Exercise 1: Finding the Best Locations and Paths: Cougar Habitat

Instructions
Use this guide and ArcGIS Online to reproduce the results of this exercise on your own.

Note: ArcGIS Online is a dynamic mapping solution. The screenshot graphics that you see in course materials may differ slightly from the version of ArcGIS Online that you will use.

Introduction

This exercise presents an opportunity to apply the spatial analysis approach to identify areas that are suitable cougar habitats. Although the data is real, the scenario, analysis, and resulting decisions are hypothetical. The purpose of this exercise is to show how you can use GIS to perform overlay analysis and derive new locations from a set of layers representing various criteria.

Scenario

The state of Oregon, located in the United States, has seen an increased cougar population over recent years. State park officials have decided to study cougar populations in and around the park. The first phase of the study will entail mapping potential cougar habitat. The state's Department of Fish and Wildlife (DFW) is already working on cougar habitat mapping projects in other parts of the state. The two agencies form a technical committee to manage the study.

DFW has been using suitability analysis for its other habitat studies. For consistency, committee members decide to use the same approach for the current study. In suitability analysis, criteria are specified for what makes an area suitable for a particular use. Criteria are often based on firsthand experience, expert knowledge (including published studies), or industry standards. Map layers representing the various criteria are overlaid, and the result is a new layer containing areas that meet all the criteria.

Wildlife experts on the committee will define the specific criteria for the study area (for example, the distance that constitutes "near" a stream). The experts from DFW have general knowledge of cougar habitat across the state. Park staff know more about the local terrain and forest types. To facilitate discussions, the experts will view maps with layers representing each of the criteria.

For the purposes of this exercise, imagine that you are a GIS analyst working on behalf of the committee. You have been tasked with assembling the data and performing the GIS analysis to answer the following question.

Where is suitable cougar habitat?

DFW has based its analysis on studies linking cougar populations with factors like terrain, vegetation, proximity to water, and proximity to highways.

What information do I need to address this question?

For this exercise, you will answer the following questions to determine where is suitable cougar habitat.

- Where are the limits of the study area?
- Where are areas with steep, forested slopes located near streams but away from highways or major roads?
- How many potential locations within or near the national forest meet these criteria?

Note: This example provides a starting point. In the real world, an analysis like this would likely involve more factors and criteria.

Technical notes

1. You will make full use of web mapping services throughout this course. You will need a robust web connection to complete this exercise and the exercises that follow.
2. Use the latest version of Google Chrome or Microsoft Edge. Other web browsers may not display your maps and apps correctly.

   Note: For information on supported web browsers, see ArcGIS Online Help: Supported browsers (https://esriurl.com/browsers).

Estimated completion time: Approximately 60-90 minutes

- Step 1: Open the map

You will begin with step two of the spatial analysis approach, explore and prepare the data. For this exercise, the initial map has already been created and shows the state park and the national forest areas.

Before opening the map, you will sign into ArcGIS Online.

a Open a new private or incognito web browser tab or window.

To help prevent confusion between your ArcGIS Online accounts, we recommend that you open a private or incognito web browser window for all course work.

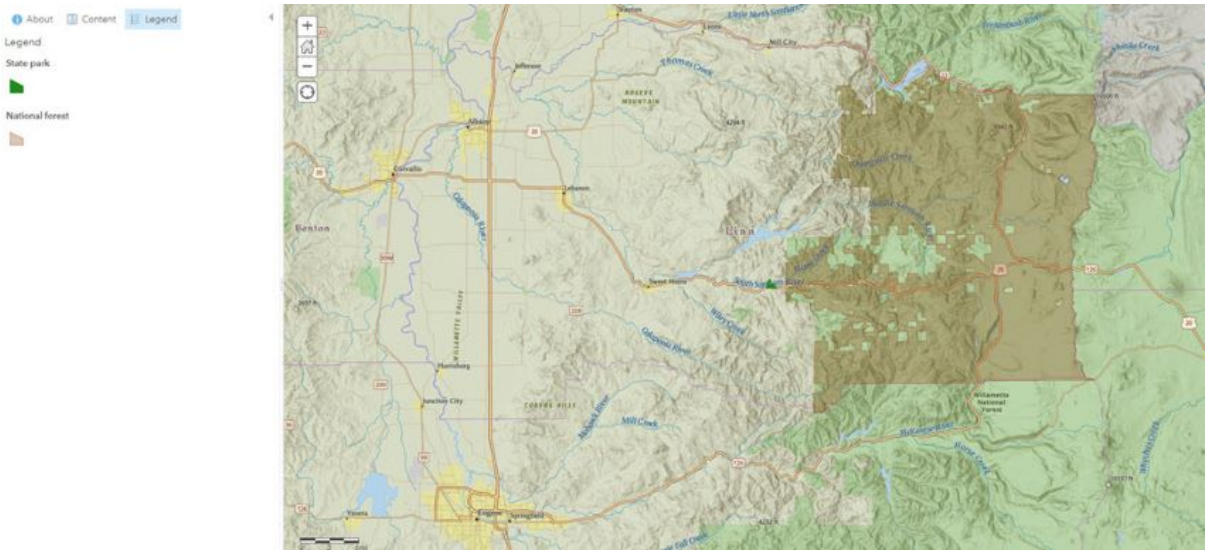
b In your private or incognito web browser window, go to https://www.arcgis.com/home/item.html?id=4a0f3248b667417a9d9727805a8713a5 (https://esriurl.com/Sec4Map).

c On the top right of the page, click Sign In.

d Sign in to ArcGIS Online using your course ArcGIS credentials.

Note: Section 1, Exercise 1 explains how to determine your course ArcGIS credentials (username and password). If you have trouble signing in, please refer to the Common Questions list on the course Help tab.

e Click the thumbnail image to open the map.



Step 1e: Open the map.

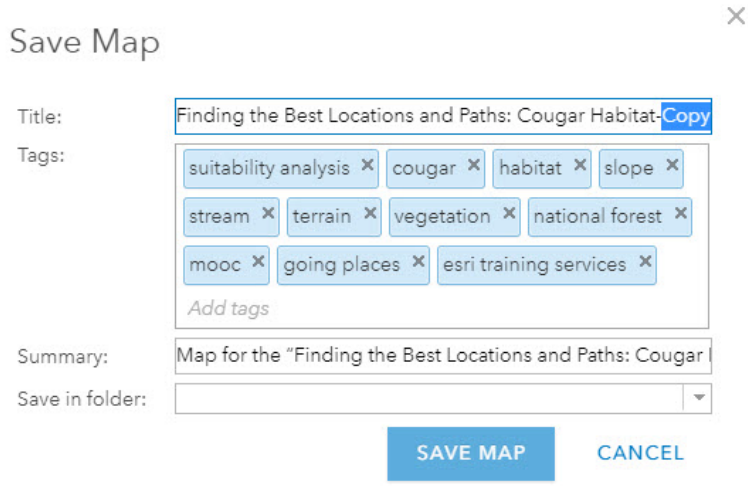
A map of the area of interest (https://esriurl.com/aoi) opens, showing the state park as a solid green polygon in the center of the map and the national forest areas shaded in light brown.

- Step 2: Save a copy of the map

For the purposes of this exercise, you will save a working copy of the map.

a On the ribbon above the map, click Save and choose Save As.

b In the Save Map dialog box, for Title, replace -Copy at the end of the name with your initials.



c Click Save Map.

