Proximity and Hot Spot Analysis Map Viewer

July 2023

esri Canada

Tutorial Overview

In this tutorial, you will learn how to use ArcGIS Online tools to analyse crime as part of the *Career Path Series* on **GIS in Crime Analysis** - https://bit.ly/3cU7zSf. Proximity, Analyze Patterns and Summarize Data tools will be used to explore break and enters that occurred in Toronto in 2019 and how the analysis can help the Toronto Police Service (TPS) make informed decisions.

Before you work on this tutorial – you should complete the tutorial *Getting to know the Map Viewer* that goes over the different sections (Contents and Settings toolbars) of the Map Viewer.

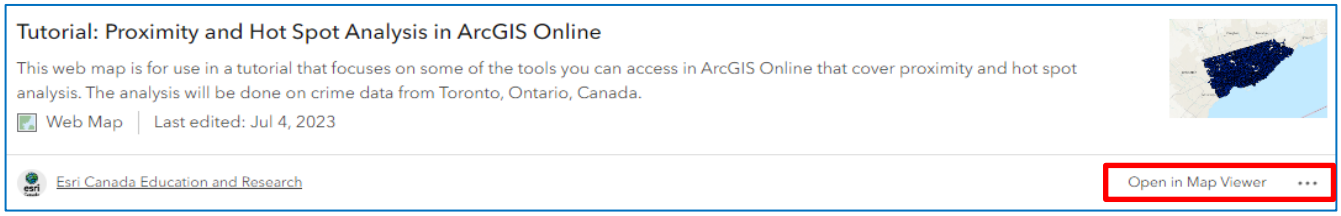
If you do not have ArcGIS Online accounts for yourself or your students, you can request them here: k12.esri.ca. Student accounts can be requested only by an adult (age 18 and over). If you have a public account, you will not be able to access the analysis tools used this tutorial.

Time required: 30-40 minutes.

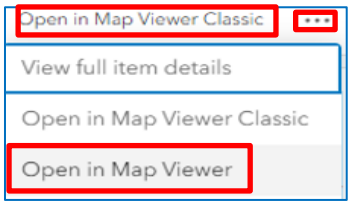
Part A: Explore Break and Enter Data from 2014 to 2019

You will begin with exploring the Toronto crime data – **Break and Enter 2014 to 2019** that is included in this tutorial. Each incident of break and enter is represented as a point on the map showing the approximate location of the crime.

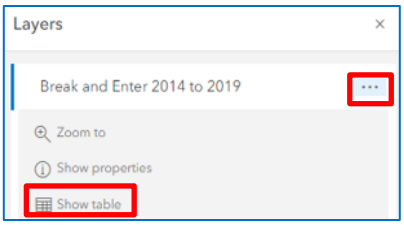
1. **Sign into ArcGIS Online** at www.arcgis.com OR through your school account.
2. Click on **Home** and **search** for **"hot spot analysis arccanada."**
3. Find the result Tutorial: Proximity and Hot Spot Analysis in ArcGIS Online. Click on **Open in Map Viewer**.



Note: If it says "Open in Map Viewer Classic," click on the … and select **Open in Map Viewer**.



4. In the *Contents* toolbar, click **Layers**.
5. Click on …. next to the **Break and Enter 2014 to 2019** layer and select **Show Table**.
6. Explore the data in the table.



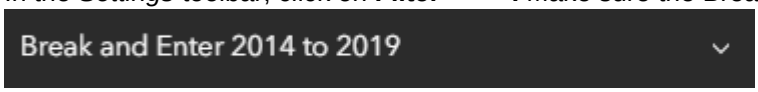
What are some of the fields you can filter to create a subset of the data?

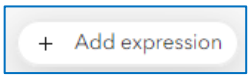
7. Close the table.
8. In the *Contents* toolbar, click **Save As** and add your name or initials to the web map.

Part B: Filter Break and Enter Data

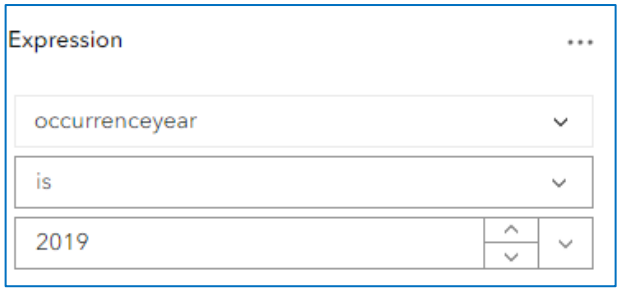
In this part of the tutorial, you will filter the data to show where **Break and Enters have occurred in Toronto in 2019**.

