

GIS Activity

Introduction

Geographic Information Systems (GIS) are a powerful tool for analyzing and selecting sites that are appropriate for developing a solar farm. We can use GIS to analyze a wide area of land and narrow our choices to the best options based on a set of selection criteria.

In this activity we will use basic GIS to select a site in the Town of Lakeville, Massachusetts which could potentially be used for a utility scale solar farm. Please complete the following steps to find the best site for the solar farm.

1. Download & Install ArcGIS Explorer

For this activity we will use a free GIS program called ArcGIS Explorer. This program is very similar to Google Earth but it allows you to display many GIS data formats in addition to KML/KMZ. For this activity we will use GIS data in Shapefile format.

- Download the FREE software at <http://www.esri.com/software/arcgis/explorer/download>
- Double-click the ArcGISExplorerDownload.exe file and follow the instructions to install the software.

2. Download GIS Data

There is a vast amount of GIS data that is available to the public on the internet. Massachusetts has a great website that is devoted to providing GIS data. This step will walk you through downloading some data from MassGIS. However, the data sets needed to complete the exercise are provided at <http://www.communityenergypraxis.com/environmental-science>.

We have decided to provide custom data sets rather than those available through MassGIS in order to reduce the file sizes so that the exercise will run smoothly on all computers. For example, we don't want to use a wetlands data set that covers the entire state of Massachusetts as this is a very large file to work with. We have tailored the data sets to cover only the Town of Lakeville.

With that said, it is good practice to know that these data sets are out there and how to access them.

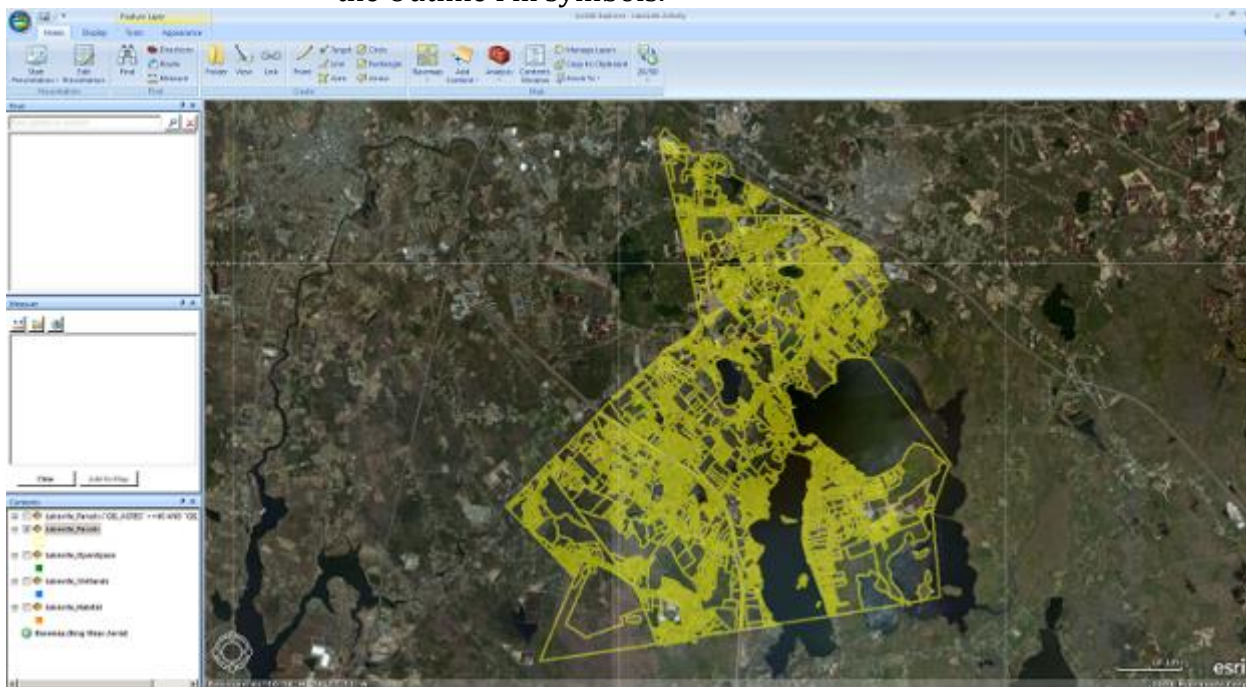
- Go to the MassGIS Datalayers web page by clicking this [link](#).
- Scroll down to 'Political/Administrative Boundaries' section and click '**Level 3 Assessors' Parcels**'
- Feel free to read through the Overview of this data. It is good information on how the data was created.
- Click '**Download this layer**' on the top left