A copy of the map will be saved to your My Content collection.

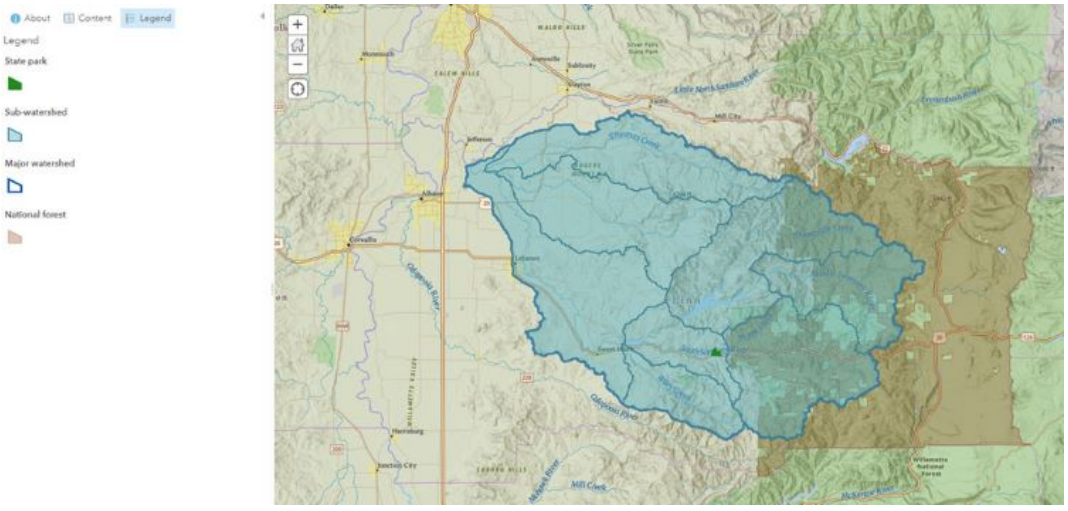
Note: ArcGIS Online does not automatically save maps; therefore, you should periodically save your map as you are working.

- Step 3: Filter map data to create an area boundary

DFW suggests defining the study area based on watershed boundaries because the results of this analysis can provide additional information to determine the health of the watersheds in the region. In this step, you will filter the Sub-watershed layer to represent the study area for your analysis.

a Turn on the Major Watershed layer and the Sub-watershed layer.

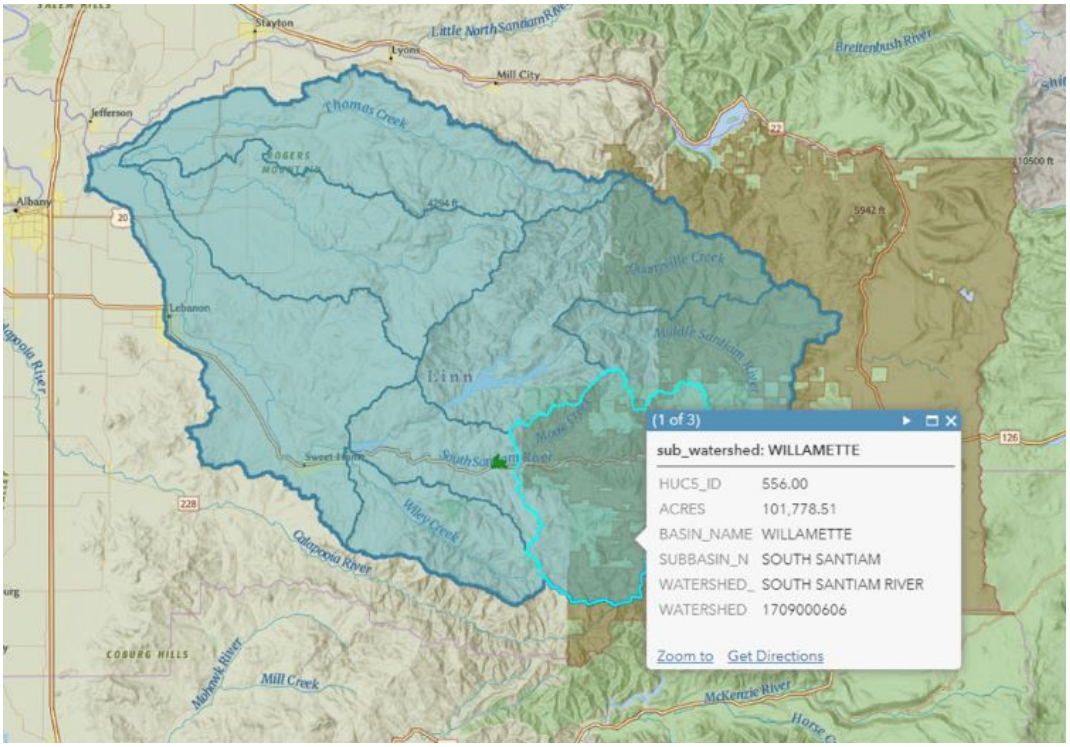
b In the Details pane, click the Legend button to view the Legend pane, and then zoom out to view the entire area of interest.



Step 3b: Filter map data to create an area boundary.

The DFW's staff want the study area to include the watersheds that intersect with the national forest. Committee members decide to limit the study based on the three sub-watersheds in the southeast (bottom-right) portion of the major watershed. This area encompasses the state park and part of the national forest.

c On the map, in the southeast portion of the major watershed, click the Willamette sub-watershed to display the information pop-up window, noting the three-digit HUC5_ID (556).



Step 3c: Filter map data to create an area boundary.

Each hydrologic unit is identified by a unique hydrologic unit code (HUC). Using the HUC5_ID numbers (550, 556, and 569), you will filter the layer to display only the sub-watersheds in the study area.

d In the Details pane, click the Content button .

e In the Contents pane, point to or click the Sub-watershed layer name and click the Filter button .

f In the Filter dialog box, choose HUC5_ID as the field to filter on.

The HUC5_ID field contains the three-digit ID for the sub-watershed.

g Confirm that the second field is set to Is.

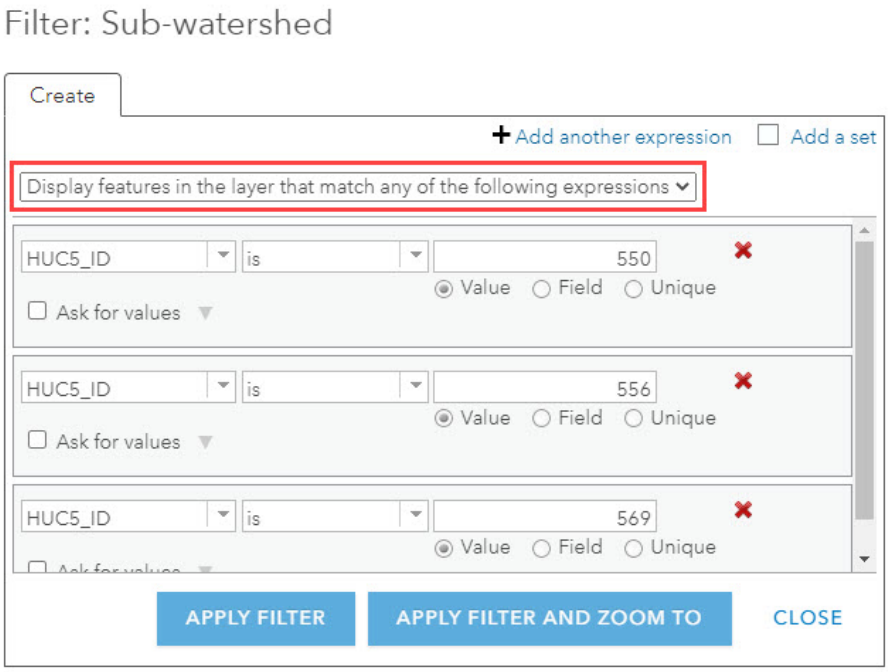
h In the Value field, type **550**.

i Click Add Another Expression, and then create a second expression where HUC5_ID Is **556**.

