Spatial Analysis with ArcGIS Pro

Welcome! The workshop will start shortly.

Download the slides here:

https://tinyurl.com/ProAnalysis





Spatial Analysis with ArcGIS Pro

Presented by: Cole White









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What We'll Cover

01	02	03	04	
Intro/GIS as a problem-	Planning a spatial analysis	Map Creation & Analysis	Sharing & Collaborati	
solving tool	workflow			

05

Resources

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1. Introduction The Map and Data Library

- Data collections
- Workshops and training
- In-person and virtual support

Robarts Library 7th Floor Open 11am - 5pm weekdays by appointment https://mdl.library.utoronto.ca/



1. Introduction **MDL: Tutorials and Workshops** <u>https://mdl.library.utoronto.ca/support/tutorials</u>



Map and Data Library: Getting Help

Virtual support:

• Email us to get started mdl@library.utoronto.ca

In-person support:

 Reference Area: Robarts, 7th Floor Monday-Friday, 11am-5pm (by appointment)



1. Introduction Open Data





1. Introduction **Spatial Problem Solving** Example: Public Health

• Identify health trends by location

• Find locations to implement new services for those at risk

• Track infectious diseases

• Study how demographic factors affect the health of communities

• Report on cases of a virus

• This is the map we'll create.





- best locations?

 - Ο
 - \bigcirc
 - Land use?
 - Ο

Case Study: Where to establish new food banks in Brampton

What questions do we need to answer?

• What are the criteria to determine the

• Income level?

• Population density?

Existing resources?

Transportation network?

Community needs?



Case Study: Where to establish new food banks in Brampton What questions do we need to answer?

- - Road network?
 - Census?
 - \bigcirc

• What **spatial** and/or **statistical data** will we need to locate or create?

• Demographic data from the Canadian

Existing services?

• Health statistics?



Case Study: Where to establish new food banks in Brampton What questions do we need to answer?

- - ArcGIS Pro?
 - QGIS?

• What tools/software will be used? • ArcGIS Online?



Case Study: Where to establish new food banks in Brampton

What questions do we need to answer?

- How will the results be shared?
 - Reports?
 - Interactive web maps?
 - Dashboards?
 - Presentations?
 - Posters?

1. Introduction Designing a GIS project

Find and assess spatial data

- MDL Website, Open Data, ArcGIS Online/Living Atlas, etc.
- Create your own data if needed.
- Assess data quality, software compatibility, completeness, licensing.

Map creation, symbolization & analysis

- Style, Labels, Filters, etc.
- Use analysis tools to gain insights.

Sharing & collaboration

• Results can be shared as digital data, printed as map layouts, or uploaded to ArcGIS Online and shared as interactive web maps.



B ArcGIS®Pro

Professional desktop GIS application Create/analyze/share maps and data



Modern user interface

2. ArcGIS Pro Logging In

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2. ArcGIS Pro Creating a new Project





2. ArcGIS Pro Creating a new Project

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• Add Data.

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• Choose ArcGIS Online.

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Search for: City Limit owner: BramptonMaps



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Type :	Feature Layer
Owner :	BracoptonMaps
Summary	City of Brampton municipal boundary
Tags :	city, limit, municipal, boundary, Local Government, Brampton, Topography and Borders, city limit
Modified :	5/27/2020 5:48:32 PM
Path :	https://www.arcgis.com/bome/item.html? kfiid837bf1134444bf1b22d69257460xf60
	Default -
	OK Cancel

• Click **OK**. The layer is added to the map.



• Adjust the symbology.



Symbology - City Limit
Primary symbology
Single Symbol
Symbol
Label
Description





- Add the following layers (also by searching and using the owner: BramptonMaps flag):
 - Transit_Stops_and_Routes
 - **Region of Peel Food Programs**



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Symbology - Region of Peel Food Programs	- * × E
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• Customize the **symbology** for each layer.



- Open the Map Properties
 Set the map rotation to -51

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• Review the **Attribute Table** of the Region of Peel Food Programs layer.

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Measurements	Styles For

Filter the Food Programs layer using a Definition Query. Build the expression: FOOD_BANK is equal to YES.



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- Create a 2km buffer around the City Limit (this will be our study area).
- From the **Geoprocessing** pane, search for and open the **Buffer** tool.



More info about buffering: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm 1 DE

26 Items

Geoprocessing

buffer

Buffer (Analysis Tools)

Creates buffer polygons around input features to a specified distance.

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Buffer 3D (3D Analyst Tools)

Creates a 3-dimensional buffer around points or lines to produce spherical or cylindrical multipatch features.

Graphic Buffer (Analysis Tools)

Creates buffer polygons around input features to a specified distance. A number of cartographic shapes are available fo...

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Create Buffers (GeoAnalytics Desictop Tools)

Creates buffers around input features to a specified distance.

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Pairwise Buffer (Analysis Tools)

Creates buffer polygons around input features to a specified distance using a parallel processing approach.

Multiple Ring Buffer (Analysis Tools)

Creates multiple buffers at specified distances around the input features. These buffers can be merged and dissolved using t...

