

# 3rd Digital Mapping Course

## Tutorial: Water-Energy Nexus

Hydropower, considered one of the main energy sources for electricity generation, is a key component of the Water-Energy Nexus. Countries utilize energy diversification strategies, based on their natural resources and landscapes to fulfill the energy demands of the population. In this tutorial you will learn how to develop a StoryMap by using ArcGIS Online public data, improve the visualization of digital features (i.e. polygons and points), apply filters using data relationships, and connect the user experience through social media platforms of a national heritage area and its Water-Energy Nexus.

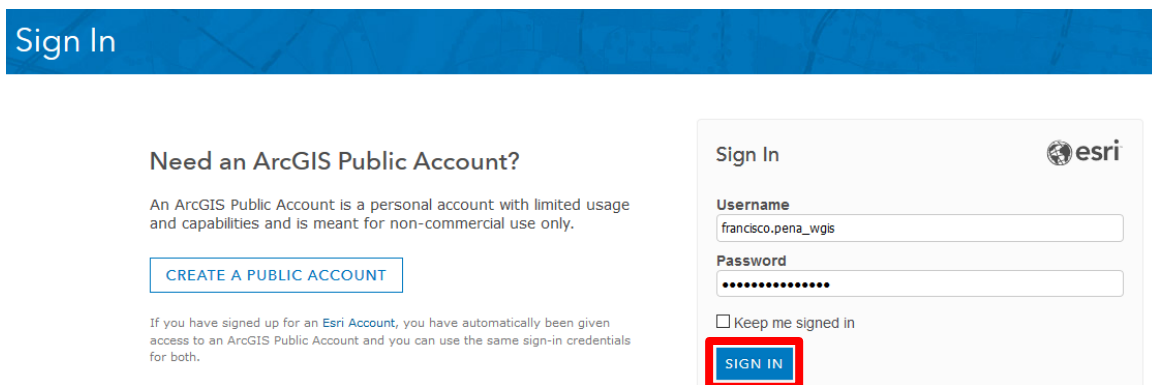
**Goal #1:** Visualize and compare the type and quantity of electricity production worldwide

### Data sources:

- Kapsarc (<http://datasource.kapsarc.org>)
- World Resources Institute (<http://datasets.wri.org/dataset>)

Note: All data presented comes from the above sources and has been postprocessed with the sole purpose to improve the overall quality of the data. In addition, the presented data will make it easier for the user to read the content, improve the visualization of features, and avoid inherent issues that arise when using open data.

1. First, visit the [ArcGIS website](#) and sign in using your credentials




Sign In

Need an ArcGIS Public Account?

An ArcGIS Public Account is a personal account with limited usage and capabilities and is meant for non-commercial use only.

[CREATE A PUBLIC ACCOUNT](#)

If you have signed up for an [Esri Account](#), you have automatically been given access to an ArcGIS Public Account and you can use the same sign-in credentials for both.

Sign In 

Username  
francisco.pena\_wgis

Password  
.....

Keep me signed in

[SIGN IN](#)

2. On the upper menu:

- Click on Map



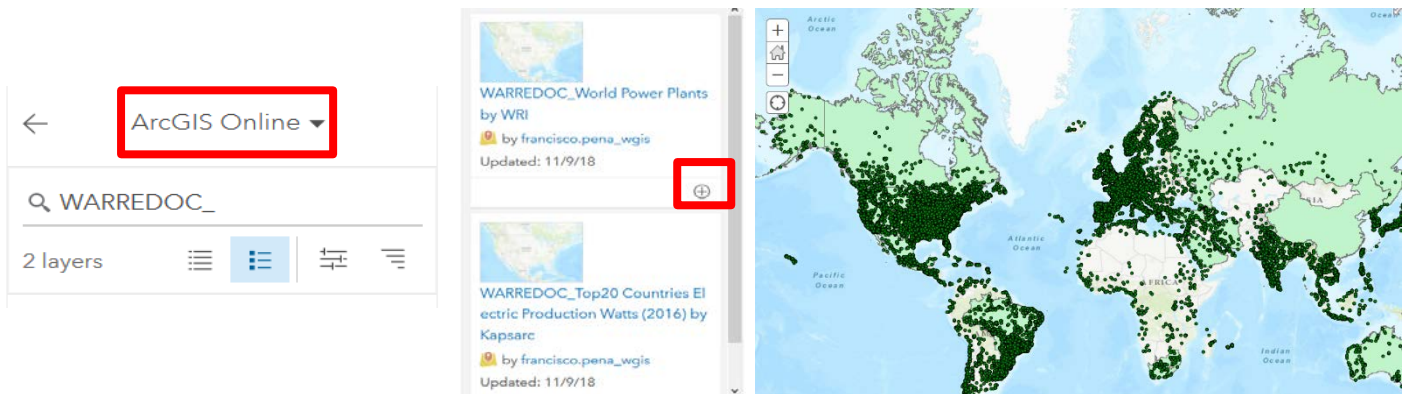
Home Gallery **Map** Scene Groups Content Organization   Francisco ▾