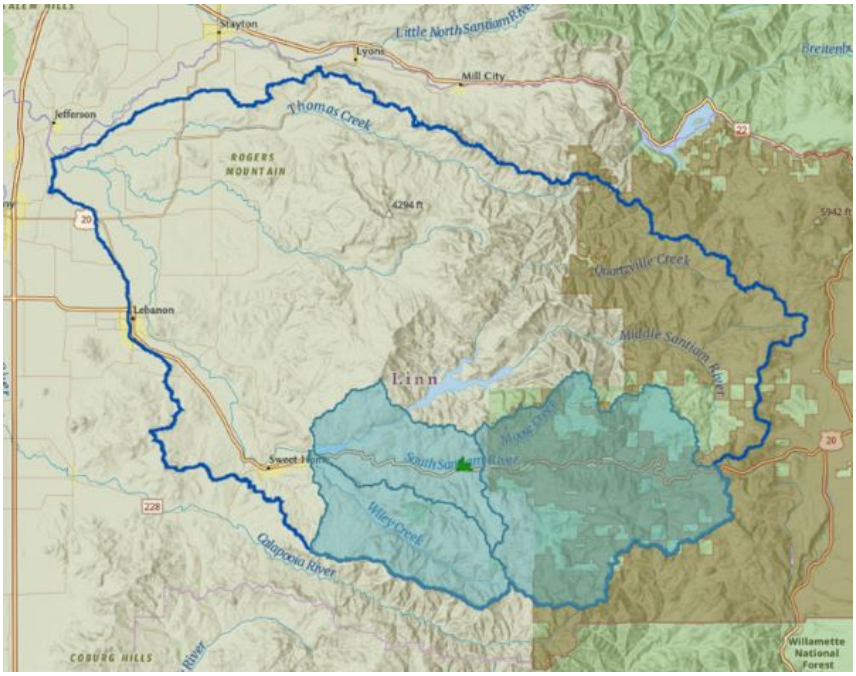
j Click Add Another Expression again, and then create a third expression where HUC5_ID Is **569**.

In defining the filter, you used the Value option. This option allows you to type any number and proceed with filtering. The Unique option restricts input to an existing value in the dataset. Experiment with the Unique option if you want to see what happens if you input a number that is not a value in the dataset.

k Near the top of the Filter dialog box, from the drop-down list, choose the option to filter based on features that match *any* of the expressions that you created, rather than all of the expressions, as indicated in the following graphic.



l Click Apply Filter.



Step 3l: Filter map data to create an area boundary.

The map now displays only the three sub-watersheds that are part of the study area.

m In the Contents pane, turn off the Major Watershed layer.

In this step, you filtered the Sub-watershed layer to show the sub-watersheds that will make up your study area.

- Step 4: Combine areas that share a boundary

In this step, you will combine the three sub-watershed areas into one polygon to create the study area boundary.

a In the Contents pane, point to or click the Sub-watershed layer name and click the Perform Analysis button .

b Expand Manage Data, and then click Dissolve Boundaries.

The Dissolve Boundaries tool combines areas that overlap or share a common boundary to form a single area.

Only the three sub-watersheds that are included in the filter will be included in the dissolve.

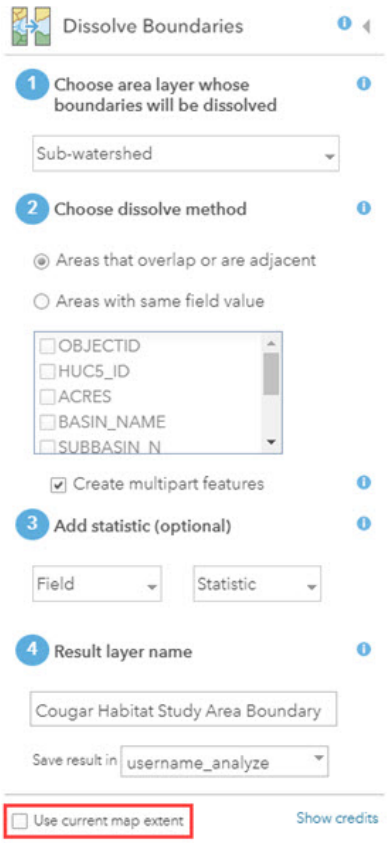
c In the Dissolve Boundaries pane, examine and accept the default parameters.

d For Result Layer Name, type **Cougar Habitat Study Area Boundary_<your first and last name>**.

Note: If you run the analysis multiple times, you will need to provide a unique result layer name each time.

The Save Result In field defaults to your account name; you do not need to change this value.

e At the bottom of the Dissolve Boundaries pane, uncheck the box for Use Current Map Extent, as indicated in the following graphic.

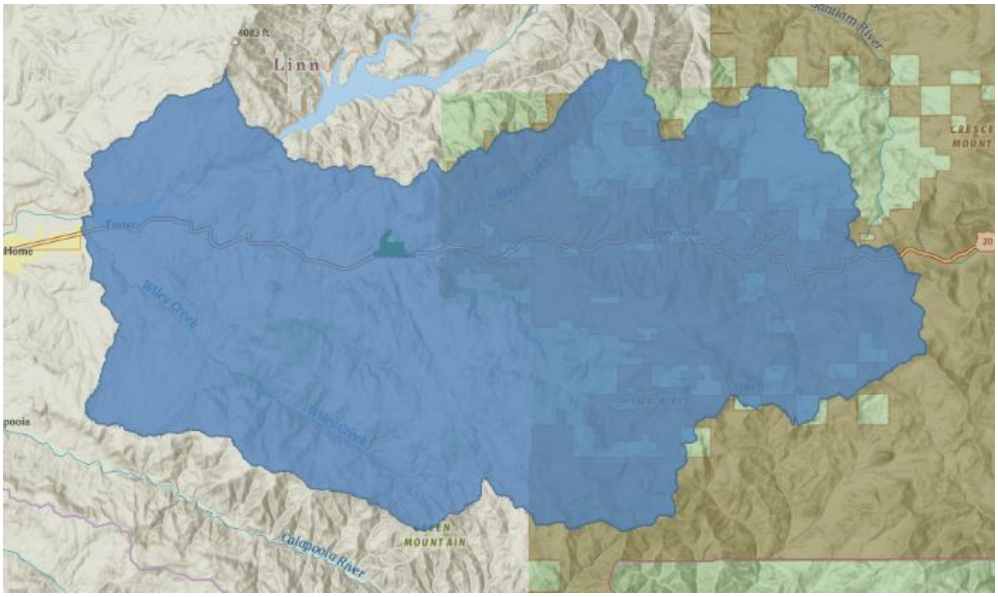


The box for Use Current Map Extent is checked by default. For this analysis, you want to analyze all (filtered) records in the Sub-watershed layer, regardless of the current extent in the Map Viewer.

f Click Run Analysis.