1. In the *Settings* toolbar, click on **Filter**  . Make sure the Break and Enter layer is active.



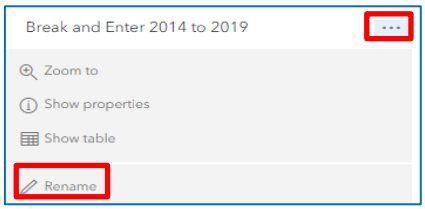
2. Click on 

to set up the filters.
   a. Select **occurrenceyear** in the first drop-down
   b. For the second drop-down - leave it as "**is**"
   c. Type in **2019**
   d. Click **Add another expression**.
   e. Select **offence** and ensure **B&E** is selected.
   f. Click **Save** to apply the filters.
3. Open the table to view the data.



How many incidents of break and enters were there in 2019?

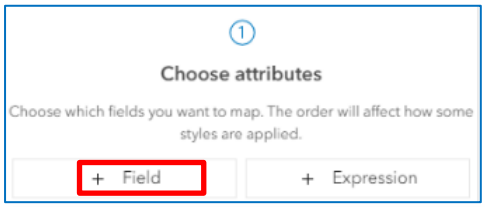
4. Close the table.
5. Select the **Neighbourhoods** layer to view it on the map.
6. Explore the map to view where the break and enters occurred in 2019.
7. Click on …in the **Break and Enter** layer and select **Rename**.
8. Rename your data layer **Break and Enter 2019**.

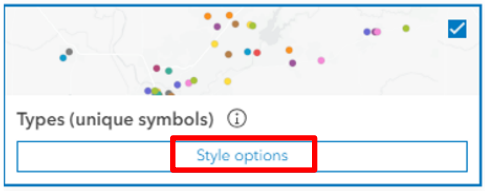


Part C: Change Symbology

Now that you have the Break and Enter data visible on your map, let's find out what the premise type is where these incidents occurred. The premise types include, commercial, house, apartment, other and outside.

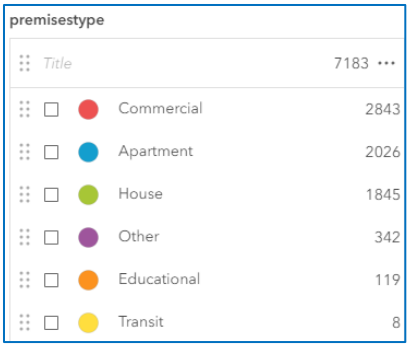
1. In the *Settings* toolbar, click on **Styles**  . **Make sure Break and Enter 2019** is the active layer.
2. Click on **Field**.
3. Select **premisetype** as the attribute to show and click **Add.**
4. By default, the data is symbolized by **Types** (Unique symbols). Click on **Style Options** to view the total number of premise by type.



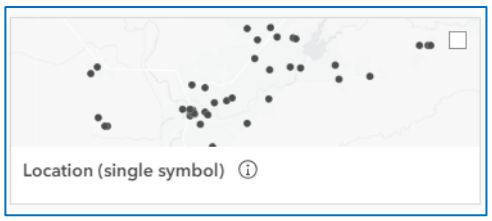


Which premise type has the highest number of break-ins?

Why do you think this premise type experiences the most break-ins?



5. Click **Cancel** with you are done answering the questions.
6. **Change Symbol** of the *Break and Enter 2019* layer to show **Location (single symbol)** to view location only.



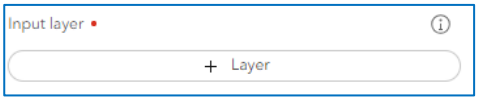
7. Click **Done**.
8. Unselect the **Break and Enter 2019** and the **Neighbourhoods** layer.
9. Select the **TPS Division** layer to make it visible on the map. This layer represents the locations of the police stations and precincts in Toronto.

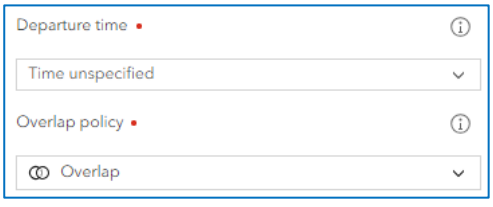
Part D: Proximity Analysis of Break and Enters in Toronto

In this part of the tutorial, you will analyse the proximity of break and enters to TPS divisions. You will begin by using the **Generate Travel Areas** (formerly Create Drive-Time Areas) tool to determine visually on a map the drive zone of five minutes from a police station.