Water Resources Research and Documentation Center  Edit

Overview **Members** Licenses Status Settings

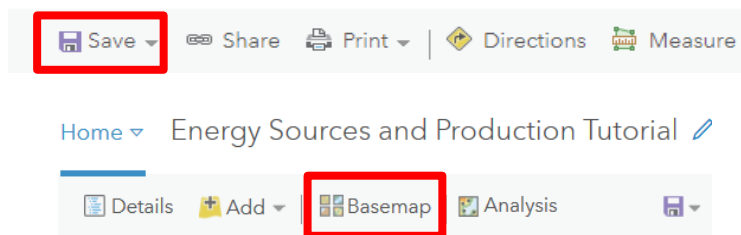
- Add > Search for Layers > ArcGIS Online > Search for the following files:
  - i. WARREDOC\_World Power Plants by WRI (Points)

## ii. WARREDOC\_Top20 Countries Electric Production Watts (2016) by Kapsarc (Polygons)



3. All layers are displayed but are difficult to understand. Before you start developing your map:

- Click on the layer name > more options icon (three points) > change Name (erase Prefix WARREDOC\_)
- Click on basemap > Dark Grey Canvas
- To save the project click on Save > Save as > Energy Sources and Production Tutorial



4. Now open the Attribute Table to check the data and the default selected attribute of the map. We are creating a point-relationship map and a thematic map that uses a range of colors in proportion to values. Do it for each layer:

## World Power Plants by WRI: (Points)

- A total of 25648 power plants are included in the list. We are interested in the type of fuel used to generate electricity and the production capacity
- Change Style > Choose an attribute to show: fuel 1 > Add attribute: Capacity\_m
- Select a drawing style > Types and Size > OK > Done

World Power Plants by WRI

country_lo	name	gppd_idnr	capacity_m	fuel1
Czech Republic	Choustnikovo Hradiště 1 Solar Power Plant	WRI1029523	3	Solar
Czech Republic	Choustnikovo Hradiště 2 Solar Power Plant	WRI1029537	3	Solar
Czech Republic	Chropyně Solar Power Plant	WRI1029748	1.1	Solar



### Top20 Countries Electric Production Watts (2016) by Kapsarc: (Polygons)

- A total of 22 features are part of the layer. We are interested in the country production of watts
- Change Style > Choose an attribute to show: value\_watt
- Select a drawing style > Counts and Amounts (Color) > Options > Classify Data using Natural break with 5 classes
- Change symbols > Green scale
- Transparency > 25% > OK

