NGA Disparate Data Challenge

PYXIS DISCRETE GLOBAL GRID SYSTEM

Disparate Geospatial Data Integration On-Demand

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Summary

Data values from many distributed and disparate types of any geospatial sources are assembled on a discrete global grid system. The DGGS allows for the aggregation and decomposition of data values from multiple sources and the formation of collection of these values – called geopackets - that hold calculated statistics and distribution (histogram or frequency) that characterize the data values.

The data can be acquired from conventional GIS data sources (vector features and raster coverages) and other data that has geospatial reference. The processing of data values into the DGGS can be completed prior to the request or in some cases efficiently processed into the DGGS after the request.

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https://pyxisglobe.com/view/Explore/Global%20Population%20Density
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The Breakthrough in Geospatial Data Integration

The PYXIS DGGS serves as an optimized digital framework for combining and analyzing geospatial information on-demand.

The PYXIS innovation has developed a fully functional Discrete Global Grid System (DGGS). Discrete Global Grid Systems are spatial references systems that use a hierarchical tessellation of equal-area cells to partition and address the entire globe. A DGGS differs from conventional geographic coordinate reference systems; **DGGS are designed to be an information grid, not a navigation grid.**

The PYXIS DGGS is fundamentally a data integration platform with the specific analytical ability to perform "what is here?" and "where is it?" queries over disparate variable geospatial data.

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2 Simple Questions…

Where is It?

What is Here?

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The Breakthrough in Geospatial Data Integration

In a DGGS, cells are the fundamental unit of geographic location. Each cell is addressed with a unique index.

A DGGS is data agnostic. Mechanisms are provided to sample and quantize data values from conventionally referenced geospatial information sources into the discrete cell structure of the DGGS. Data values, assigned to cells, are aligned to the DGGS tiling structure, integrated and fused; they are independent of spatial reference system, spatial scale, or data type. Operations built on the DGGS index allow Earth data to be efficiently accessed, related, aggregated, and transformed. Information in a DGGS can be portrayed and analysed at any spatial datum including WGS-84. PYXIS has worked with the Open Geospatial Consortium to make DGGS an international standard.

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OGC Standard -

http://www.opengeospatial.org/projects/groups/dggsswg

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The Breakthrough in Geospatial Data Integration

ANY geospatially referenced information can be used to populated data values in a DGGS cell.

PYXIS Studio uses Geospatial Data Abstraction Library (GDAL) to read GDAL raster and OGR vector formats including those listed in the Data Challenge Data Depot:

- **Services** – OGC WMS, WFS, and WCS, Esri Rest, Published APIs, GeoJSON, OpenDAP
- **Conventional GIS Formats** – NITF Data, Geotiff, NetCDF, ADF, GRID, GML, KML, Shapefiles, GDB, CSV

So simple a child can use it…

The PYXIS DGGS is exposed as an easy to use web interface called the PYXIS Studio that can be easily customized with Java Script.

The Studio is so easy that children as young as 10 are using it to learn Earth Sciences and Geospatial Statistics - https://vimeo.com/117639516 but provides unique data integration capabilities that make it desirable for advanced data analytics. The UN-GGIM has just adopted its use in their forthcoming Global Statistical Geospatial Framework. NASA, NRCan, USGS, and others have been testing and running pilots with the PYXIS Studio this year.

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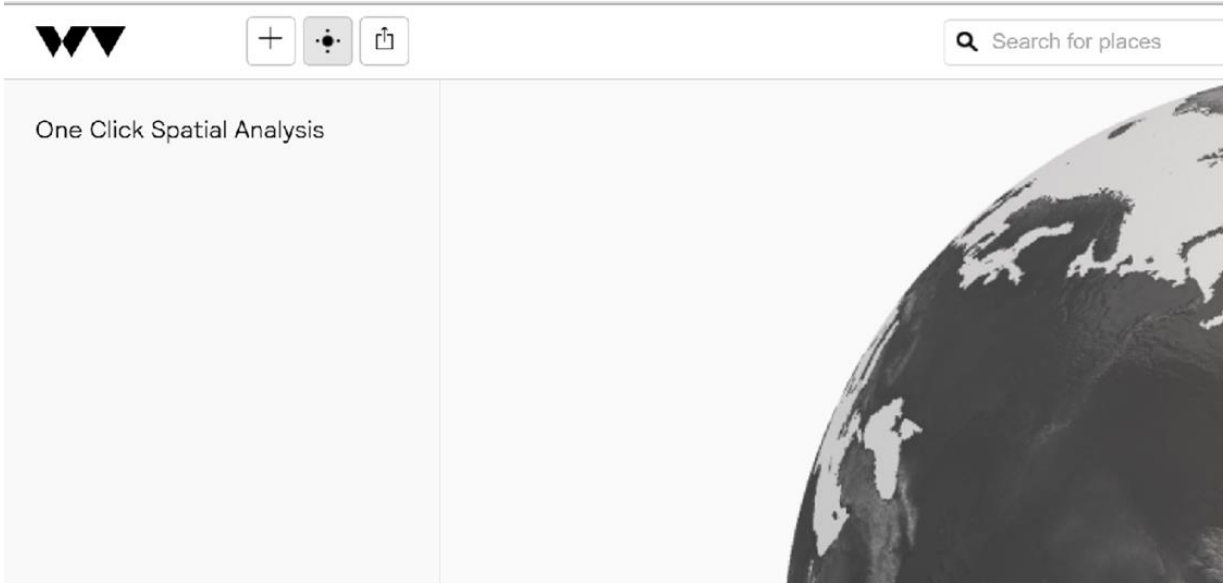
How it works

The PYXIS Studio is a web based interface that simplifies Spatial Analysis into a Three Buttons Workflow...