Note: If your analysis is not complete after 4 minutes, try saving the map and refreshing the page. You can also exit ArcGIS Online and try again later.

g When the analysis is complete, turn off the Sub-watershed layer and the Major Watershed layer, if necessary, as they are no longer needed.



Step 4g: Combine areas that share a boundary.

The updated map now shows a single area representing the study area boundary.

Note: Remember to periodically save your map as you are working.

- Step 5: Change the map style

In this step, you will change the style associated with the study area boundary for better viewing.

a Change the style associated with the Cougar Habitat Study Area Boundary layer so that it is transparent and has a 3-px dark slate gray outline.

- Hint

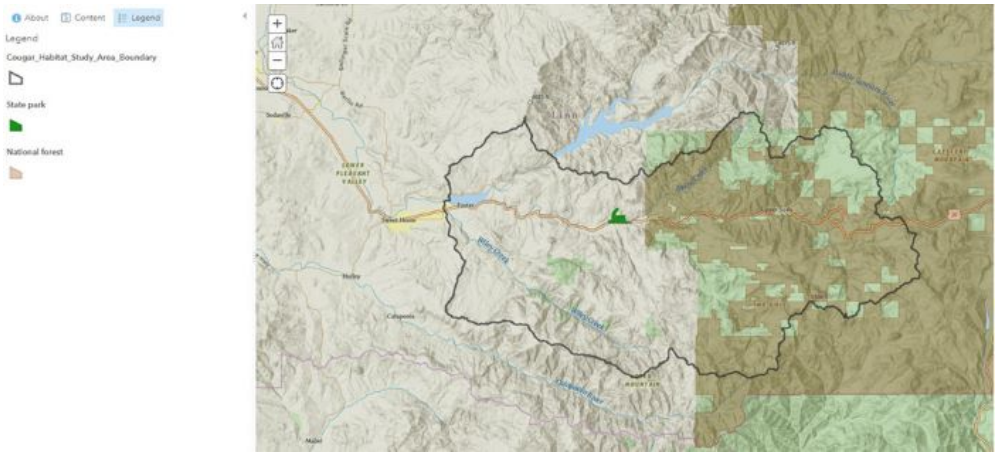
First, try changing the style on your own. If needed, the detailed steps are as follows:

- In the Contents pane, point to or click the Cougar Habitat Study Area Boundary layer name and click the Change Style button .
- In the Change Style pane, for Choose An Attribute To Show, confirm that Show Location Only is selected.
- Click Options.
- Click Symbols.
- At the top of the Change Symbols window, confirm that the Fill tab is selected.
- Drag the Transparency slider to change the transparency to 100%, or click the No Color button .
- At the top of the Change Symbols window, click the Outline tab.
- From the palette, choose an outline color, such as dark slate gray (hex color #242424).
- Change the Line Width to 3 px.
- Click OK to close the Change Symbols window.
- Click OK, and then click Done.

b Display the map legend.

- Hint

In the Details pane, click the Legend button .



Step 5b: Change the map style.

The map shows the agreed-upon study area boundary outlined in gray.

Having agreed on the study area boundary, the committee turns to the analysis in the next step.

- Step 6: Filter data to limit feature display

In this step, you will use ArcGIS Online to filter data to create a model that identifies areas that are suitable cougar habitat using the criteria defined by the experts from the state park.

First, you will set up the analysis, review the project criteria, and create the model for the analysis.

Set up the analysis
The various agencies use the area boundary to clip (https://esriurl.com/clip) their criteria data and provide you with the appropriate layers to use for the analysis. DFW provides a slope layer, a streams layer, and a highway layer. The state Department of Forestry provides vegetation data.

Note: For the purposes of this exercise, these clipped layers have already been integrated into your map.

Project criteria review
There are several criteria for this project. The committee has reviewed and discussed each issue in preparation for the analysis that you will perform.

Create the model for analysis
Recognizing that the agencies have different interests, the committee decides to create two models of cougar habitat. One model will be based on a narrower definition, using the criteria preferred by the experts from the state park. Another model will be based on a broader definition, using the criteria preferred by the experts at DFW. Because the analysis is being done using GIS, it is relatively easy to model the habitat using several sets of criteria. You will approach the criteria provided by the state park experts first.

Model 1: Suitable cougar habitat based on criteria from the state park experts

Criterion	State park values
Steep slopes	>18 degrees
Forested	Vegetation codes 34, 49, and 67
Near streams	Within 500 feet
Away from highways	More than 1,500 feet

You will filter the data associated with the Vegetation layer. You only want to show areas that contain the three suitable vegetation types identified by the state park experts: True Fir-Hemlock Montane Forest, Douglas Fir-W. Hemlock-W. Red Cedar Forest, and Mixed Conifer-Mixed Deciduous Forest.

a In the Contents pane, turn on the Vegetation layer.

b Point to or click the Vegetation layer name and click the Show Legend button to examine the types of vegetation included in the dataset.

c Click the Vegetation Filter button .

d In the Filter dialog box, choose VEG_CODE as the attribute.

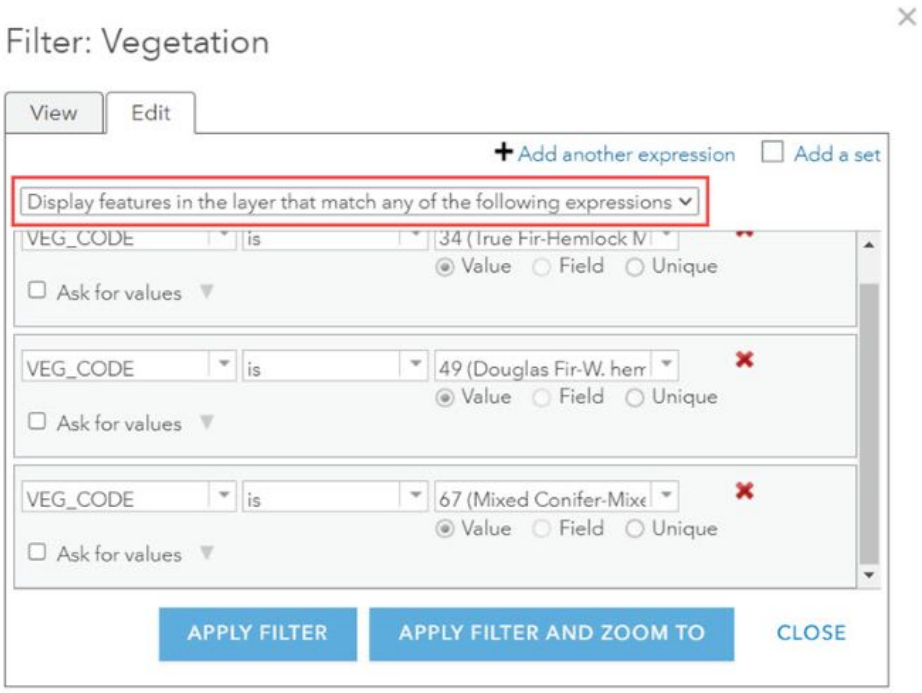
e Confirm that the second field is set to Is.

f For the third field, confirm that 34 (True Fir-Hemlock Montane Forest) is selected as the Value.

g Click Add Another Expression, and then create a second expression where VEG_CODE Is 49 (Douglas Fir-W. Hemlock-W. Red Cedar Forest).

h Click Add Another Expression, and then create a third expression where VEG_CODE Is 67 (Mixed Conifer-Mixed Deciduous Forest).

