Thailand's Rescue Cave Miracle
A race against time

On June 23, 2018 twelve boys between 11 and 17 years of age and their coach entered the Tham Luang cave to explore. The team was trapped in the cave by continuous rainfall. They were found and rescued by an international team that involved 100 divers and many countries. They were found on July 2 and were finally all rescued on July 11, 2018.
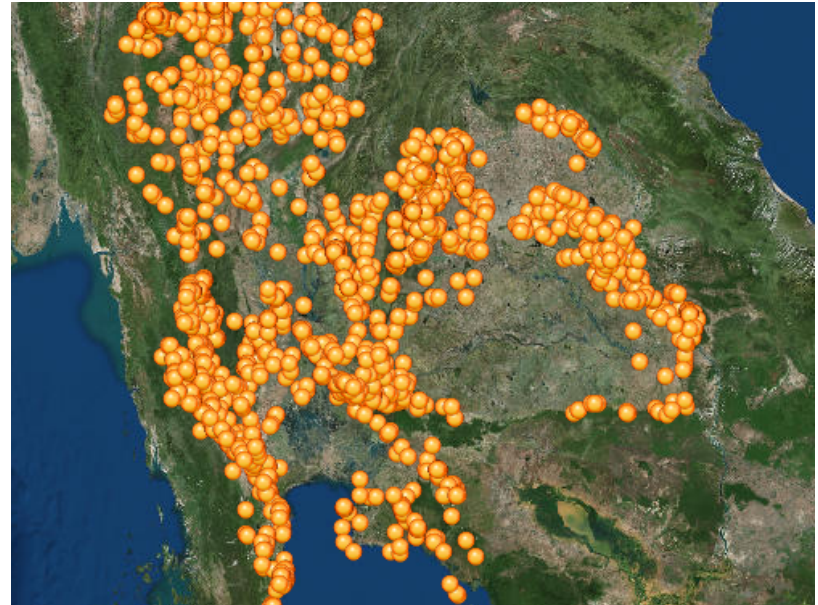

Build skills in these areas

▸ Select by attribute

▸ Create bookmarks

▸ Configure pop-ups

▸ Search for data

▸ Filter

What you need

▸ An ArcGIS Online organizational account

▸ Estimated time: under 30 minutes

Scenario

The International Community needs maps to describe the location of the caves and the rescue to inform the public. They have hired you to construct the maps.

Teacher Resources

Youtube Video: Thailand Cave Rescue: ABC New (Australia)

Hands-on Lab: Sinkholes in a Cup

National Spelelogical Society

National Geographic Caves

Make a map: Identify Thailand

1. Go to ArcGIS Online and sign into your Organizational Account.
2. Click Map on the top ribbon.
3. Click content under Details.
4. Go to Add >> Search for Layers >> ArcGIS Online and search for World Countries (Generalized).
5. Click the plus in the lower right corner to add the layer to the map.
6. Click the back arrow to return to the contents pane.
7. Click the three dots at the end of the World Countries and Zoom to layer.
8. In the upper right corner type Thailand and hit return.
9. Click Add to Map Notes.
10. In the Content Pane click on the three dots at the end of Map Notes.
11. Name the Map Notes: Thailand
12. On the top ribbon click Save.
13. Add the appropriate metadata to the map:

    Title: Thailand Rescue_your initials

    Tags: your individualized tags

    Summary: A spatial presentation of the Thailand Cave Rescue.
14. Save Map.

Identify International Help

The following countries helped in the rescue: Australia, China, Japan, Laos, Myanmar, United Kingdom, and the United States. Your job is to make a map showing the location of these countries.

1. Click Filter under World Countries.
2. Create the expression: country is Australia
3. Add expression.
4. Create the expression: Country is China
5. Continue adding expressions until all seven countries have been selected.
6. Select the tab that says: "Display features in the layer that match any of the following expressions".
7. Click APPLY FILTER.

8. Click the three dots at the end of World Countries and rename the layer: "International Help".
9. On the top ribbon to the left of the search tab, click on the Bookmark Tab.
10. Add a bookmark and name it "International Help".
11. Click Save on the top ribbon.
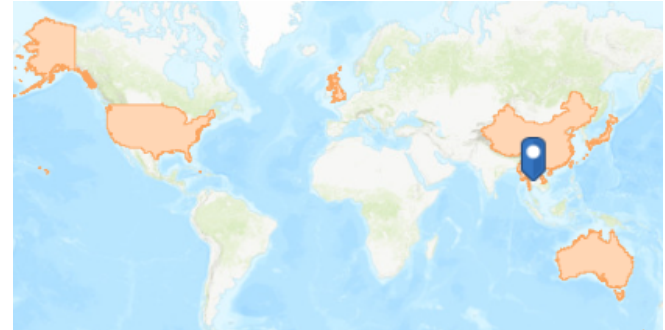
Make a map: Identify Thailand

Karst is defined as a type of landscape formed by the dissolving of soluble rock such as limestone, dolomite, and gypsum. The karst layer used in this exercise shows the percent of each ecoregion that contains karst. Karst area generally reflects the distribution of karst cave systems. The data set was derived by the Nature Conservancy.