Top20 Countries Electric Production Watts (2016) by Kapsarc



1

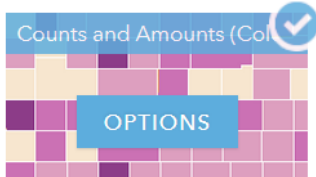
Choose an attribute to show

value\_watt

+ Add attribute

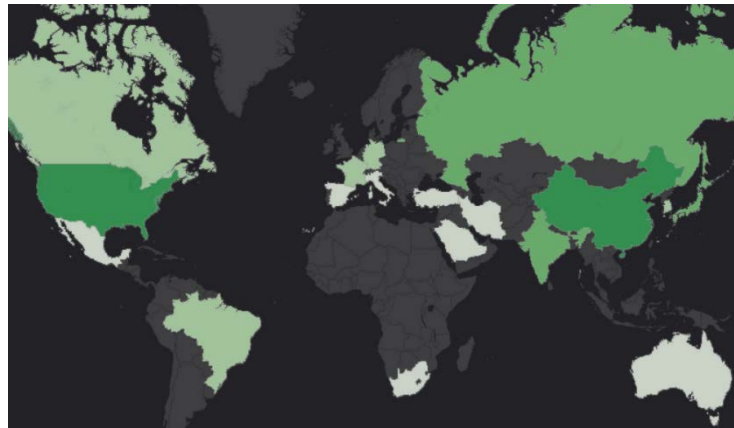
2

Select a drawing style

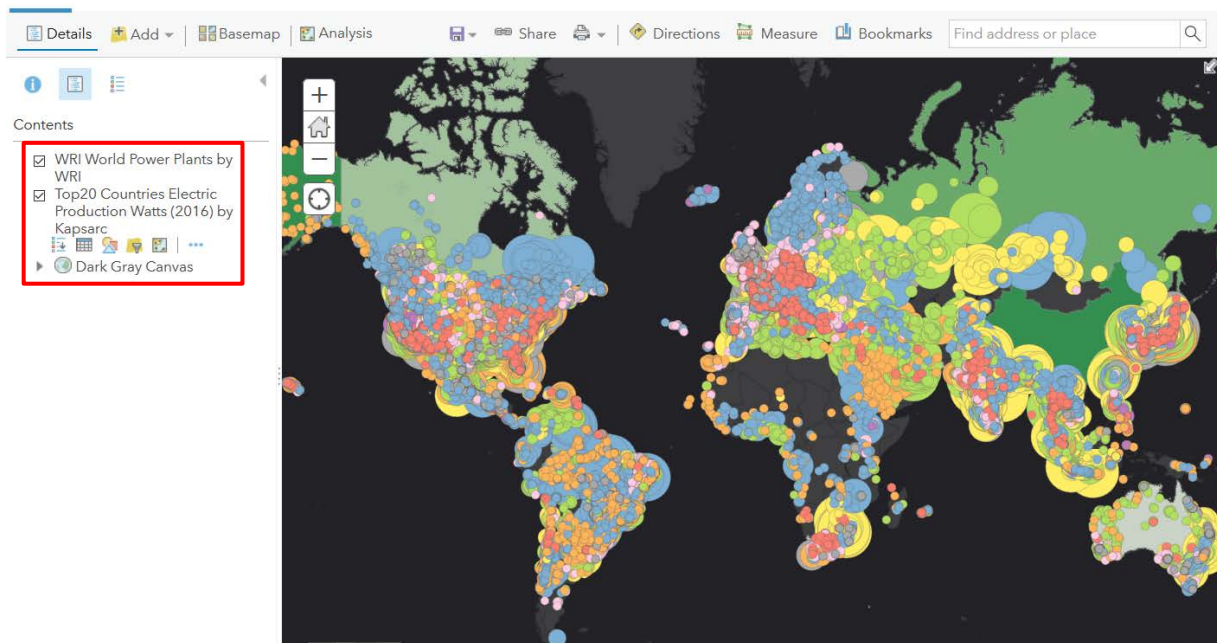


Top20 Countries Electric Production Watts (2016) by Kapsarc (Features: 22, Sele

cartodb_id	year	country	yoy_in_201	global_sha	value_watt
15	2,016	Germany	0	0.0261279333003	648.4
19	2,016	France	-0.0297101918885	0.0222980541305	553.356368913
21	2,016	South Korea	0.00759563369258	0.0222103091938	551.178859642