The PYXIS Studio DGGS Interface

The interface is a Globe. It works the same anywhere on the planet providing equal area anlysis anywhere on the planet.

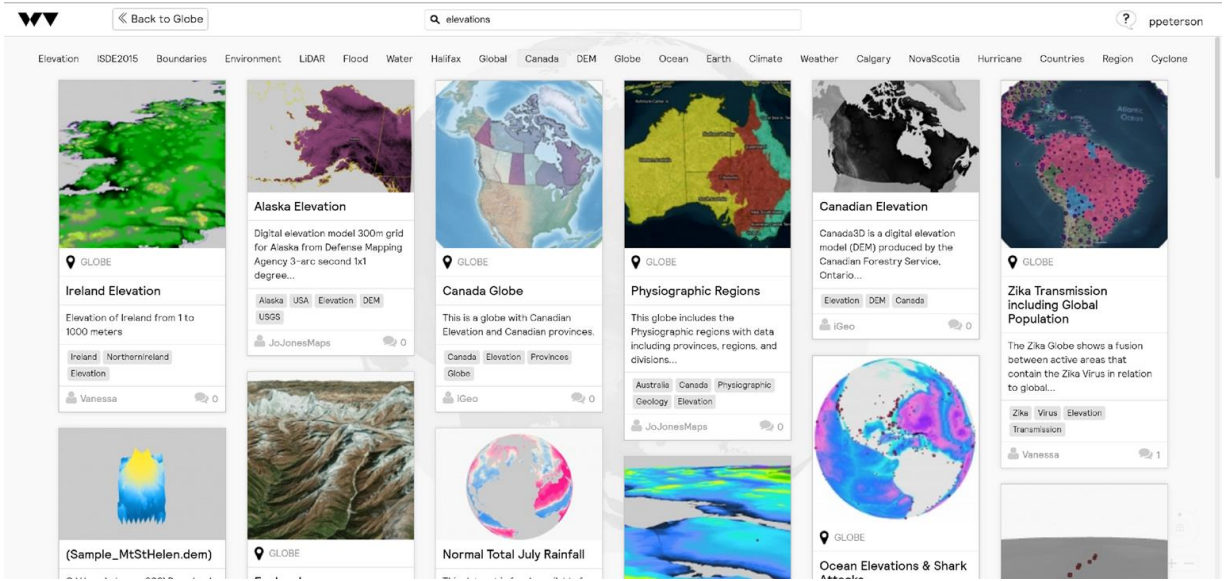


Data Assembly: Search Network (PyxNet) for Content

A network of data collections of geospatial Data Values is recorded in a searchable catalog. The catalog contains information that allows the character of the source data to be searched by keywords, metadata, attributes, attribute values, location and spatial extents, etc. The catalog is populated manually with local GIS content to a gallery and populated by crawling open web services - e.g. OGC, Esri REST, openDAP, public APIs, etc

The user searches over the catalog of content by entering search parameters in the UI (including spatial extents), potentially previewing, then chooses data sources, and each is automatically listed in a legend.

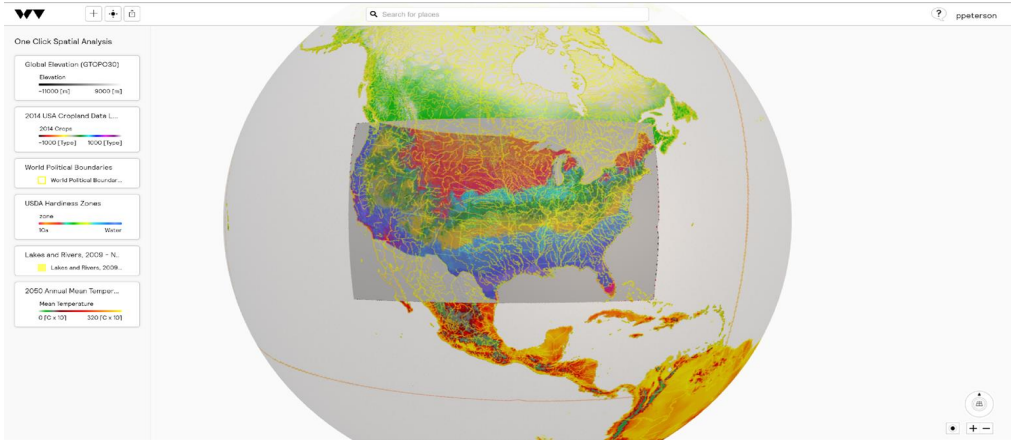
Data Assembly: Select Multiple Geospatial Data Sources



Data Assembly: The Legend connects content to the globe

The legend contains a graphic symbolizing the geometry of the phenomena that is represented by the data sources. Data values that describe the geometry, also called attributes, are used to style the Legend symbol.

Data Assembly: Displays representation of phenomena on DGGS and in Legend



Try this globe out here - https://www.pyxisglobe.com/view/b73af68a-53b6-4e6c-812e-9d212d002603

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Data Assembly: Individual Data Values are stored in a DGGS Cell

Data values held in DGGS cells and can be accessed directly by the user by picking a location on the Earth.