1. Go to Add >> Search for Layers >> Living Atlas.
2. Search for Karst.
3. Add **Percent Karst Area**. Click on the layer to expose the legend.

   Notice that the karst layer is categorized by different colors to show the percentages of land that is karst.

4. Click the back arrow to return to the Contents Pane.
5. Click Filter under Percent Karst Area.
6. Filter the karst layer for the most percentage which is 97.1467%.
   Expression should be: Karst_pct is 97.1467
7. Apply Filter

8. Zoom to the area that has the most karst % in the world.

    Q: What boundary has the most karst % in the world?

9. Change the basemap from topographic to imagery.

    Q: What features do you see in the imagery that would be an indication of karst?

    Change the basemap back to topographic.

10. Filter the karst layer that greater than 41.028 (this means that more of the area contains karst).

11. Expression should be: Karst_pct is greater than 41.028

    The map is now showing areas that have a karst % of more than 41.028

    A province is an administrative division of a country. It is the same thing as a state. The province where the cave is located is CHIANG RAI.

12. Go to Add >> Search for Layers >> ArcGIS Online and search for thailand_provinces by Kathryn_Karanen_LearnArcGIS.

13. Click the + to Add to the map.

14. Click the back arrow to return to the Content Pane.

15. Click Filter under the Thailand Province layer and use the expression:
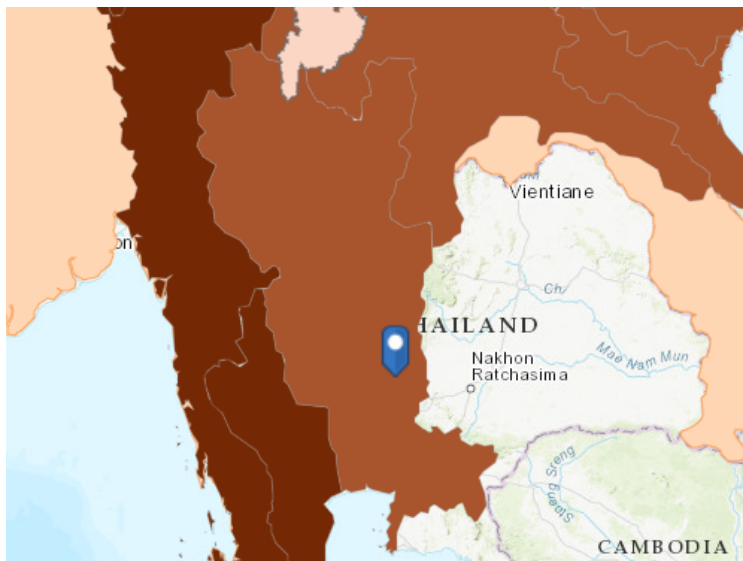
    Name is Chiang Rai

16. Apply Filter.

    This isolates the Chiang Rai province.

    Q: Is the province of Chiang Rai located in a high karst percentage area?

17. Go to the top ribbon and bookmark this view. Name the bookmark Chiang Rai province.

1. Go to Add >> Search for Layers >> ArcGIS Online >> thailand_caves by Learn ArcGIS.
2. Add thailand_caves.

   Q: Is there any correlation between the karst and the amount of caves?

3. Click Change Style under thailand_caves.
4. SELECT Head Map.

   Heat maps are used to map the location of point features. They are useful when many points on the map are close together or overlapping. In ArcGIS Online this heat map produced is scalable.

5. Uncheck the Percent Karst Area.
6. Change the basemap to imagery with labels.

   Q: Name some locations that have high concentrations of caves.

   Q. What is a scalable map?
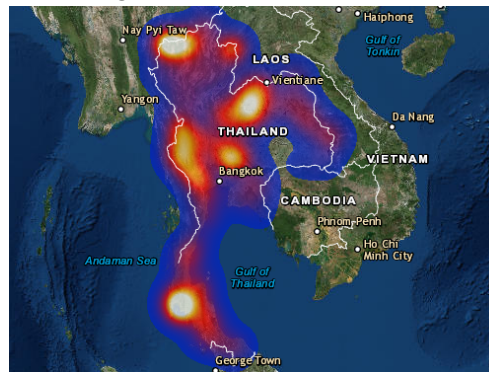
7. Filter the caves using the expression: Name starts with CR0003.
   The name of the cave is Tham Luang.

8. Apply Filter.
9. Click Change Style under Caves.
10. Click Options.
11. Click Symbols and pick a symbol of your choice and make it larger.
12. Click OK.
13. Zoom to the cave.
14. Uncheck International Help, Percent Karst Area, and Thailand Provinces.
15. Change the basemap to imagery.
16. Create a bookmark called Cave.

    Q: Describe the landscape around the cave.

Different Symbolization of Thailand Caves

Thailand Cave Symbolization

Above is a story map that shows four different types of symbolization.

Locations show the caves as stationary points.