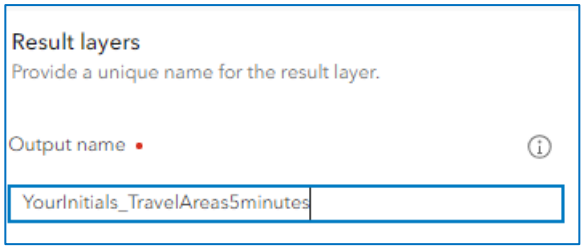
This analysis tool uses information about road networks and travel speed to determine how far someone could drive from a location within a specified time. The result of your analysis will determine the percentage of crime that the TPS can respond to within five minutes.

1. Click on Analysis > **Use proximity** > **Generate Travel Areas.**
   a. Step 1 – Click **+ Layer** and select **TPS Police Divisions.**
   b. Step 2 - Change the *Travel Mode* to **Driving Time.**
   c. Step 3 – Type in "**5**" under *Cutoffs* and click **Add**.
   d. Step 4 – Ensure the *Cutoff units* are "**minutes**."
   e. Step 5 – *Travel directions* is "**Away from input locations**."
   f. Step 6 - Keep the *Depart time* and *Overlap policy* as the defaults.

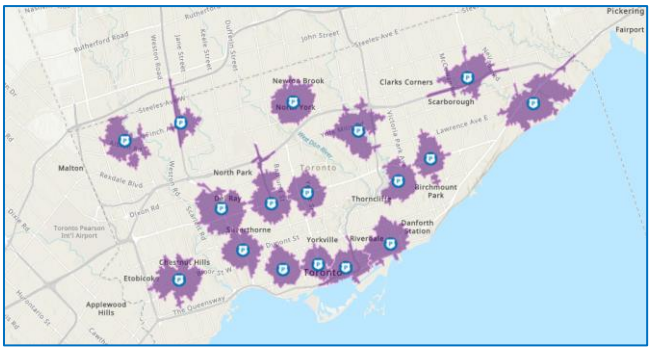




g. Step 7 - **Add your name or initials** to "**TravelAreas5minutes.**"



h. Click **Run** when you are ready.

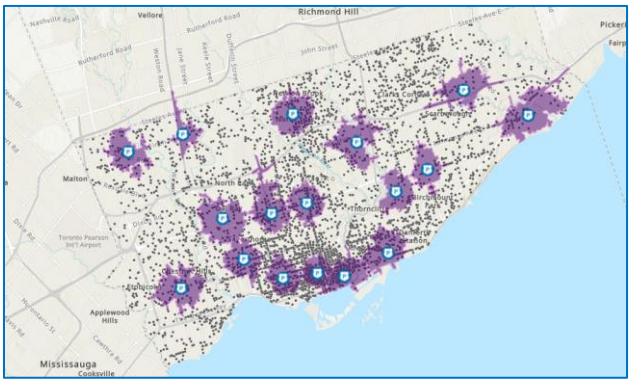


This map shows the drive-time area of five minutes from each TPS Division.

Part E: Break and Enters within a five-minute drive of a Police Station

In this part of the tutorial, you will use the **Aggregate Points** tool to find out how many break and enters occurred within a five-minute drive of each of the TPS police divisions (police stations) in 2019. This tool summarizes a set of points that fall within a specified area. This will help us determine the percentage of break and enters that are close to police stations across the city.

1. **Click and drag** to move the *TPS Police Divisions* layer to the top in the *Layers* section.
2. Under *Layers*, make the **Break and Enter 2019** layer visible on the map.

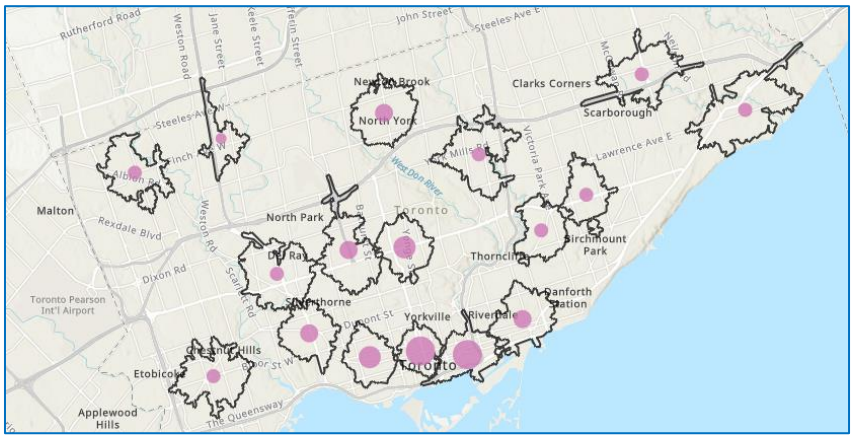


3. Click on Analysis > **Summarize Data** > **Aggregate Points**.
    a. Step 1 – Click **+ Layer** and select the **Break and Enter 2019** layer.
    b. Step 2 – Ensure the *Area type* is "**Polygon Layer**"
    c. Step 3 – Click on **+ Layer** and select the travel area layer you created in the previous section.