- Scroll down to the Municipality of Lakeville and click the link to download the ESRI Shapefile (column on right)
- Save the zip file to your desktop (or wherever you prefer) and extract the files to a location that you can easily find.*
 *Shapefiles are made up of multiple individual files. These individual files all need to be stored in the same folder for the shapefile to work properly.

Download and extract all of the layers to the same folder on your computer as the Lakeville parcel layer.

3. Add Data to Map

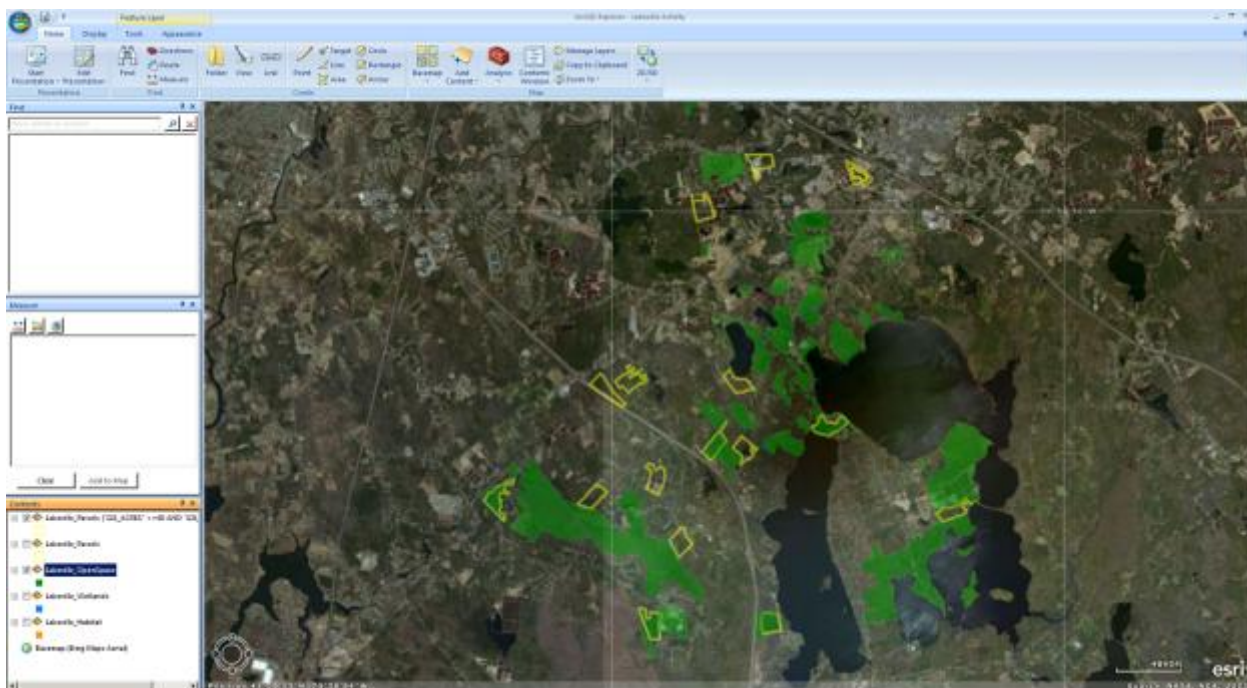
- Open ArcGIS Explorer
- Click Basemap and change to Bing Maps Aerial
- Click Add Content > Shapefiles
 - Browse to where you stored your GIS data
 - Open Lakeville_Parcels
 - The parcel layer will be added to your map. Change the symbology by right-clicking the layer in the Contents window, scroll to Symbol and select one of the Outline Fill symbols.