Summarize Nearby (Analysis Tools)

Finds fastures that are within a reacifia

- Select the **City Limit** layer for the **Input Features** parameter.
- Give the output feature class a descriptive name.
- Specify 2 for the **Distance** value and **Kilometers** for the **Unit**.
- The other parameters can be left at the default values.
- Click Run.

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• Adjust the symbology of the new buffered layer.

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- Create a layer containing only food banks within the study area.
- In the **Geoprocessing** pane, search for and open the **Clip** tool.

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clip

Clip (Analysis Tools)

Extracts input features that overlay the clip features.

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Clip Layer (GeoAnalytics Desktop Tools)

Extracts input features from within specified polygons.

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Clip Raster (Data Management Tools)

Cuts out a portion of a raster dataset, mosaic dataset, or image service layer.

106

Clip Locator (Geocoding Tools)

Clips a locator based on an area of interest or extent and creates a locator with a smaller extent and size.

Pairwise Clip (Analysis Tools)

Extracts input features that overlay the clip features.

106

Flip (Data Management Tools)

Reorients the raster by turning it over, from top to bottom, along the horizontal axis through the center of the raster. This may be...

10

Flip Line (Editing Tools)

Bayarses the from to direction of line features 33 Items

- Specify the **Region of Peel Food Programs** as the **Input Features or Dataset**.
- Leave 'Use the filtered records' toggled **on**.
- Select the buffer layer as the **Clip Features**.
- Give the output a descriptive name.
- Click Run.



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• Remove the original Region of Peel Food Programs layer.


- Create labels for the existing food bank locations
- Right-click the BramptonFoodBanks layer and click the Label menu item to enable labels.



- Right-click the BramptonFoodBanks layer again.
- Click the Labeling Properties item in the contextual menu.



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- Select NAME as the label field if it isn't already
- The Expression box should contain text reading **\$feature.NAME**
- Click Apply.
- Next, click the **Symbol** tab to customize the label's appearance.



- Adjust the label font, size, and colour.
- Click Apply.

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Catalog Geoprocessing Labe	l Class

• Labels will now appear for each point.



2. ArcGIS Online

- Analyze income within the study area.
- Add Data
- Search for and select **Hexagon Bins 500m** owner:BramptonMaps within ArcGIS Online. Click OK.



• In the **Geoprocessing** pane, search for and open the **Enrich** tool.



Geoprocessing

enrich

Enrich (Analysis Tools)

Enriches data by adding emographic and landscape facts about the people and places that surround or are inside data location...

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Enrich Layer (Business Analyst Tools)

Enriches data by adding demographic and landscape facts about the people and places that surround or are inside data locations.

Calculate Motion Statistics (GeoAnalytics Desktop Tools)

Calculates motion statistics for points in a time-enabled feature class.

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Encode Field (Data Management Tools)

Converts categorical values (string, integer, or date) into multiple numerical fields, each representing a category. The encoded n...

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Enclose Multipatch (3D Analyst Tools)

Creates closed multipatch features from open multipatch features.

Neighborhood Selection (Geostatistical Analyst Tools)

Creates a layer of points based on a user-defined neighborhood.

Neighborhood Summary Statistics (Spatial Statistics Tools)

Calculater rummans statistics of one or more numeric fields

19 Items

- The Enrich tool defaults to United States locations. Change this by clicking on the **Environments** tab.
- Click the **folder icon** to the left of the Data Source box.





• Find and select Canada. Click OK.



- In the **Parameters** tab of the **Enrich** tool, specify the following:
- Input Features: Select the Hexagon Bins 500m layer
- Output feature class: Enter BramptonMedianIncome or another descriptive name.

Geoprocessing		~ 4 ×				
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Parameters Environme	ents	0				
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Hexagon Bins - 500m Output feature class BramptonMedianIncome Variables (+)						
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- Click the + button next to the word Variables.
- Navigate to Income > Common Income Variables.
- Check the box next to 2023 HH Inc. Median Curr\$.

- Navigate to **Population** > **Common Population Variables**.
- Check the box next to **2023 Total Population**.
- Click OK. Click Run.



- Review the Attribute Table of the new layer created by the Enrich tool.
- The layer now includes median household income values and population counts for each feature.

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- Open the **Symbology** pane for the BramptonMedianIncome layer
- From the Primary Symbology dropdown, choose Graduated Colors.

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- Select 2023 HH Inc: Median Curr\$ for the Field
- Input 5 for the number of classes
- Choose a colour ramp
- Note: you may wish to experiment with the classification method, number of classes, and color scheme to see how the same data may be visualized in different ways.

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eoprocessing Symbolog

- Click on the **Histogram** tab of the Symbology pane.
- Note the high number of zeros for the Median Income field.
- This is because some features had no data returned by the Enrich Layer function.



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- Add a **Definition Query** to the Median Income layer to filter out the zeros.
- Build the expression: 2023 HH Inc: Median Curr\$ is not equal to 0
- Click Apply. Click OK.

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ter out the zeros. **qual to 0**

• Remove the original Hexagon grid layer. The map should look something like this.