d. Step 4 – Skip the *Calculate Statistics* section.

e. Step 5 – Make the *Output name* "**Your name or initials_AggregateBE2019**."

i. Step 6 - Click **Run**.

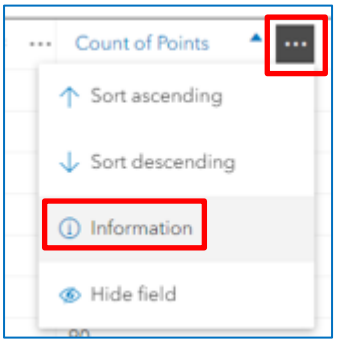


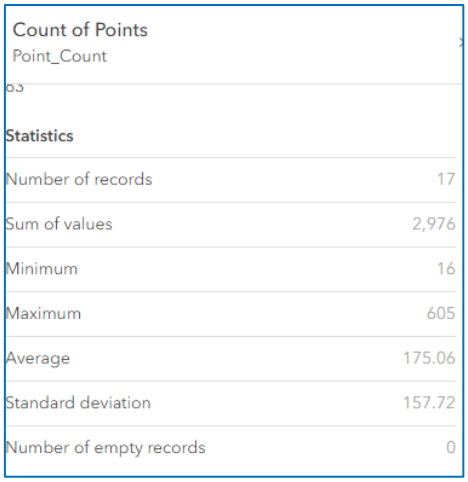
4. Once the analysis has been completed, uncheck all the layers except for the one that was just created to show the break and enters that are within a drive-time zone of five minutes of a police division.
5. Click on the purple circles in the zones that have been created. What information is included in the pop-up?
6. Under *Layers*, click on … next to the new aggregate layer you created and select **Show table**.

Explore the data in the table. Does it look familiar?

Let's view the statistics for this layer.

7. Scroll across to the end of the table and left click over the column - **Count of points** and click on **…** then select **Information.**





8. Using a calculator, calculate the percentage of break and enters in 2019 that occurred within a five-minute drive time from a police station.

Equation: Sum of Values (aggregated points in five-minute drive zone)/total # of break and enters in 2019 *100

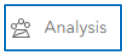
Note: The total # of break and enters in 2019 should be noted in Part B, page 2.

What is the percentage of total break and enters that occurred within a five-minute drive of a police station in Toronto?

9. Close the table.
10. Uncheck all the layers, except the **Break and Enter 2019** layer.

Part F: Hot Spot Analysis of Break and Enters in Toronto, 2019

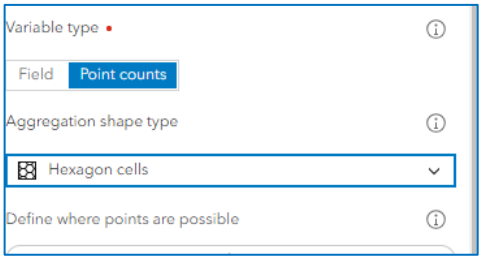
In this part of the tutorial, you will use the **Hot Spot Analysis** tool to discover the areas where a large concentration of break and enters occurred in 2019. Crime analysts use this tool to identify patterns in order to understand why crimes are happening where they are and to plan a response to deter incidences of crimes in the area.

1. Go to 

> **Analyze Patterns** > **Find Hot Spots**.
    a. Step 1 –Click **+ Layer** and select the **Break and Enter 2019** layer
    b. Step 2 – Leave the *Variable type* as **Point counts**.
    c. Step 3 - Change the *Aggregation shape type* to **Hexagon cells.**

    Learn about why use Hexagons https://bit.ly/2zry83H

    d. Step 4 – Skip to *Result layer*. Name this layer using "**Your name or initials_HotSpotsBE2019**."
    e. Step 5 - Click **Run**.