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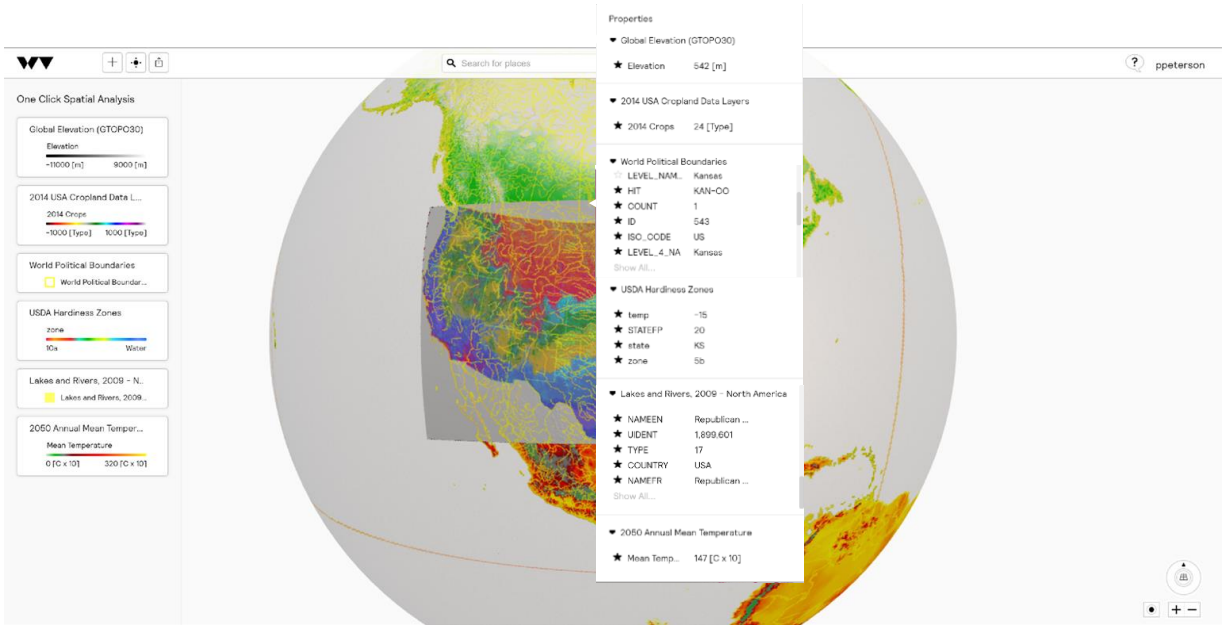
Data Assembly: Individual Data Values are stored in a DGGS Cell



One Click Spatial Analysis: Select place of interest

Using the cursor the user selects/picks an area of interest with one click of the mouse (or to define a more complex selection several points). Selection could also be made:

1. By other graphical method,
2. An algorithm, or
3. A search criteria or filter using a query string or
4. By processing natural language

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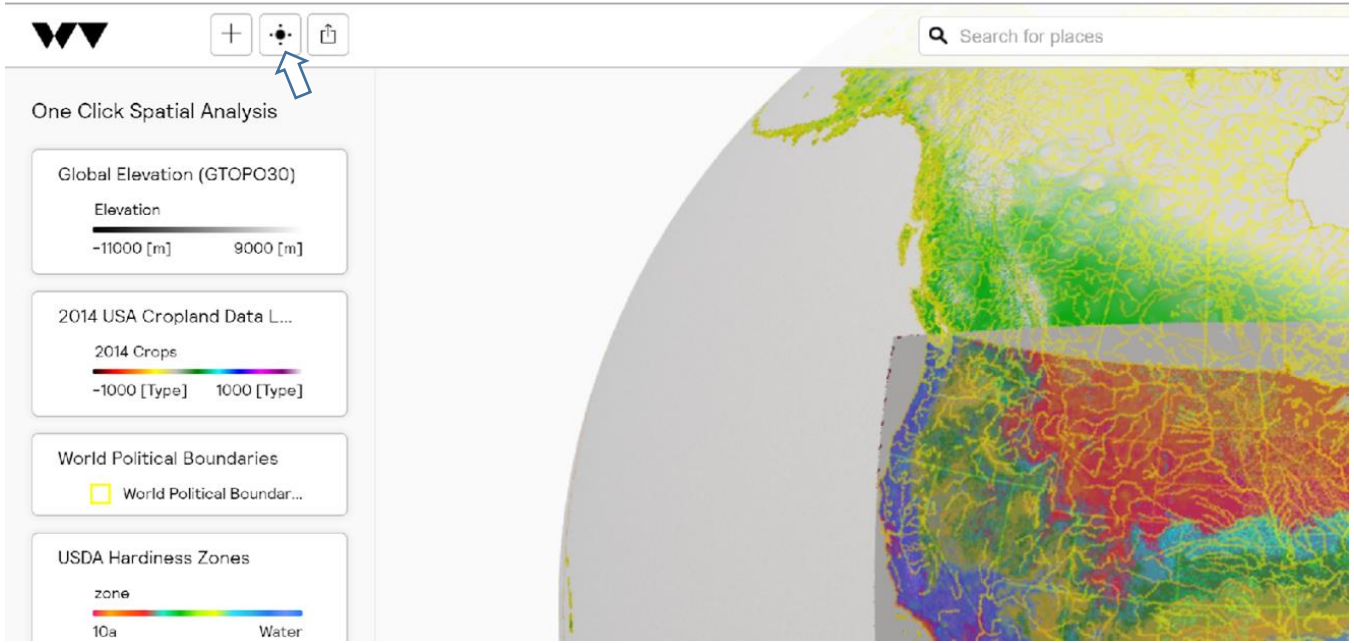
One Click Spatial Analysis: Select place of interest