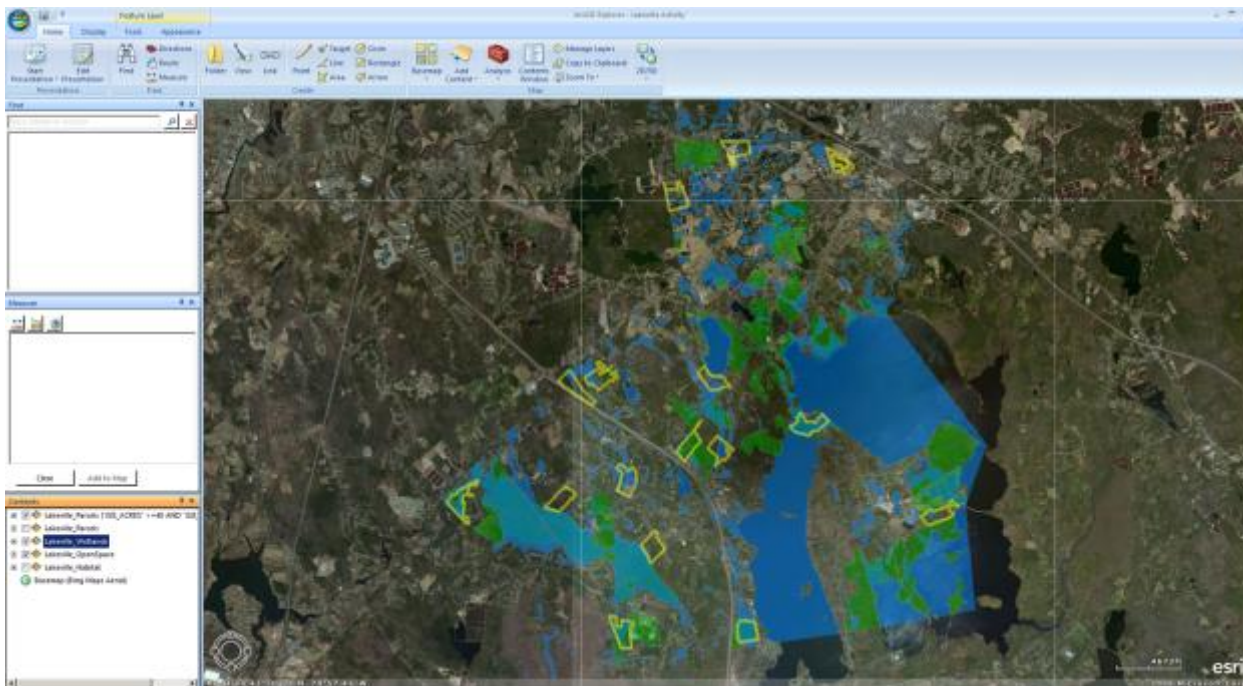
- Repeat the Add Content step to open Lakeville_OpenSpace, Lakeville_Wetlands, and Lakeville_Habitat.
- Re-symbolize these layers so that they are all different and you can tell them apart.
- Turn off all layers except for the Lakeville_Parcels layer (uncheck the box to the left of the layer names)

4. Site Selection Analysis

- Select Lakeville_Parcels in the Contents window
- Go to the Tools tab (on the ribbon at the top of the screen)
- Click Query to open the Query Builder
 - All of the data layers we are using have attribute tables that store data for each feature. For example, each parcel has a GIS_ACRES attribute field that stores the size of each parcel in acres. We are going to use this field to narrow down the parcels we are interested in.
 - In the Query Builder select GIS_ACRES in the Fields list. You will see it added to the Select Features Where... box. Select the >= Operator then type 40. Click the AND Operator. Select GIS_ACRES again then the <= Operator then type 50.
 - Your full query should look like this: **GIS_ACRES >=40 AND GIS_ACRES <=50**
 - Click Test
 - **QUESTION: How many parcels does this query operation return?**
 - Click OK
 - A layer is added to the map which shows all parcels between 40-50 acres. Turn off the Lakeville_Parcels layer so that you are only viewing the remaining parcels.
- Now we will use the remaining layers to further narrow our search. Full featured GIS programs such as ArcMap would allow you to query the parcels based on spatial relations. For example, which parcels intersect Open Space. However, the free program you are using does not have this functionality so you will visually analyze the data layers to further refine your search.
- Let's analyze the Open Space layer – check the box next to the Lakeville_OpenSpace layer to turn it on. Open Space are areas that have been set aside as permanent green space such as athletic fields, golf courses, conservation easement, water protection areas, etc. We cannot use these areas to build a solar farm.



