-background="img/cluster/wind.gif">
    <div class="fullscreen text-center">
        <br/>
        <h1 class="">Thanks for watching!!!</h1>
        <h1>

        </h1>
    </div>
</section>
```

Figure 16. section10



Scenes:

In continue all the scenes including the data layers and tile layers will define

```
var scenes = {
    overview: {lat: 44.0000000, lng: -123.5000000, zoom: 7, name: 'Cover Page'},
    Umatilla0: {lat: 45.74006, lng:  -120.1795, zoom: 4, name: 'Umatilla0', layers:
['ESRI2', 'UWWBasin']},
    Umatilla: {lat: 43.74006, lng:  -121.0795, zoom: 7, name: 'Umatilla', layers:
['umat', 'Willow', 'WallaWalla']},
    Umatilla2: {lat: 45.74006, lng:  -119.0795, zoom: 10, name: 'Umatilla2', layers:
['Umatilla', 'Willow', 'WallaWalla']},
    FEWNexus: {lat: 45.74006, lng: -119.0795, zoom: 11, name: 'FEWNexus', layers:
['ESRI','FoodPro']},
    Food: {lat: 45.842206, lng: -119.2924395, zoom: 10, name: 'Food', layers:
['ESRI','PhotoLayers1','FoodPro']},
    Energy: {lat: 45.896365,  lng: -119.709961, zoom: 10, name: 'Energy', layers:
['PhotoLayers2','energy','solar']},
    Water: {lat: 45.74006, lng: -119.0795, zoom: 9, name: 'Water', layers: [
'satellite','PhotoLayers3' ,'umatillastreams' ,'willowstreams', 'River']},
    Threats: {lat: 45.74006, lng: -119.0795, zoom: 7, name: 'Threats', layers:
```

```
['counties', 'GEE']},
    Strategy: {lat: 45.83006, lng: -119.3795, zoom: 12, name: 'Threats', layers:
['ESRI','River','FoodPro','energy','solar','umat', 'Willow', 'WallaWalla']},
    end: {lat: 45.74006, lng: -119.0795, zoom: 7, name: 'The End'}
};
```

Story map elements:

In this section you can manipulate some of the element of the story map

```
$('#storymap').storymap({
    scenes: scenes,
    layers: layers,
    baselayer: layers.cartodb_light,
    legend: true, // if you do not want a legend feature, you can simply not define
the createLegend function.
    credits: "",
    loader: true,
    scalebar: false,
    flyo: true,
    navwidget: true,

    createMap: function () {
        // create a map in the "map" div, set the view to a given place and zoom
        var map = L.map($(".storymap-map")[0], {zoomControl: false, scrollWheelZoom:
true,fadeAnimation: true,
            zoomAnimation: true}).setView([44, -120], 7);

        //add an miniglobe
        new L.Control.GlobeMiniMap({
            marker: 'red',
            position: 'bottomright'
        }).addTo(map);


        return map;
    }
});
```

Results:

All the libraries and the materials of this story map was placed on my GitHub and from below address you can get access to all of them.

https://github.com/farahanimajid/GISProject

Here is the link for opening the storymap. https://farahanimajid.github.io/GISProject/