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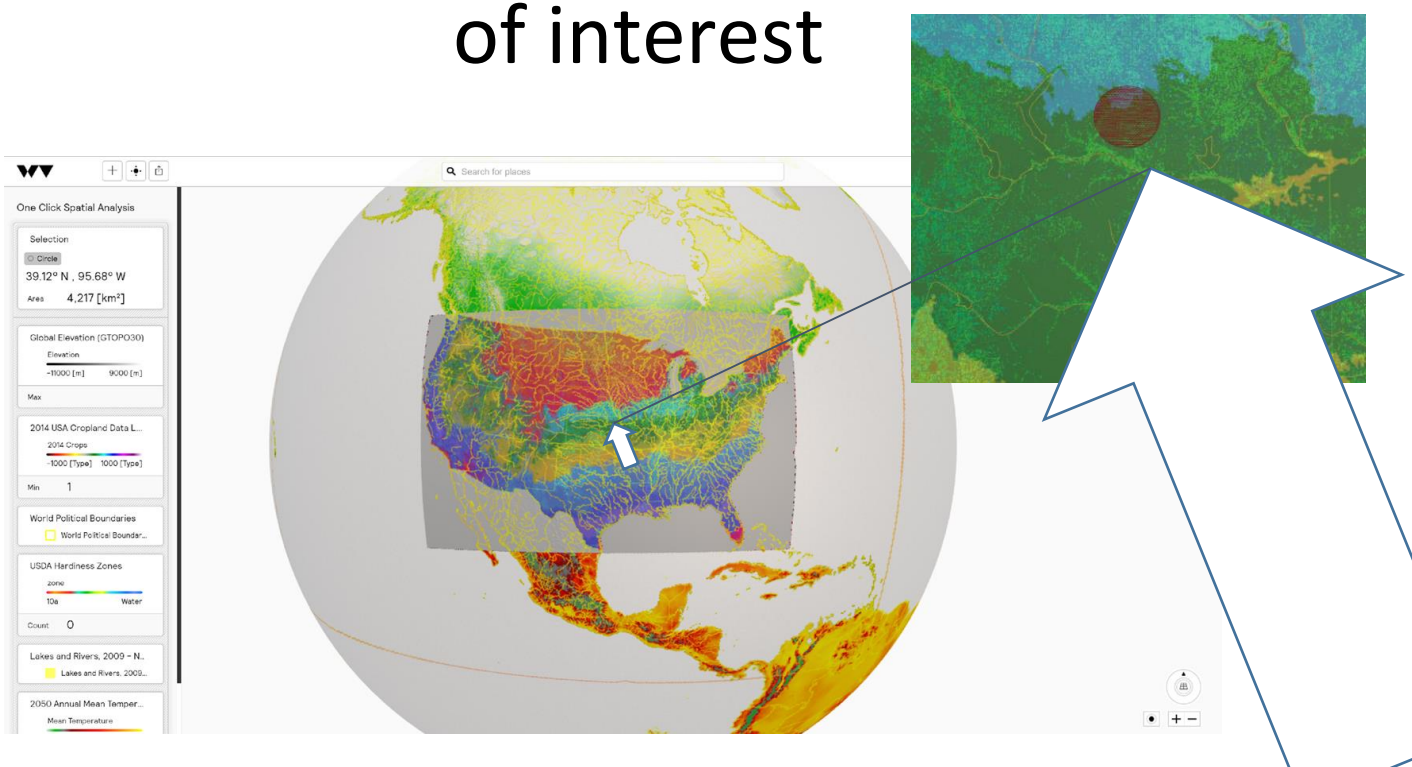

One Click Spatial Analysis: data values, results of mathematical operations, statistics and models

The DGGS efficiently and automatically extracts the data values stored or represented in the cells of the DGGS and then calculates, generates, and/or reports on:

- 1) the actual data value or
- 2) the result of mathematical operations between various data values or
- 3) statistics on the aggregation of data values - exemplar: sum, mean, average, count, max, min.
- 4) the result that use the values along with algorithms to compute or model a secondary phenomena

as a

- 1) a single numerical value or
- 2) a list of values or
- 3) a graph or
- 4) animated sequence of graphs

which is displayed within the Legend and related to the phenomena represented in the legend.