A heat map is a scalable map that takes into consideratioin if points are on top of each other.

Clustering is used with a large number of points to extract information from your data.
It is applied at multiple scales which means as you zoom out, more points are aggregated into fewer groups, while zooming in creates more cluster groups.

Hex bins are used to summarize point data into equal sized connected hexagons. By using hexagon you can make the actual x, y location of the point private which is good for sensitive material such as the actual cave locations.

Q. Click on each of the tabs and investigate the different types of classification. You have already constructed a locational map and a heat map.l
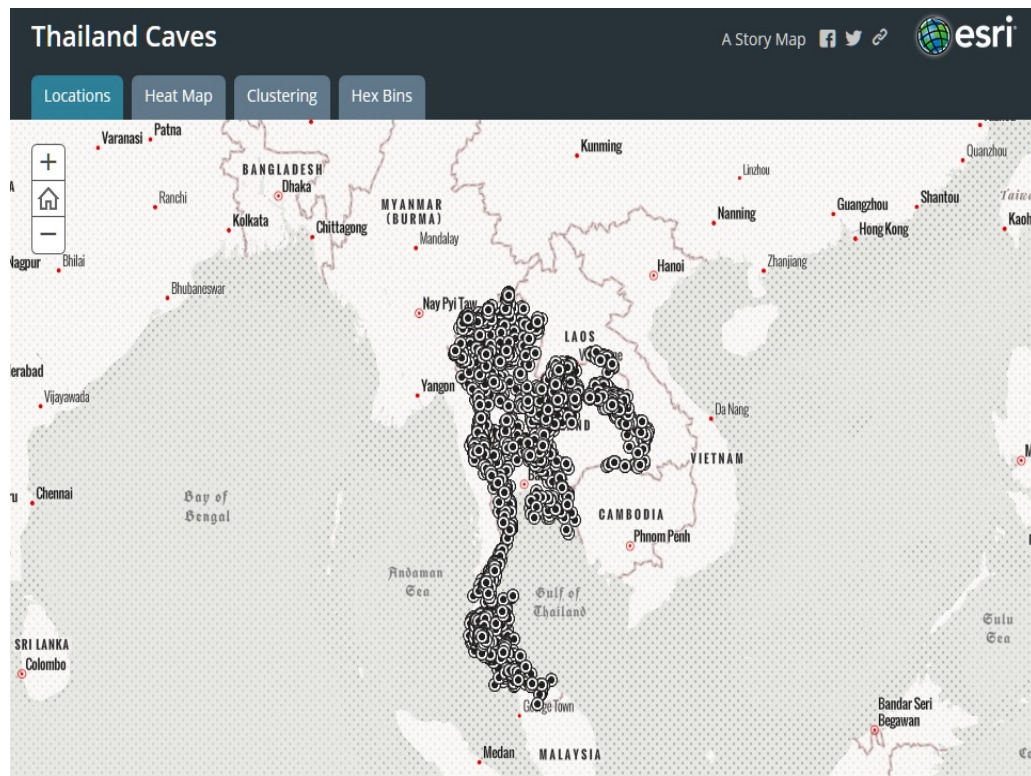
1. Go to Add << Search for Layers >> ArcGIS Online.
2. Search for learn_thailand.
3. Add learn_thailand to the map.
4. Click the back arrow to return to the content pane.

   Notice the entrance of the cave.

5. In the locate tab type: 99.8578044,20.3780681
6. Add a Map Note.
7. Name the Map Note: Pattaya Beach and change the symbol.
This is where the rescue crew hoped to find the boys .
8. In the locate tab type: 99.8575364,20.3767639
9. Name the Map Note: BOYS and change the symbol.

The boys and their coach were found on a ledge.

10. Make a bookmark and name it: Inside the Cave.
11. Save.
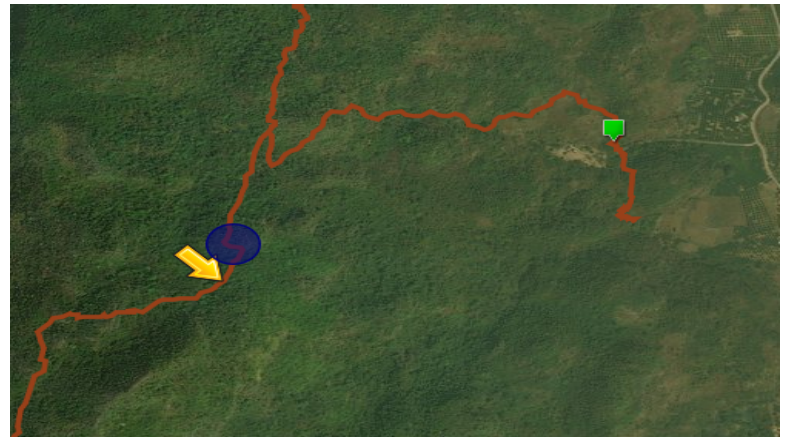
In this lesson you have created a series of world, regional, and local maps to show the location of the Tham Luang Cave.