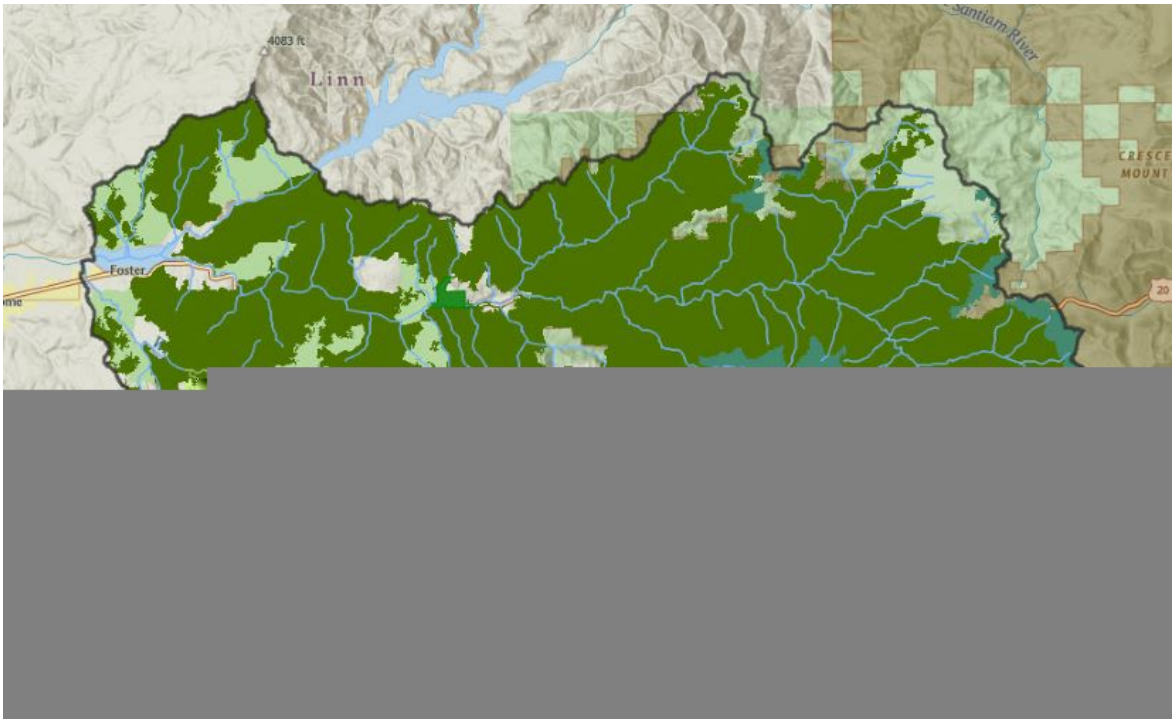
i Near the top of the Filter dialog box, from the drop-down list, choose to filter based on features that match any of the expressions that you created, rather than all of the expressions, as indicated in the following graphic.



j Click Apply Filter.

The map display updates to show only the vegetation types that meet the specified criteria. The areas without any green are open areas that are not potential cougar habitat.

k Turn on the Stream layer.



Step 6k: Filter data to limit feature display.

In this step, you created a filter to identify the forested areas—one of your analysis criteria.

- Step 7: Identify suitable locations

Next, you begin step three of the spatial analysis approach, analyze and model. You will perform a suitability analysis to identify areas that may be suitable cougar habitat based on the criteria from the state park experts.

In ArcGIS Online, the Derive New Locations tool allows you to combine attribute and spatial criteria into a single statement. The tool creates a layer of areas that meet the specified criteria.

Because you filtered the vegetation criteria first, you can create a simpler selection statement. When you run the second analysis using the criteria defined by DFW, you can also streamline the process.

a If necessary, point to or click the Vegetation layer name and click the Hide Legend button .

b Turn on the Slope layer.

c If necessary, point to or click the Slope layer name and click the Show Legend button to examine the types of slopes included in the dataset.

For this study, slopes are categorized as either gentle (less than 18 degrees) or steep (greater than 18 degrees).

d Turn on the Highway layer.

You could use either area criteria layer (Slope or Vegetation) as the basis for the analysis. For consistency as you build expressions, you will use the Slope layer throughout.

e Point to or click the Slope layer name and click the Perform Analysis button .

f Expand Find Locations, and then click Derive New Locations.

To find locations where the terrain meets the slope criterion, you will add an attribute query expression.

g In the Derive New Locations pane, click Add Expression.

h Add an attribute query expression to find areas where the slope is considered steep (greater than 18 degrees).

- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- For the layer name, confirm that Slope is selected.
- From the second drop-down list, confirm that Where (Attribute Query) is selected.
- Choose SLOPE_CODE as the name of the attribute.
- Confirm that the second field is set to Is.
- Select the Unique option, and then choose Steep from the drop-down list.

- Click Add to add the expression to the Derive New Locations pane.

Because you have other criteria, you will add more expressions to create a combined query expression.

Next, you will add a spatial query to find locations where both the slope criterion and the vegetation type criterion are met. You already filtered out vegetation types that are not considered relevant.

i Add a spatial query expression to find locations that meet both the slope and vegetation type criteria.

- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, choose Intersects.
- For the second feature, choose Vegetation.

Note: Because you already filtered the Vegetation layer, only the selected vegetation types will be included in the output.

- Click Add to add the expression to the Derive New Locations pane.

Next, you will find areas located within 500 feet of a stream.

j Add a third expression specifying that the suitable areas need to be within 500 feet of a stream.

- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, choose Within A Distance Of.
- Type **500** and choose Feet as the measurement.
- For the second feature, choose Stream.

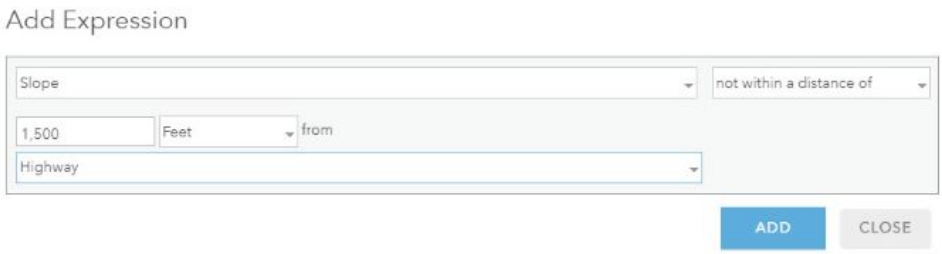
- Click Add to add the expression to the Derive New Locations pane.

k Add a final expression to specify that the areas need to be located more than 1,500 feet from a highway.