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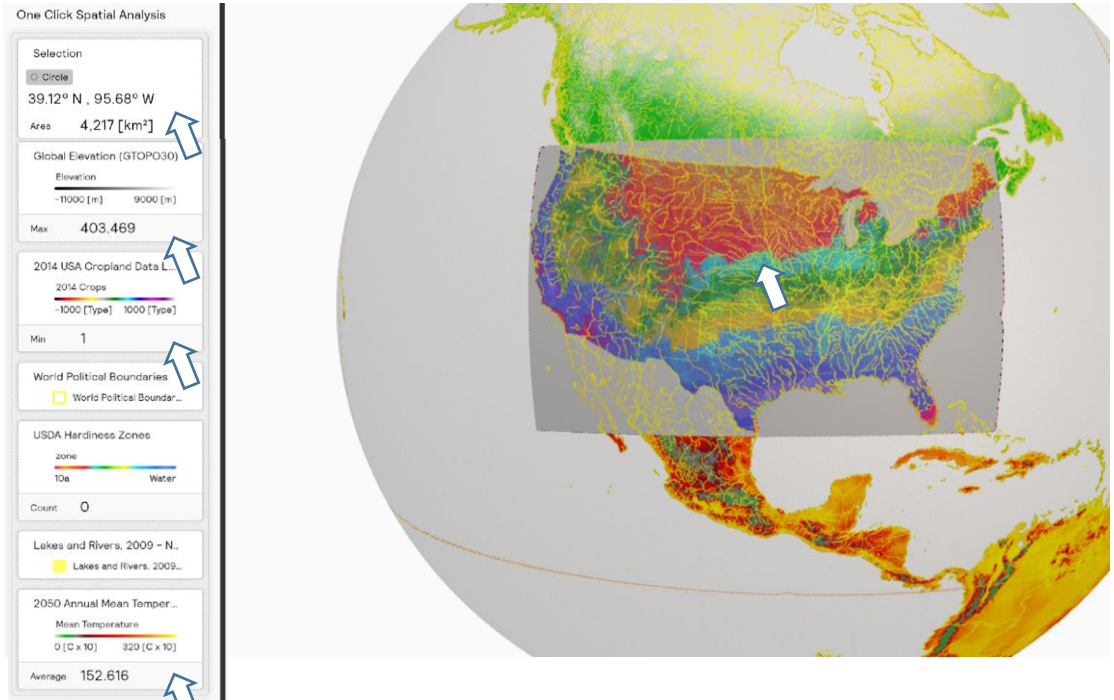
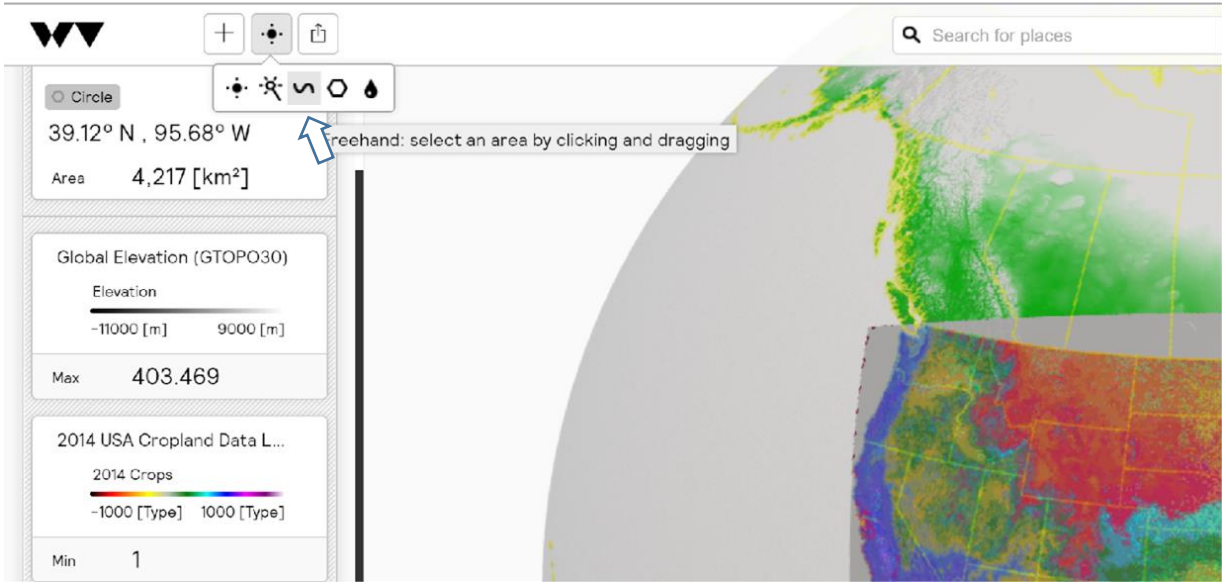
One Click Spatial Analysis: data values, results of mathematical operations, statistics and models



One Click Spatial Analysis: or to define a more complex selection several points



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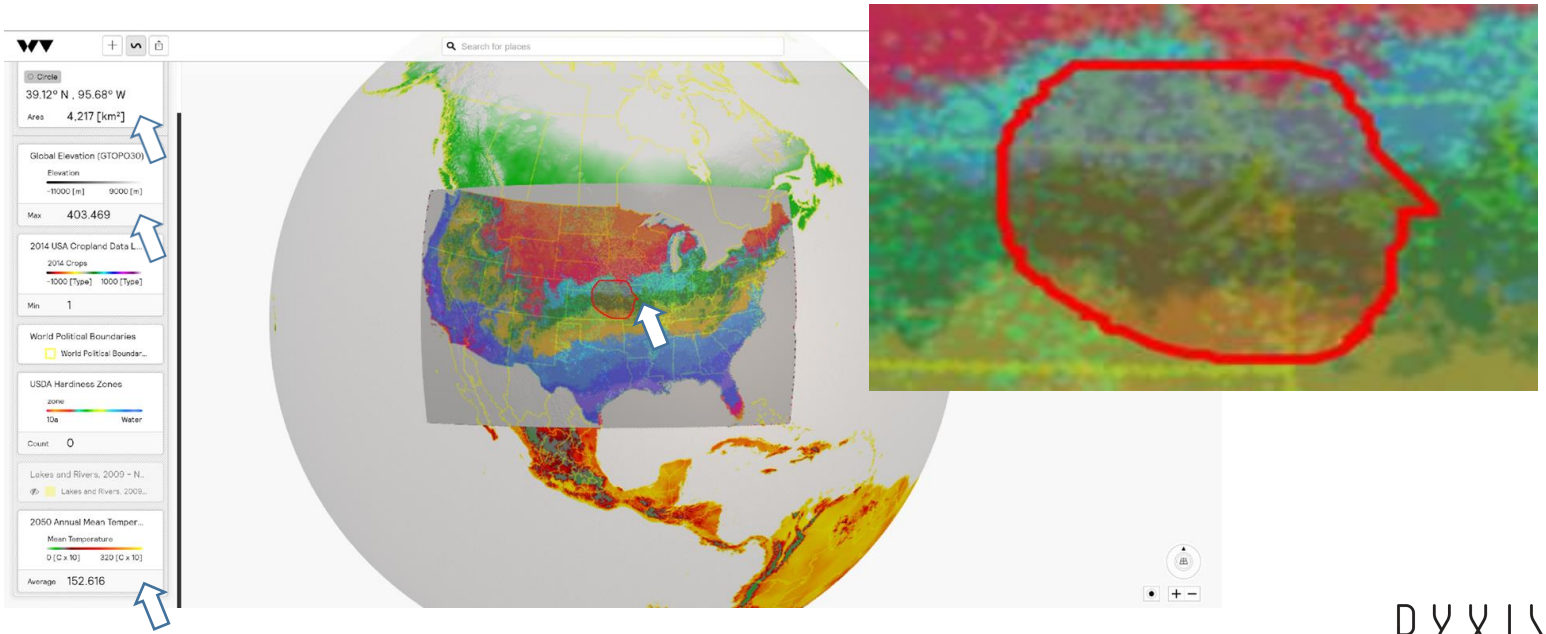