- How far is each area from a food bank?
- Open the Near geoprocessing tool.
- Specify the geoenriched layer as the **Input Features**.
- Input the Food Banks layer for the **Near Features**.
- Distance Unit = **Kilometres**.
- Distance Field Name = NEAR_FoodBank
- Click Run.

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- The layer's Attribute Table now contains a field called **NEAR_FoodBank**.
- The attribute values in the NEAR_FoodBank field represent how far each area is from a food bank, in kilometres.

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- How far is each area from a bus stop?
- Open the Near geoprocessing tool.
- Specify the geoenriched layer as the **Input Features**.
- Input the Bus Stops layer for the **Near Features**.
- Distance Unit = Metres.
- Distance Field Name = NEAR_BusStop
- Click Run.

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Geoprocessing Symbology	

- Use the information in the attribute table to select some potential locations.
- Click the **Select by Attributes** button.

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tionmentConfidence	populationToPolygonSizeKating	2023 Total Population	2023 HH Inc: Median Curr\$	Shape_Length	Shape_Area	NEAR_FID	NEAR_DIST
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-1	-1	4590	115328.05	2999.999993	649519.050001	7	2.166207
- 1		3262	110204.08	2999.999993	649519.05	2	1.281385
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• We will build an expression to find areas that are:

• Densely populated

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- We will build an expression to find areas that are:
 - Densely populated
 More than 2km from an existing food bank

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- We will build an expression to find areas that are:
 - Densely More than 3km populated from an existing food bank
- Within 50 metres of a bus stop

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Where 2023 Total Population And • NEAR FoodBank	is above average is greater than	



- We will build an expression to find areas that are:
 - Densely populated
 More than 3km
 Within 50 means of a bus stop of a bus stop food bank

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And • NEAR_BusStop	• is less than • 50	• 🗙
And • 2023 HH Inc: Median Curr\$	• is below average •	*
		Apply OK

Within 50 metres Relatively lowof a bus stop income

- Click OK.
- Results will be something like this:





• Export the selection to create a new layer.





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• Result:



• Based on the result, where would the best locations be to establish new food banks in Brampton, Ontario?

• What could be done to make this analysis better?

2. ArcGIS Pro - Next Steps - Layouts

• Next steps: Create a map **Layout** by choosing New Layout from the Insert tab



2. ArcGIS Pro - Next Steps - Layouts

• Click the **Map Frame** button and click the **Map** button



2. ArcGIS Pro - Next Steps - Layouts

- Hold down the left mouse button and drag to place the Map Frame within the Layout.
- **Title text, north arrows, scale bars**, and **legends** can be added at this point.



Resources: Further Reading

Learn ArcGIS Pro

- Map and Data Library Tutorials https://mdl.library.utoronto.ca/taxonomy/term/70
- Esri Training: Getting Started With Spatial Analysis

https://www.esri.com/training/catalog/5bca58f8f77b99238f 845elc/getting-started-with-spatial-analysis/

• Esri Training: Exploring Spatial Relationships

https://www.esri.com/training/catalog/60d1fa75b588b75ae 084c42c/exploring-spatial-relationships/

• Layouts in ArcGIS Pro https://pro.arcgis.com/en/proapp/latest/help/layouts/layouts-in-arcgis-pro.htm

Other Resources

• Esri Education Blog: How to find, evaluate, and use geospatial data in a GIS https://community.esri.com/t5/education-blog/how-to-findevaluate-and-use-geospatial-data-in-a/ba-p/1366056

planning/overview



GIS for Urban Planning (Official Esri website) https://www.esri.com/en-us/industries/urban-community-

Resources: Finding Data

Spatial Data

MDL Geospatial Data Collection <u>https://mdl.library.utoronto.ca/collections/geospatial-data</u>

Scholars GeoPortal https://geo1.scholarsportal.info

Natural Earth Data https://www.naturalearthdata.com/

Open Street Map https://www.openstreetmap.org

City of Toronto Open Data <u>https://open.toronto.ca/</u>

Ontario GeoHub https://geohub.lio.gov.on.ca/

Toronto and Region Conservation Authority Open Data <u>https://data.trca.ca/</u>

GIS at NASA https://www.earthdata.nasa.gov/learn/gis

ArcGIS Hub https://hub.arcgis.com/search

Other Data and Media

MDL Numeric Data Collection <u>https://mdl.library.utoronto.ca/collections/numeric-data</u>

Wikimedia Commons <u>https://commons.wikimedia.org/wiki/Main_Page</u>

Creative Commons Search Portal <u>https://search.creativecommons.org/</u>

Freesound https://freesound.org/

Open Culture (see the Free Art & Images and Free Music sections) <u>https://www.openculture.com/</u>

Burst by Shopify https://www.shopify.com/stock-photos

GitHub: Awesome Public Datasets <u>https://github.com/awesomedata/awesome-public-datasets</u>

Internet Archive (Archive.Org) <u>https://archive.org/</u>

Resources: Troubleshooting

Esri community discussion boards https://community.esri.com/

GIS StackExchange https://gis.stackexchange.com/

Contact the Map and Data Library https://mdl.library.utoronto.ca/about/contact-form


Thank you!

https://tinyurl.com/ProAnalysis