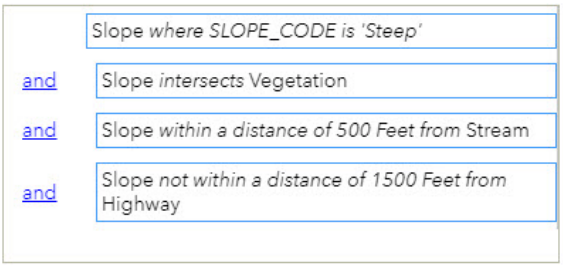
- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, choose Not Within A Distance Of.
- Type **1500** and choose Feet as the measurement.
- For the second feature, choose Highway.



- Click Add to add the expression to the Derive New Locations pane.



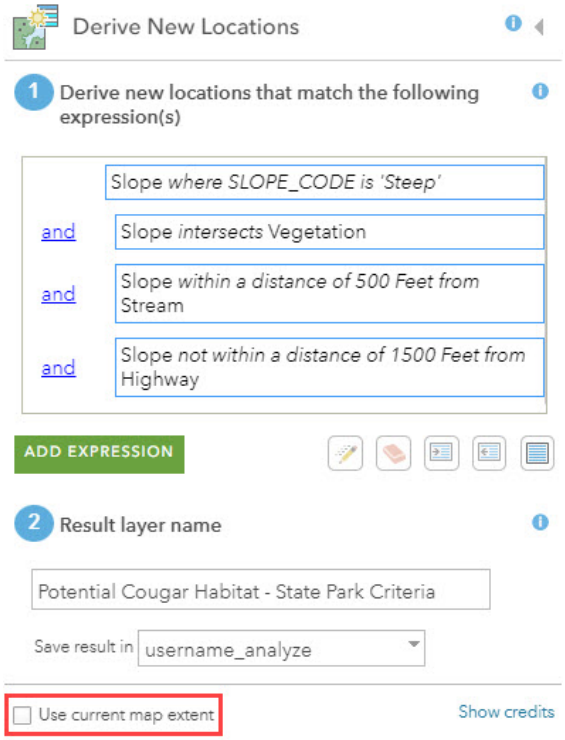
Step 7k: Identify suitable locations.

l For Result Layer Name, type **Potential Cougar Habitat - State Park Criteria_<your first and last name>**.

Note: If you run the analysis multiple times, you will need to provide a unique result layer name each time.

The Save Result In field defaults to your account name; you do not need to change this value.

m At the bottom of the Derive New Locations pane, uncheck the box for Use Current Map Extent, as indicated in the following graphic.



The box for Use Current Map Extent is checked by default. For this analysis, you want to analyze all records in the Slope layer, so you will uncheck the box.

n Click Run Analysis.

Note: If your analysis is not complete after 4 minutes, try saving the map and refreshing the page. You can also exit ArcGIS Online and try again later.

A new result layer with the name that you assigned appears in the Contents pane. The map display updates to show the locations that meet all the criteria that the state park experts identified.

Step 7n: Identify suitable locations.

o Turn off the Vegetation and Slope layers to see the identified locations better.

The result layer uses default styling, so identified areas appear in blue. To avoid confusion, you will change the map style.

- Step 8: Change the map style

In this step, you will change the style of the areas identified as potential cougar habitat.

a Change the style associated with the Potential Cougar Habitat State Park Criteria layer to solid bright yellow with a 1-px bright yellow outline.

- Hint

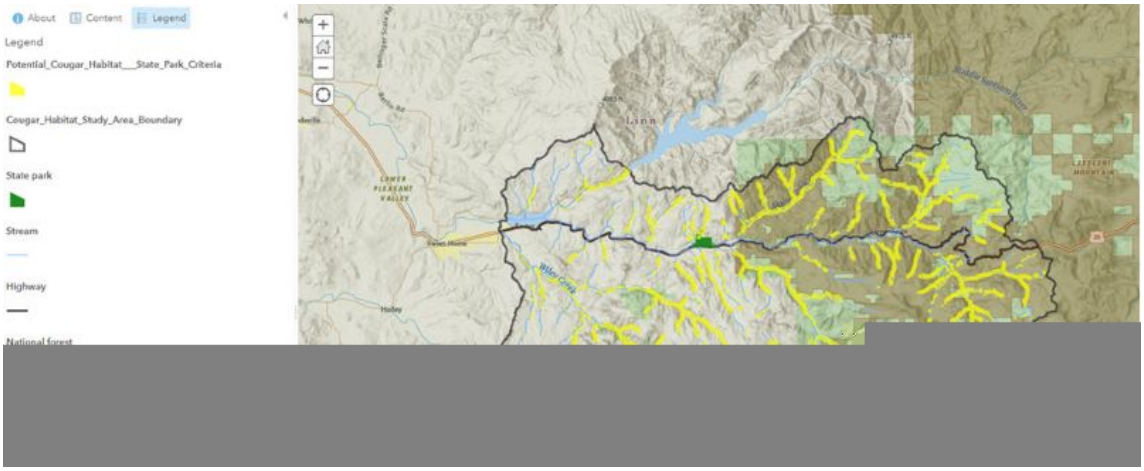
First, try changing the style on your own. If needed, the detailed steps are as follows:

- In the Contents pane, point to or click the Potential Cougar Habitat State Park Criteria layer name and click the Change Style button .
- In the Change Style pane, for Choose An Attribute To Show, confirm that Show Location Only is selected.
- Click Options.
- Click Symbols.
- At the top of the Change Symbols window, confirm that the Fill tab is selected.
- From the palette, choose a fill color, such as bright yellow (hex color #FFFF00).
- At the top of the Change Symbols window, click the Outline tab.
- From the palette, choose an outline color, such as bright yellow (hex color #FFFF00).
- Change the Line Width to 1 px.
- Click OK to close the Change Symbols window.
- Click OK, and then click Done.

b Display the map legend.

- Hint

In the Details pane, click the Legend button .



Step 8b: Change the map style.

Note: Layer names will vary based on the names that you assigned.

Now that you have completed your initial analysis, you will save your map.

c On the ribbon above the map, click Save and choose Save.

The result map provides state park experts with a good picture of potential cougar habitat within the study area boundary.

- Step 9: Edit a data filter

Next, you will edit the data filter to create a layer that identifies potential cougar habitat based on criteria provided by the DFW. You will follow a similar approach, modifying the criteria for Model 2 as needed.

Model 2: Suitable cougar habitat based on criteria from the DFW

Criterion	DFW values
Steep slopes	>18 degrees
Forested	Vegetation codes 34, 49, 67, and 121
Near streams	Within 2,500 feet
Away from highways	More than 500 feet

You want to include the additional suitable vegetation type identified by the DFW (Grass-Shrub-Sapling or Regenerating Young Forest), so you will edit the filter on the Vegetation layer.

a In the Details pane, click the Content button .

b Turn off the Potential Cougar Habitat State Park Criteria layer.

c Turn on the Vegetation layer.