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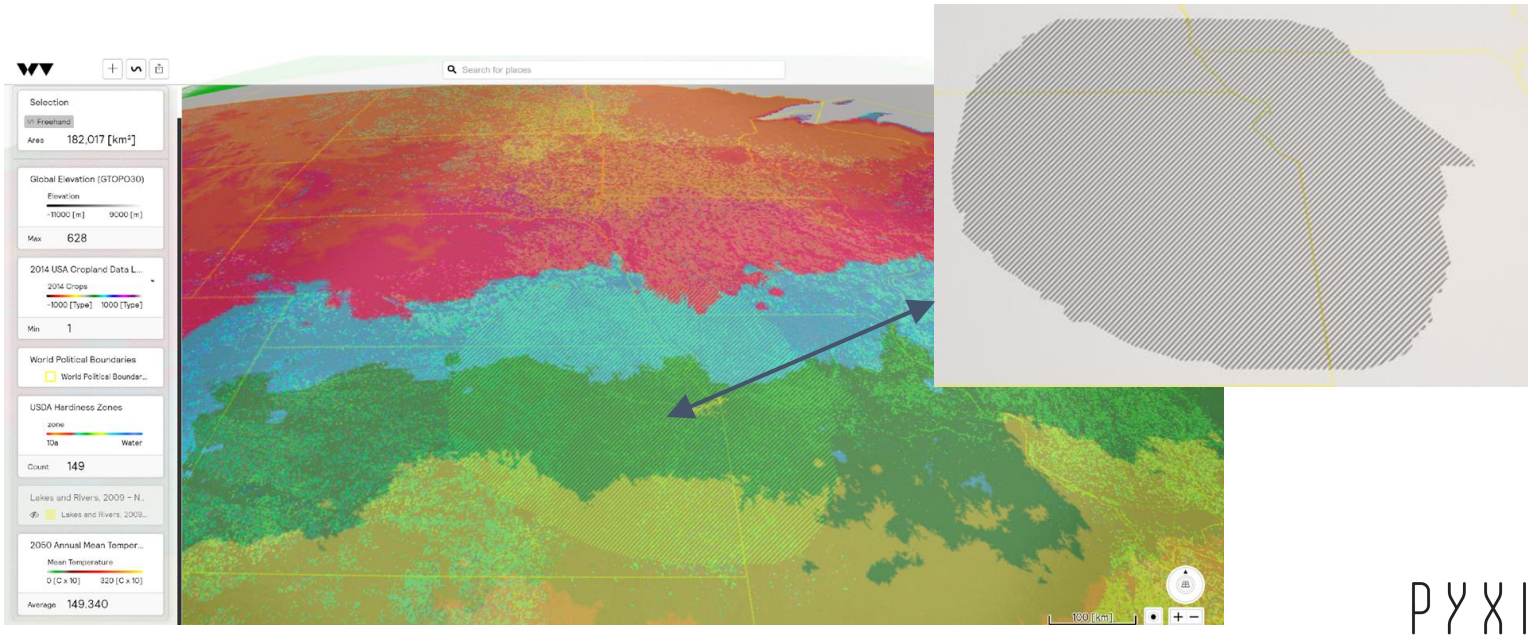
One Click Spatial Analysis: or to define a more complex selection several points



One Click Spatial Analysis: selection refinement

Further, the selection can be refined by modifying the range of values contained within the selection. Example a selection of DGGS cells that contains values representing elevations could be refined by subselecting a range of values that would update the selection and thus recalculate, regenerate, and/or re-reports on the updated values as shown above. The refinement could also occur

1. By graphical method,
2. An algorithm, or
3. A search criteria or filter using a query string or
4. By processing natural language