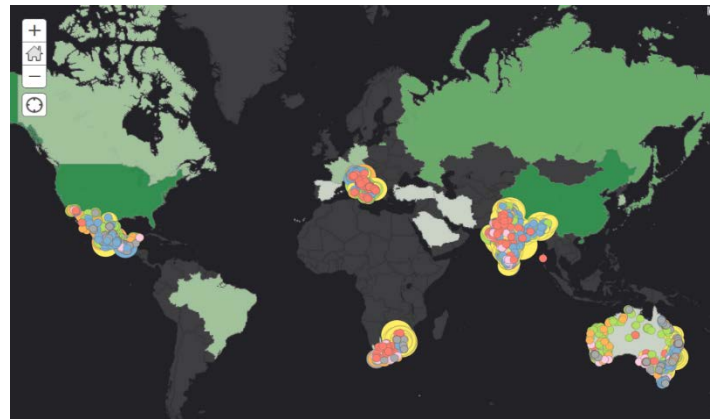
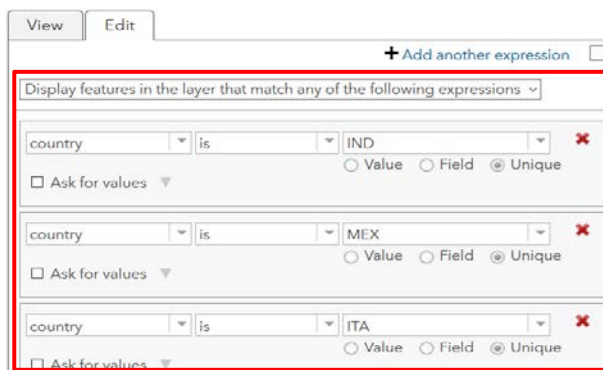
Activate both layers to visualize the updated map:



**Goal #2:** Create two maps to visualize:

- A. The energy production in one country from each continent
  - B. The global water energy nexus on hydropower generation and river streams
5. Both layers are ready, but the amount of features overwhelm the map and it is not clear how electricity is produced in each country. Data filtering is needed to improve the visualization of data. To achieve goal 2A, we will perform an analysis comparison in the following countries: Italy, Mexico, India, Australia and South Africa. To apply filters:
- World Power Plants by WRI > Filter: Display features in the layer that match any of the following expressions
  - 'Country' 'is' 'ITA' > Unique
  - Add another expression > 'Country' 'is' 'MEX'
  - Add another expression > 'Country' 'is' 'IND'
  - Add another expression > 'Country' 'is' 'AUS'
  - Add another expression > 'Country' 'is' 'ZAF' > Apply filter
  - Save Map > Save as: Energy production

Filter: World\_Power\_Plants by WRI



We observe the type of fuel and total energy capacity in each of the abovementioned countries. Don't worry about the overlapped features, the visualization will improve when changing the zoom.

6. You will now create another map to correlate the proximity of hydropower plants and main river streams. To match the mentioned criteria:
  - Save Map > Save as: Water-Energy nexus
  - Content pane > Deactivate World Power Plants by WRI
  - Add > Search for Layers > ArcGIS Online > Rivers World Natural Earth > Add
  - Add > Search for Layers > ArcGIS Online > World Hydropower Power Plants by WRI
    - i. Add > Click on the layer name > more options icon (three points) > change Name (World Hydropower Power Plants)
    - ii. Click Filter > 'FUEL1' 'IS' > Unique > 'HYDRO' > Apply Filters
  - Change Style > Choose an attribute to show: fuel 1 > Select a drawing style: Types and Size > Options > fuel1 Types (Unique symbols) > Click Change symbol • > Fill: Blue > OK > OK
  - Save Map > Save

Filter: World Hydropower Power Plants by WRI

View Edit + Add another expression

Display features in the layer that match the following expression

fuel1 is Hydro

Ask for values  Value  Field  Unique

**APPLY FILTER** **APPLY FILTER AND ZOOM TO**

**1** Choose an attribute to show

fuel1

capacity\_m

This layer has multiple styles.

**2** Select a drawing style

Types and Size

OPTIONS

fuel1

Types (Unique symbols)

OPTIONS

capacity\_m

Counts and Amounts (Size)

OPTIONS

fuel1

Click to edit symbol or label.

LABEL	COUNT
Hydro	6049

fuel1

Click to edit symbol or label.