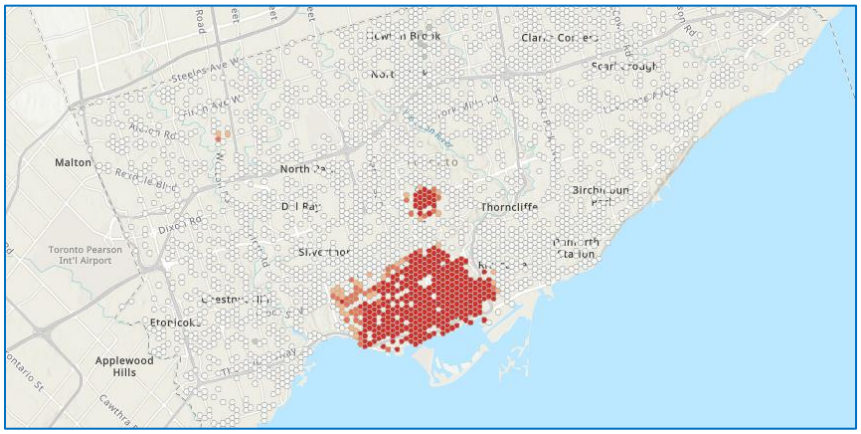


2. When the analysis has run and the new layer appears in the *Layers* section, click **Back**.
3. Close the *Analysis* window by clicking on X next to the Tools menu.

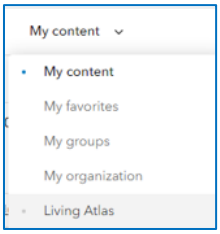
4. Remove the Break and Enter 2019 layer from the map by clicking on the eye icon next to the layer name.

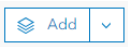
Proximity and Hot Spot Analysis Map Viewer

Explore the map to view the areas of the city where there were higher concentrations of break and enters in 2019. Refer to the legend for information to help you interpret the findings.



Now let's add some demographic data to your map to get a better picture of what is going on in those hot spots. This type of data provides characteristics of a geographic region, like a dissemination area or census tract.



5. Click  > Change from *My content* to **Living Atlas Layers.**

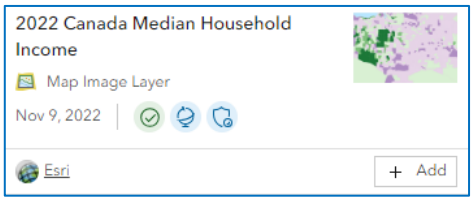
6. Type "**Canada population**" in the search box.

   a. Add the **Canadian Population & Dwelling Counts 2021** layer.

   You will see the population density per square kilometre, 2021.

7. Type "**median**" to **Canada population** in the search box.

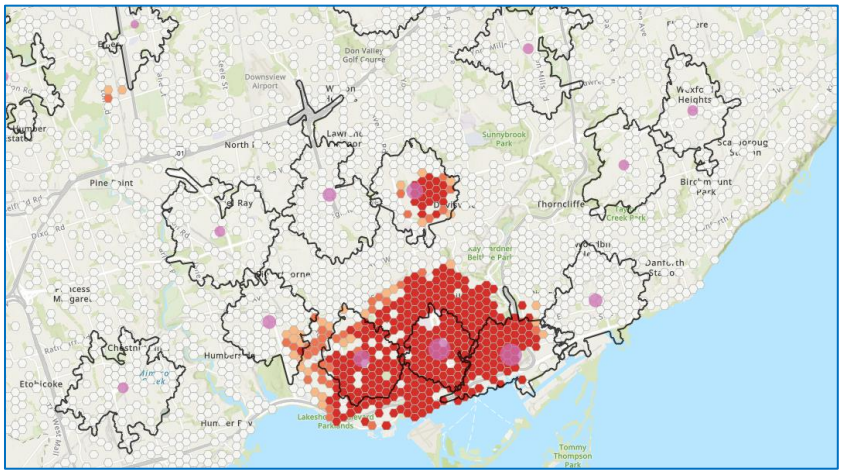
   a. Add the **Canada Median Household Income** layer.



8. Zoom to the hot spots on your map and explore the population density and median household income in those areas.

What connections can you make between the break and enter hot spots and the demographic data that you have explored on the map?

9. Activate the **BE2019 Near Police Stations** layer and make sure it is above the hot spot layer in the *Content* section. See map below.



Looking at the map and referring to the legend, what does this analysis tell you about where the break and enters occurred in Toronto in 2019? What are some decisions the TPS can make now that they have this information?

Reference

Track crime patterns to aid law enforcement tutorial, Learn ArcGIS.

Next Steps

You now have a glimpse into how you can use GIS for crime analysis. Do you want to learn how it's used for health? Try the following resource on **GIS in Health** - https://arcg.is/1CfbCD.