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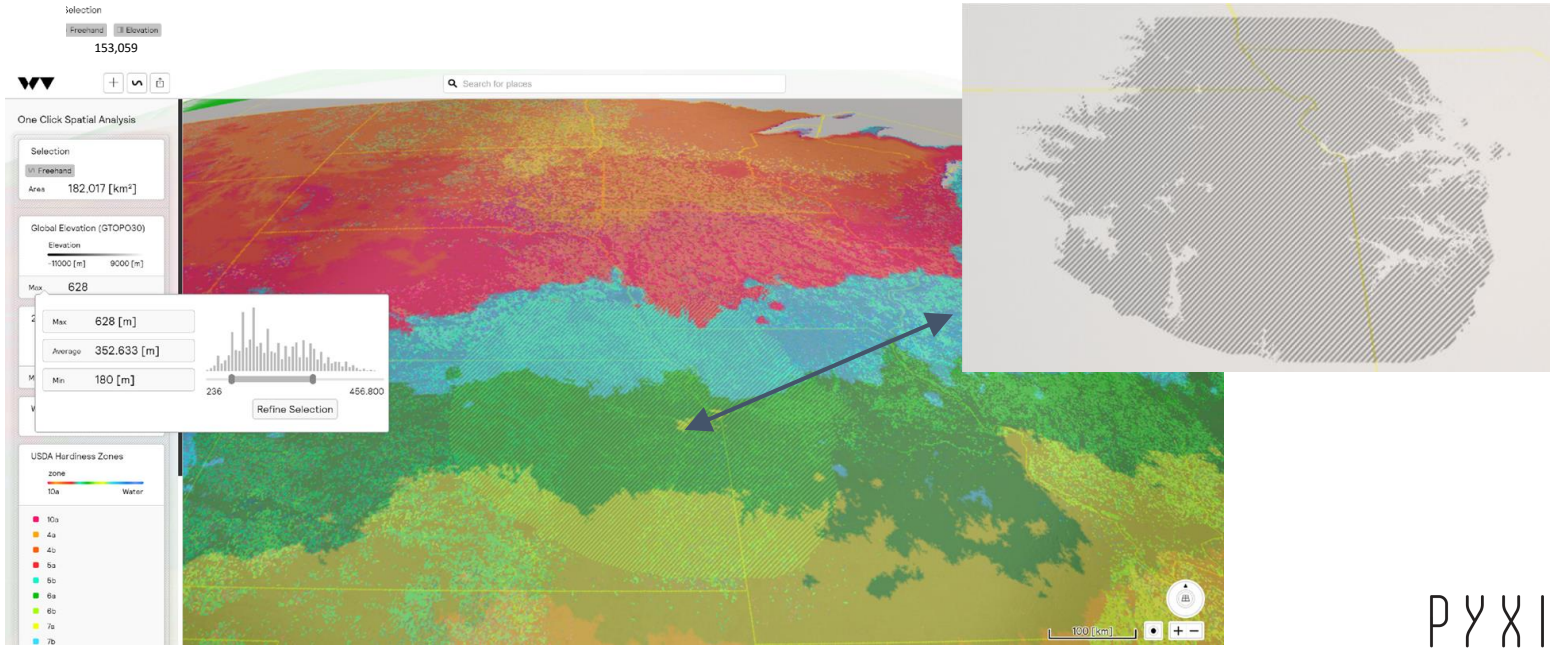
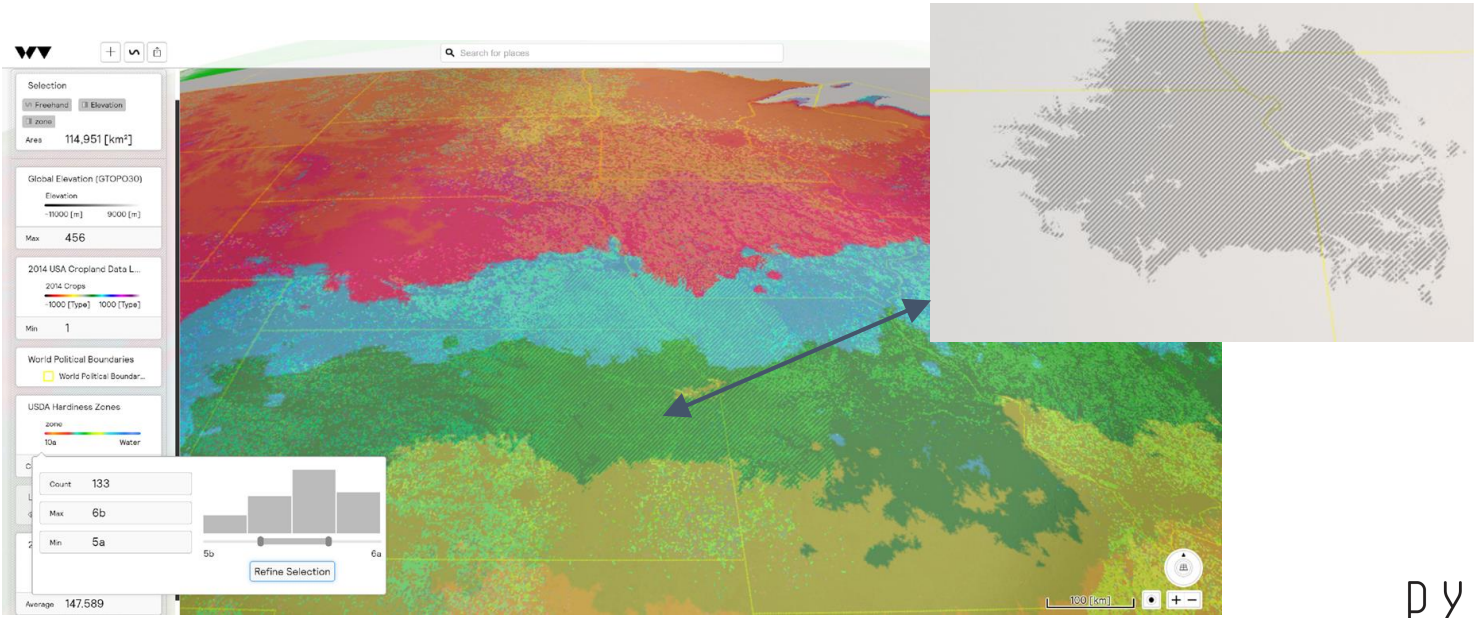
Refine Selection: modify the range of values contained within the selection.