- **QUESTION: How many parcels are covered by Open Space?**
- You have now further reduced the number of parcel candidates.
- Next, you will use the aerial image to eliminate parcels that have already been developed. Take a look at the remaining eligible parcels and count how many have some sort of existing development that takes up a large portion of the parcel (commercial buildings, subdivisions, etc.)
 - **QUESTION: How many parcels are already developed?**
- Next, you will analyze the Wetlands layer. This data is taken from the National Wetlands Inventory (NWI). This is a national dataset that estimates the location of wetlands across the United States. While the true extent of wetlands should always be confirmed in the field by a qualified scientist, this data gives us a very good approximation of wetland boundaries.
 - Turn on the Wetlands layer and visually inspect the remaining eligible parcels for the existence of wetlands. In Massachusetts, most parcels contain some mapped wetlands. It is OK to build a project around wetlands but not in them. Look for parcels that have a reasonable amount of contiguous buildable area outside of the wetlands (more than 60% buildable area).
 - **QUESTION: How many parcels have a reasonable amount of contiguous buildable area outside of wetlands? (Remember, only count parcels that are still eligible after the previous steps!)**

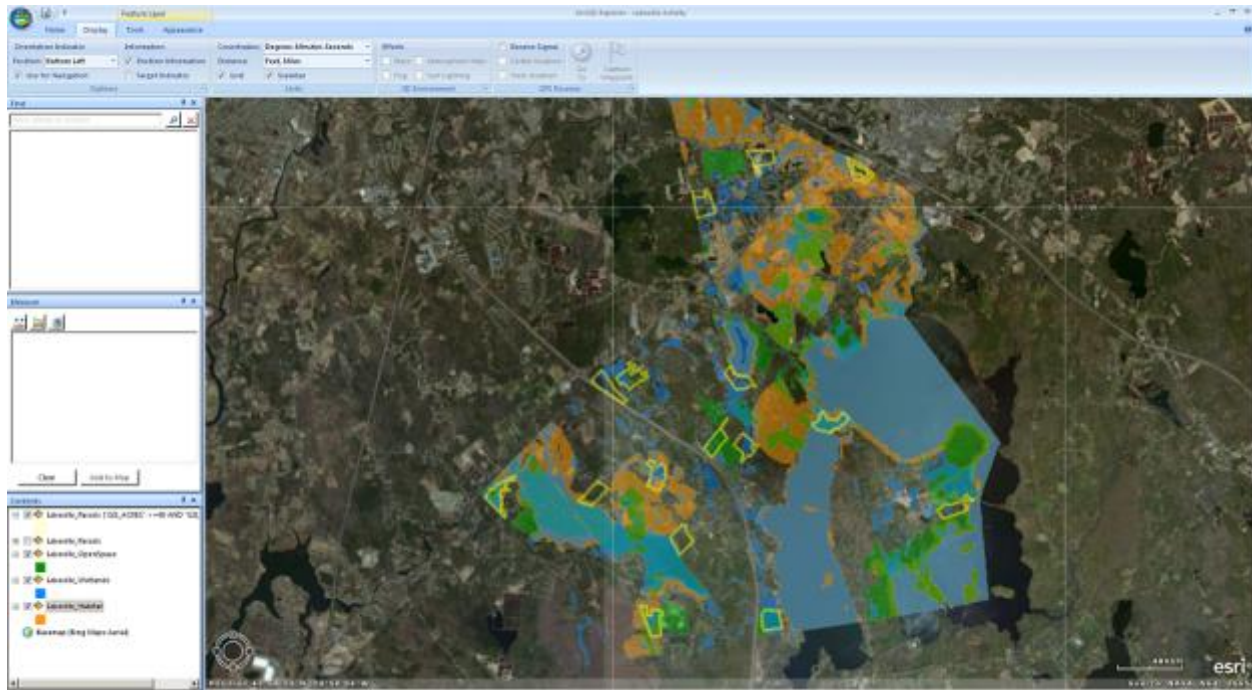


- Next, you will analyze the Habitat layer. Priority Habitat of Rare Species is a dataset that was developed by the Natural Heritage and Endangered Species Program, part of the Massachusetts Division of Fisheries and Wildlife. The program's highest priority is protecting species of plants and animals that are officially listed as Endangered,

Threatened, or of Special Concern in the state of Massachusetts. These areas can be developed, but it involves a permitting process that can be time consuming and costly.