LABEL	COUNT
Hydro	6049

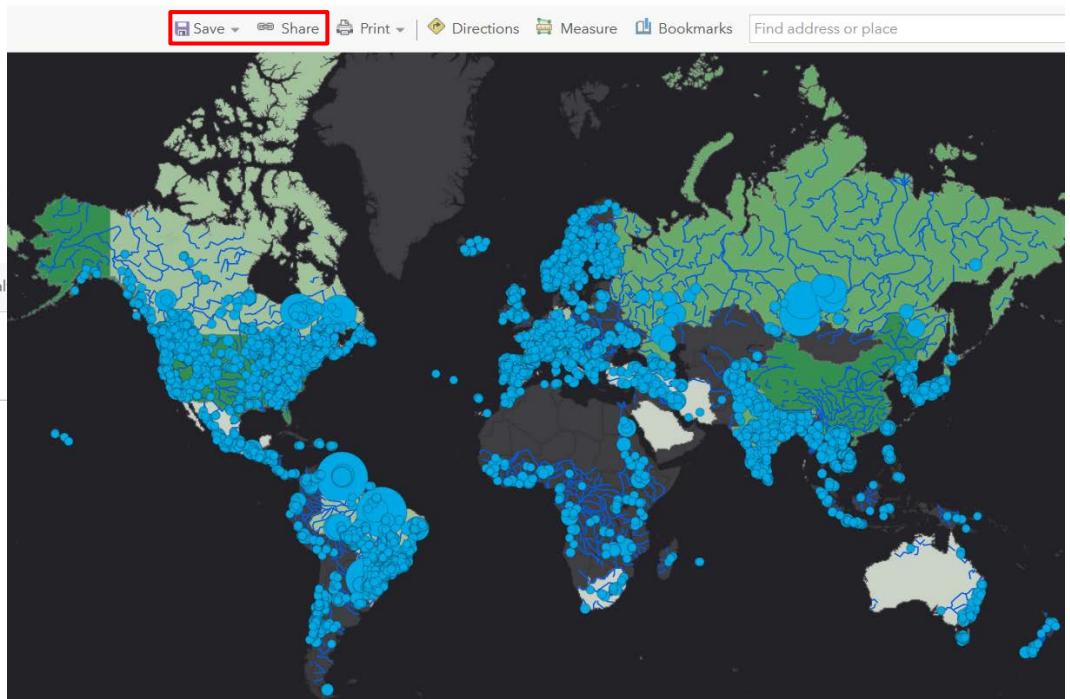
Home ▾ Water-Energy Nexus

Details Add ▾ Basemap Anal

About Content Legend

Contents

- World Hydropower Power Plants by WRI
- Rivers World Natural Earth
- World Power Plants by WRI
- Top20 Countries Electric Production Watts (2016) by Kapsarc
- Dark Gray Canvas