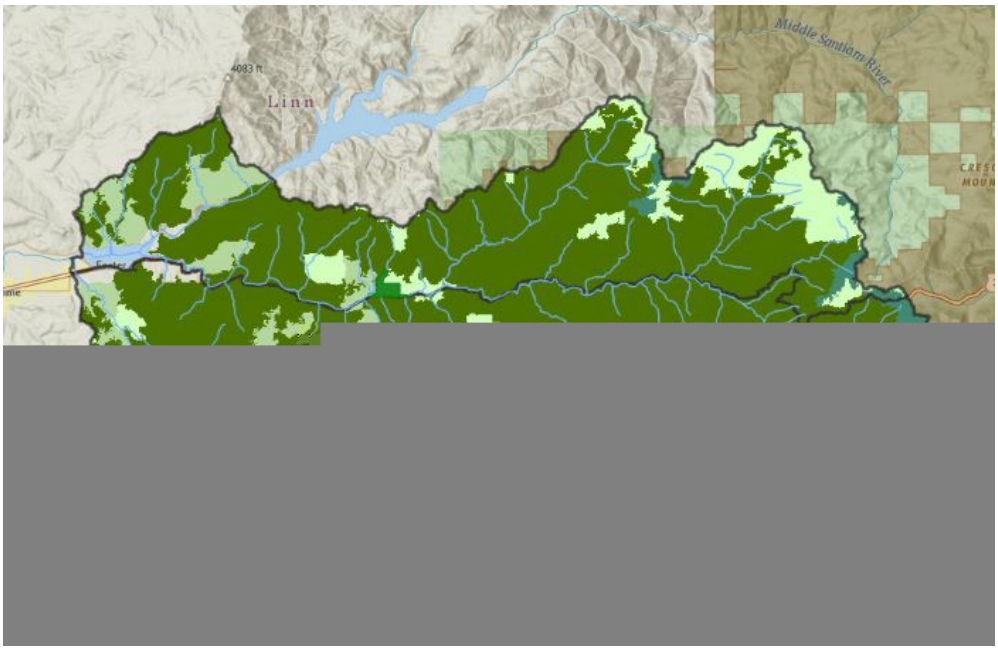
d Point to or click the Vegetation layer name and click the Filter button .

e In the Filter dialog box, click the Edit tab.

ArcGIS Online includes the ability to edit an existing filter, which makes a comparative analysis like this one more efficient.

f Click Add Another Expression, scroll down, and then enter criteria to display features where the VEG_CODE Is 121 (Grass-Shrub-Sapling Or Regenerating Young Forest).

g Click Apply Filter.



Step 9g: Edit a data filter.

The map display updates to show vegetation types that meet the specified criteria. The areas without any green are open areas that are not potential cougar habitat.

- Step 10: Identify suitable locations

In this step, you will perform a suitability analysis to identify areas that may be suitable cougar habitat based on the criteria identified by DFW.

a Turn on the Slope layer.

As before, you will use the Slope layer as the basis for the analysis.

b Point to or click the Slope layer name and click the Perform Analysis button .

c Expand Find Locations, and then click Derive New Locations.

To find locations where both the terrain (vegetation) and slope criteria are met, you will add an attribute query expression.

In the Derive New Locations pane, you will add four expressions to represent the criteria identified by the DFW.

d Add an attribute query expression to find areas where the slope is considered steep (greater than 18 degrees).

- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, confirm that Where (Attribute Query) is selected.
- Choose SLOPE_CODE as the name of the attribute.
- Confirm that the second field is set to Is.
- Select the Unique option, and then choose Steep from the drop-down list.

- Click Add to add the expression to the Derive New Locations pane.

Because you have other criteria, you will add more expressions to create a combined expression.

Next, you will find locations that meet both the slope criterion and the vegetation type criterion. You already filtered out vegetation types that are not considered relevant.

e Add a spatial query expression to find locations that meet both slope and vegetation criteria.

- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, choose Intersects.
- For the second feature, choose Vegetation.

Note: Because you already filtered the Vegetation layer, only the selected vegetation types will be included in the output.

- Click Add to add the expression to the Derive New Locations pane.

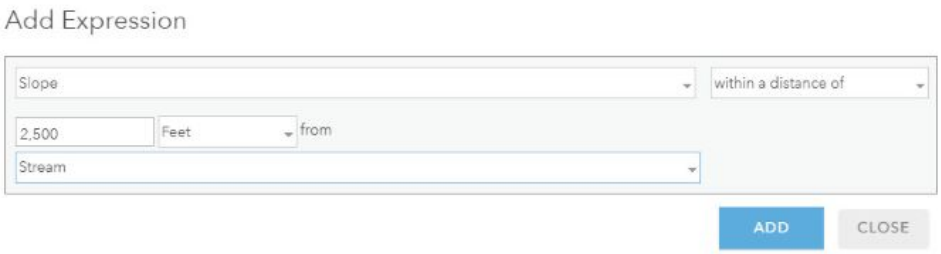
Next, you will find areas located within 2,500 feet of a stream.

f Add a third expression, specifying that the suitable areas need to be within 2,500 feet of a stream.

- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, choose Within A Distance Of.
- Type **2500** and choose Feet as the measurement.
- For the second feature, choose Stream.



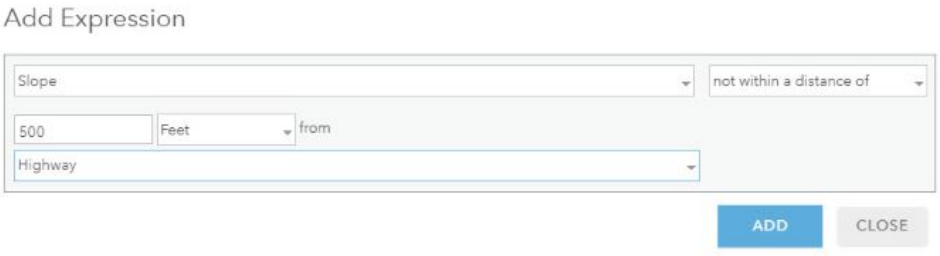
- Click Add to add the expression to the Derive New Locations pane.

g Add the final expression, specifying that the areas need to be more than 500 feet from a highway.

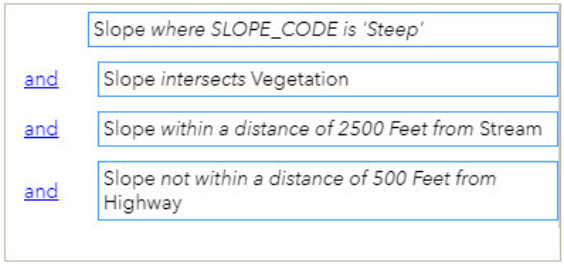
- Hint

First, try creating the expression on your own. If needed, the detailed steps are as follows:

- Click Add Expression.
- For the layer name, confirm that Slope is selected.
- From the second drop-down list, choose Not Within A Distance Of.
- Type **500** and choose Feet as the measurement.
- For the second feature, choose Highway.



- Click Add to add the expression to the Derive New Locations pane.