- Like you did with Wetlands, look for parcels that have minimal or no Habitat coverage.

- **QUESTION: How many of the remaining eligible parcels have minimal or no Habitat coverage? This is how many parcels are still eligible for the development of a solar farm after our process of elimination.**

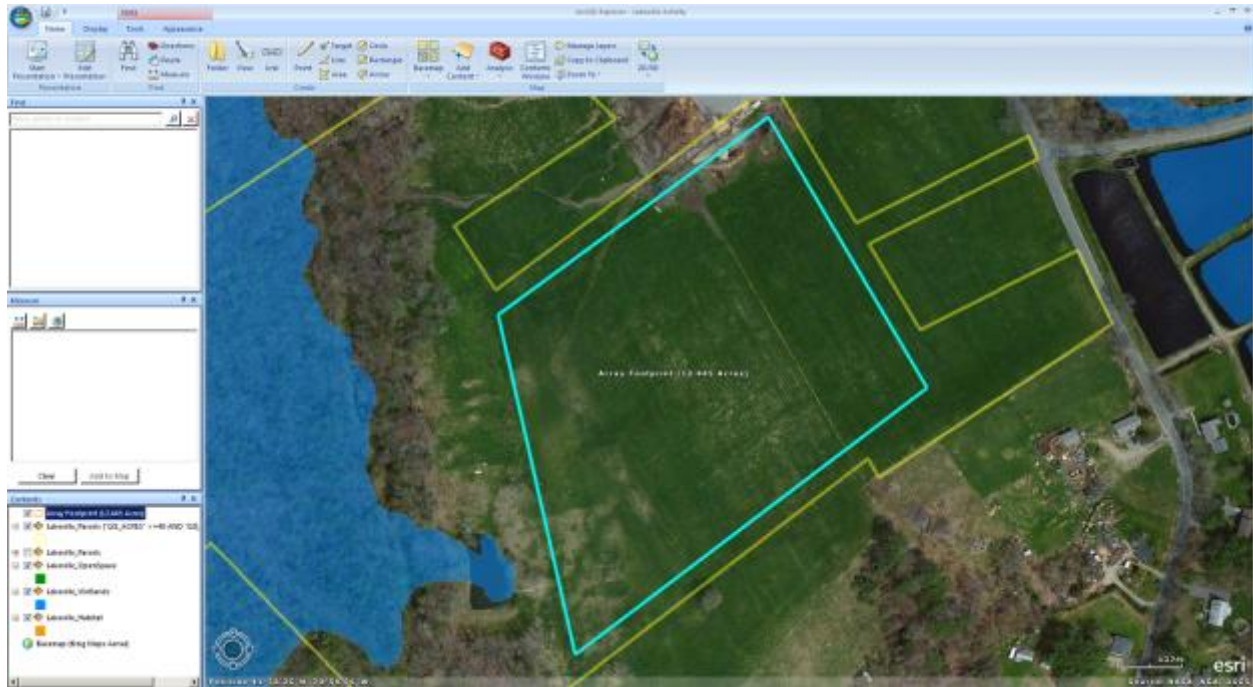


- Finally, you will examine the remaining parcels and choose one that is the most suitable for development of a solar farm. Your final criteria will be to eliminate the remaining parcels that are wooded. While land that is wooded could be developed, it is not ideal. Find the remaining parcel meets all the previous criteria and is not wooded.

- **QUESTION: What is the exact acreage of the one remaining parcel that is not wooded and thereby the most suitable for development of a solar farm? (click the parcel to see attributes - use the GIS_Acres field for your answer)**

- By process of elimination, using a set of constraints and basic GIS analysis you have selected the best parcel for the development of a solar farm! Now you will create a basic array footprint inside this parcel.

- Create a polygon by clicking the Measure button on the Home ribbon. Draw a polygon within the parcel lines on the large southern field, staying away from the wetlands to the west. Make this area between 10-15 acres. Click Add to Map.



- The area drawn in the image above is ~12.5 acres and would be a great location for a solar farm.

Congratulations! You have successfully located a suitable site for a solar farm.