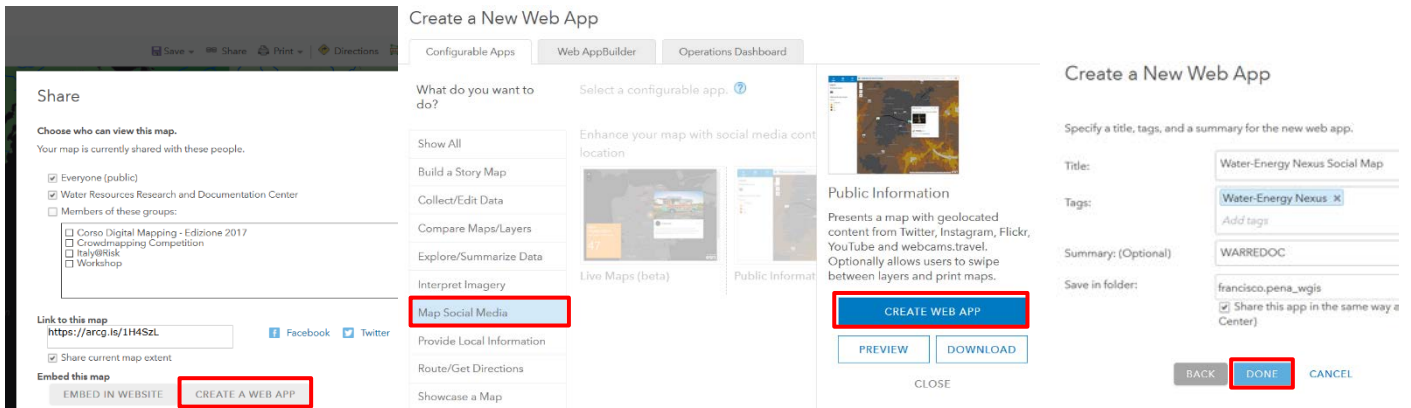


**Goal #3: Create a Social Media App**

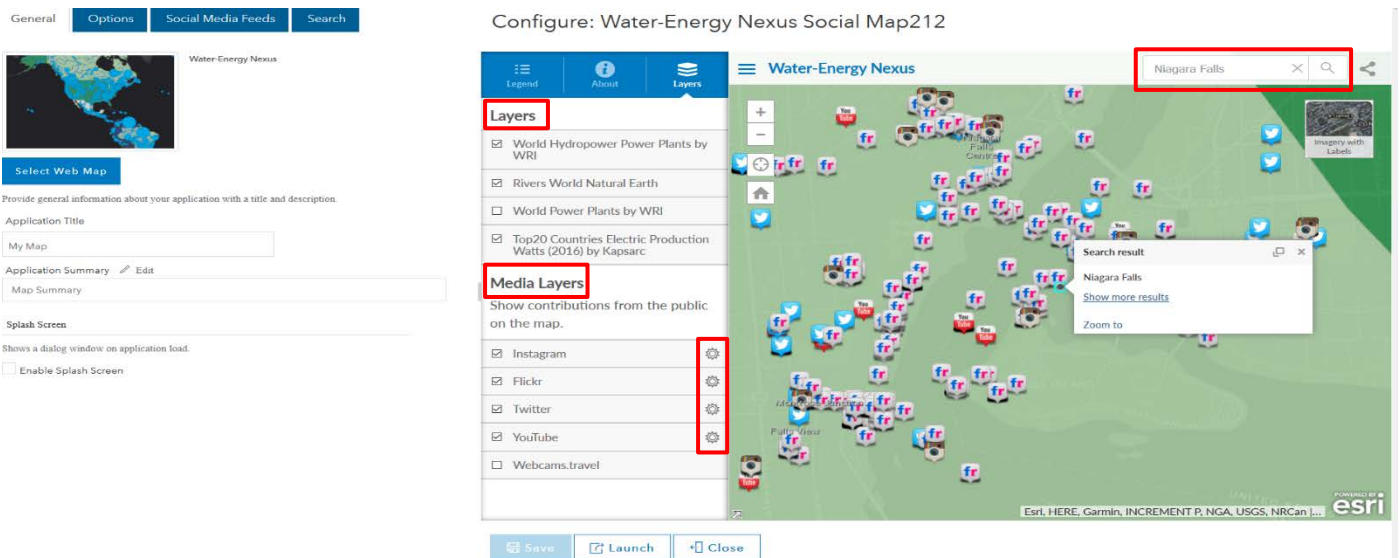
While the integration of open big data in digital maps is the cornerstone for spatial analysis and location intelligence (to understand natural and anthropic processes), the perception of locations, activities and experiences are broadened with the use of social media content. The selection of keywords provide a more precise understanding of anticipated, expected and unexpected human behaviors related to your search.

7. To incorporate social media content into the map:

- Share < Share with everyone < Create a Web App < Map Social Media < Public Information < Create App
- Title: Water-Energy Nexus Social Map
- Tags and Summary: As desired < DONE

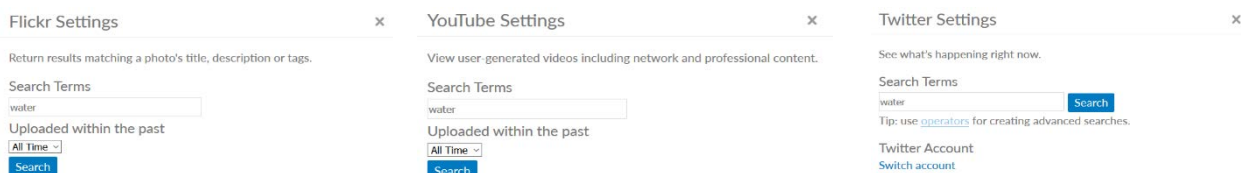


8. The web app pane will appear on the right side of the screen, which displays three tabs:
- The Legend provides the name and colors of each layers represented in the map
  - The About tab includes the name of the project, last edition and additional information
  - Layers is subdivided into two parts. The first one includes all shapefiles from the Water-Nexus Map and the second layers provide a list of social media platforms such as Flickr, Twitter and YouTube. Go to the search bar and write 'Niagara Falls', then activate all media layers