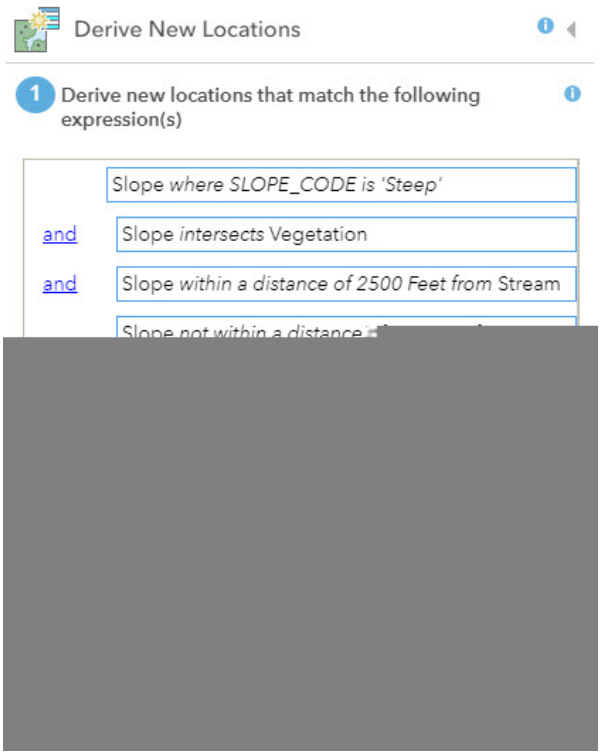


Step 10g: Identify suitable locations.

h For Result Layer Name, type **Potential Cougar Habitat - DFW Criteria_<your first and last name>**.

The Save Result In field defaults to your account name; you do not need to change this value.

i At the bottom of the Find New Locations pane, uncheck the box for Use Current Map Extent, as indicated in the following graphic.



The box for Use Current Map Extent is checked by default. For this analysis, you want to analyze all records in the Slope layer, so you will uncheck the box.

j Click Run Analysis.

Note: If your analysis is not complete after 4 minutes, try saving the map and refreshing the page. You can also exit ArcGIS Online and try again later.

A new result layer with the name that you assigned appears in the Contents pane. The map display updates to show the locations that meet all the criteria that the DFW identified.

k Turn off the Vegetation and Slope layers to see the identified locations better.

Step 10k: Identify suitable locations.

The result layer uses default styling, so identified areas appear in blue. To avoid confusion, you will change the map style.

- Step 11: Change the map style

In this step, you will change the style of the potential cougar habitat areas in the map.

a Change the symbol associated with the Potential Cougar Habitat DFW Criteria layer to solid brown with a 1-px brown outline.

- Hint

First, try changing the style on your own. If needed, the detailed steps are as follows:

- In the Contents pane, point to or click the Potential Cougar Habitat DFW Criteria layer name and click the Change Style button .
- In the Change Style pane, for Choose An Attribute To Show, confirm that Show Location Only is selected.
- Click Options.
- Click Symbols.
- At the top of the Change Symbols window, confirm that the Fill tab is selected.
- From the palette, choose a fill color, such as brown (hex color #734C00).
- At the top of the Change Symbols window, click the Outline tab.
- From the palette, choose an outline color, such as brown (hex color #734C00).
- Change the Line Width to 1 px.
- Click OK to close the Change Symbols window.
- Click OK, and then click Done.

b Display the map legend.

- Hint

In the Details pane, click the Legend button .

Step 11b: Change the map style.

c Save the map.

The result map provides the DFW with a good picture of potential cougar habitat within the study area boundary. This model is noticeably different from the state park model.

- Step 12: Save the two maps

In this step, you will save two maps—one with the state park criteria and one with DFW criteria—to prepare them for inclusion in a web app.

a Turn off the following layers, if necessary:

- Major Watershed

- Sub-watershed
- Potential Cougar Habitat DFW Criteria

b Confirm that the following layers are turned on:

- Potential Cougar Habitat State Park Criteria
- Cougar Habitat Study Area Boundary
- State Park
- Stream
- Highway
- National Forest

Note: Layer names will vary based on the names that you assigned.

Contents

Step 12b: Save the two maps.

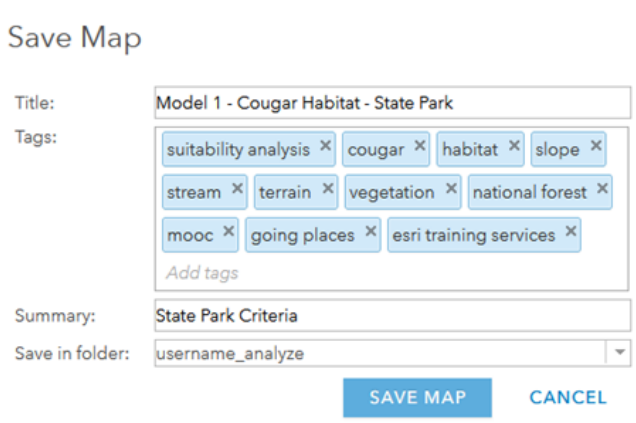
c On the ribbon above the map, click Save and choose Save As.

d In the Save Map dialog box, for Title, type **Model 1 - Cougar Habitat - State Park_<your first and last name>**.

e For Tags, accept the default entries.

f For Summary, type **State Park Criteria**.

g For Save In Folder, accept the default location.



Step 12g: Save the two maps.

h Click Save Map.

i Turn off the Potential Cougar Habitat State Park Criteria layer.

j Turn on the Potential Cougar Habitat DFW Criteria layer.

k On the ribbon above the map, click Save and choose Save As.

l In the Save Map dialog box, for Title, type **Model 2 - Cougar Habitat - DFW_<your first and last name>**.

m For Tags, accept the default entries.

n For Summary, type **DFW Criteria**.

o For Save In Folder, accept the default location.

Step 12o: Save the two maps.

p Click Save Map.

Your maps will be saved to your My Content collection. You now have two maps—one for each set of criteria.

- Step 13: Conclusion

In this exercise, you learned how to implement the spatial analysis approach to perform suitability analysis, finding the best locations for cougars. Next, you will review how each step of the spatial analysis approach was used throughout this exercise.

Ask questions

For this scenario, the following questions were considered:

What is suitable cougar habitat?

- Where are the limits of the study area?
- Where are areas with steep, forested slopes located near streams but away from highways or major roads?
- How many potential locations within or near the national forest meet these criteria?

Explore and prepare data

You explored and prepared data used in the analysis, by creating an agreed-upon study area. Additionally, there were several layers needed to perform the suitability analysis to find optimal cougar habitat. These included vegetation, slope, watersheds, streams, and major roads layers.

Analyze and model

You analyzed the data using the Derive New Locations tool to identify optimal suitability areas for both sets of criteria defined by the state park and the DFW. Additionally, you modeled the data accordingly by changing the map style.

Interpret results

As you analyzed the data, you identified the answers to your spatial questions.

What is suitable cougar habitat?

The outcome of the analysis led to two maps; Model 1 - Cougar Habitat - State Park and Model 2 - Cougar Habitat - DFW. The analysis results in both maps depict areas with steep, forested slopes located near streams but away from highways or major roads that are within the agreed-upon study area of the three combined sub-watersheds. Results displayed in each map vary based on the criteria provided from the state park versus the DFW.

Repeat or modify

The spatial analysis approach is intended to be iterative throughout the process. The committee members decided the study area should include three sub-watersheds in the southeast portion of the major watershed, as this area encompasses the state park and part of the national forest. You applied a filter to visualize the three-sub layers and combined them to create an agreed-upon study area. Additionally, although the committee defined and agreed on the project study area, each agency proposed slightly different criteria based on interests and prior studies that led to slightly different analysis.

Present results

The two maps can be presented to facilitate discussions between State Park officials and the Department of Fish and Wildlife (DFW).

Make decisions

Analysis feedback and discussions could lead to decisions made across the state of Oregon to more effectively protect cougars and park visitors.

a Close your private or incognito web browser window or continue to the next exercise.

In the next exercise, you will build and share an app that allows stakeholders to view both maps.