**Note: Some social media platforms may request login verification to access and visualize the content**

9. Click on the settings tool and write the keyword 'water' in each media layer.



10. Click on Share to get the map link. You will use this link to connect the social media component with the StoryMap.

The map should look like this:



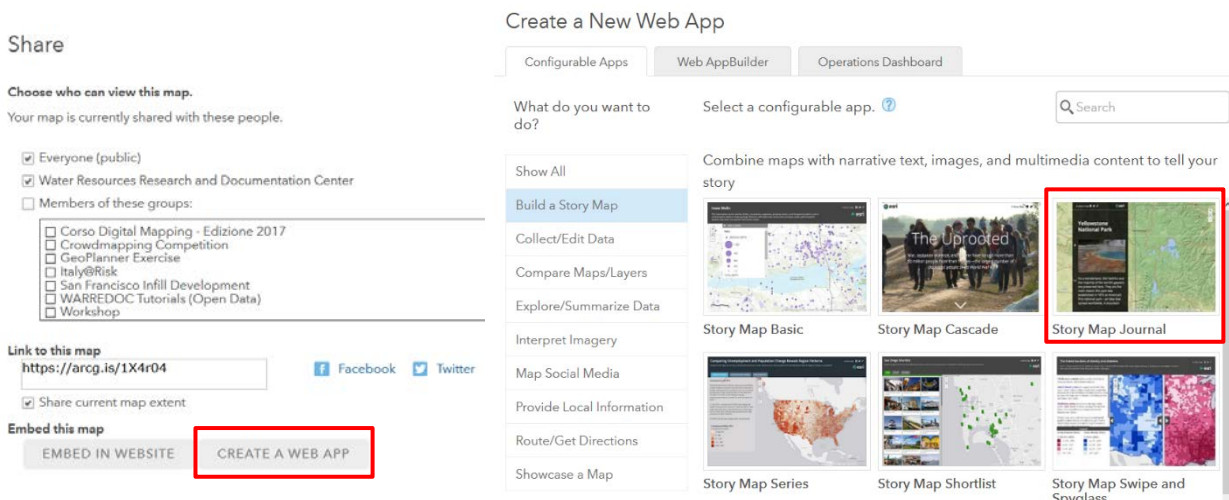
### Goal #4: Create a Story Map

The resulting maps are rich in content, self-explanatory to the audience and provide preliminary conclusions:

- **Russia** is considered one of the top 20 energy producers in the world but has low hydropower production based on the main rivers and total land surface in comparison to **Switzerland**.
- The geographical resources and climate conditions of **Saudi Arabia** are not suitable for hydropower generation.
- **Brazil** hydropower generation is considerably high, thanks to the river Amazonas and the Iguacu waterfalls.

11. The integration of multiple open data layers in digital maps can result in rich content stories that provide additional value to your work at the geographic context. These results can answer complex questions and visualize new trends. Now you can incorporate text, media content and the human experience to your story. To create a Story Map:

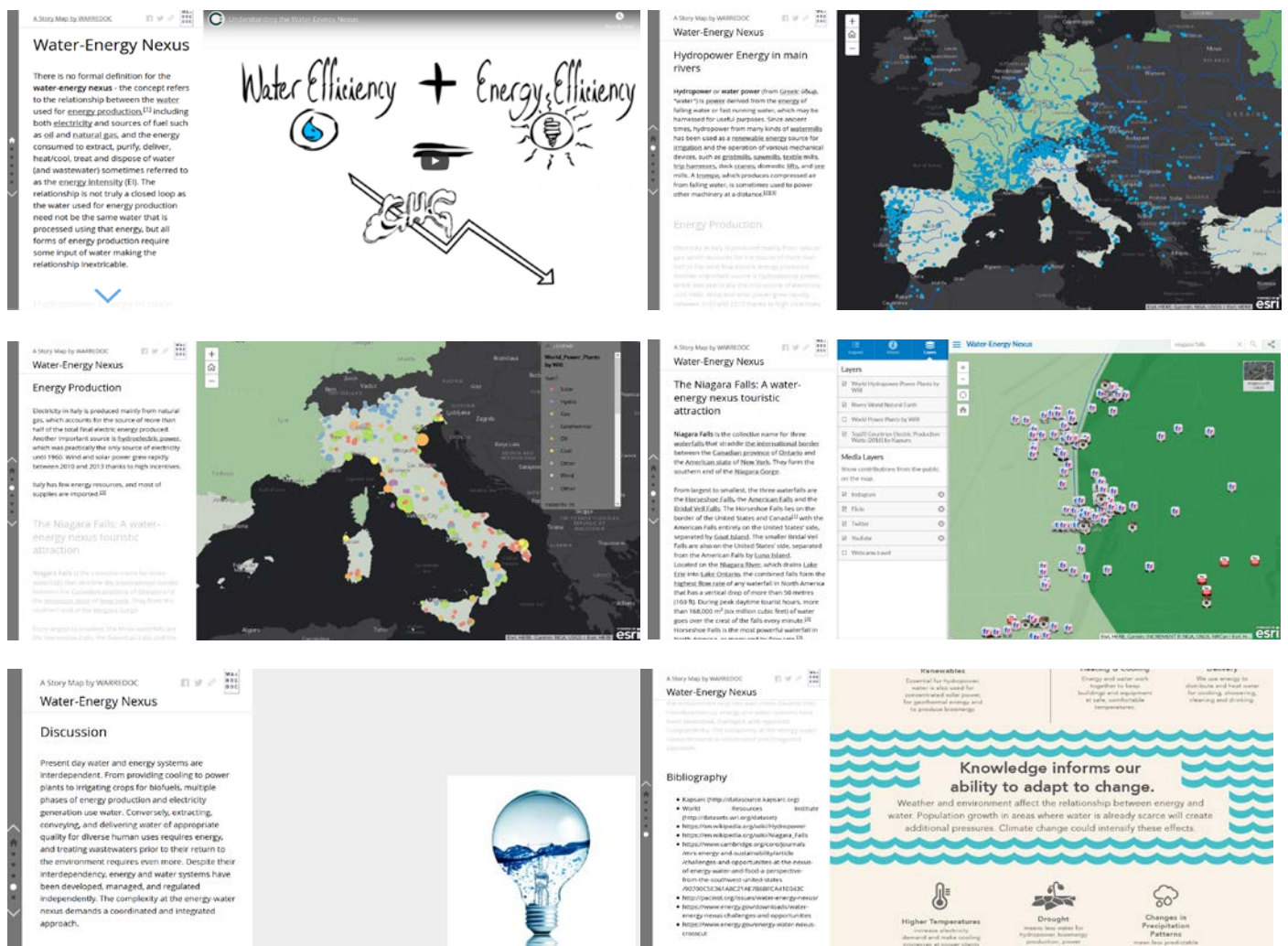
- Share > Everyone (public) > Create a Web App > Build a Story Map > Story Map Journal > Create Web App > Title: Water-Energy Nexus > Fill the Tags and Summary > DONE
- Select Side Panel



12. According to the 3rd Digital Mapping Terms and Conditions, the map must comply with the following requirements:

- **Introduction (1 page):** Select a video that best describes the topic and write a brief introduction
- **GIS section (2 page):** Create two maps to display the connection between water and energy (at the local, national, regional or continental scale)
- **Human experience (1 page):** Integrate the user experience into your map by adding social media content (using keywords and hashtags) to obtain meaningful insights on human behavior
- **Discussion and References (2 pages):** Create a brief summary of your main points and also include a bibliography

The following illustrates the potential outcome of a well-developed StoryMap:



Have a look at the StoryMap: [Water-Energy Nexus](#)

**Congratulations!**

**You have successfully completed this tutorial.**