Refine Selection: modify the range of values contained within the selection.



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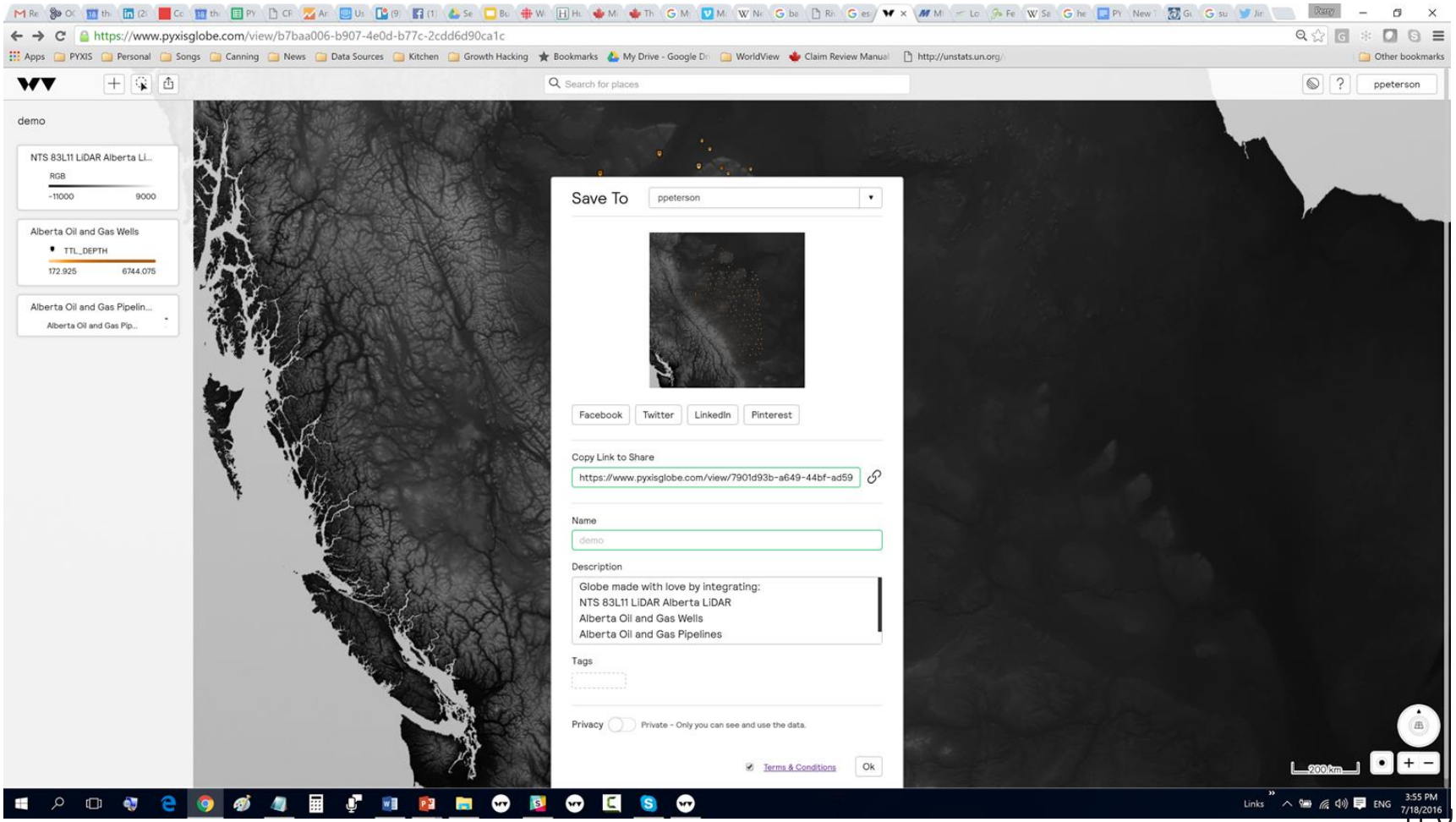
Share it: Geospatial Network (PyxNet)

Each instance of a globe, including the Studio which is just a specially functional instance of a globe, is a node on a network that is connected and managed. We call the network PyxNet. Data in the form of GeoPackets are shared between these nodes.

The nature of the network nodes can be variable types including client server and peer to peer configurations that use conventional web services, cloud based platforms, local computers, and other devices. Some configurations allow a node to retain functionality when not connected to other nodes.

The network is managed and maintained by license server which organizes the various network pieces so they can efficiently discovered, ensures proper credentials on the GeoPackets, messaging between nodes, caching, digital rights management, data transactions, etc.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7/18/2016

Share it: Another node on the network

Once the mashup of data values and the analysis is complete, the resulting analysis can be shared back to the network as a collection of cells or geometry and related cell values where it can be discovered and used again.

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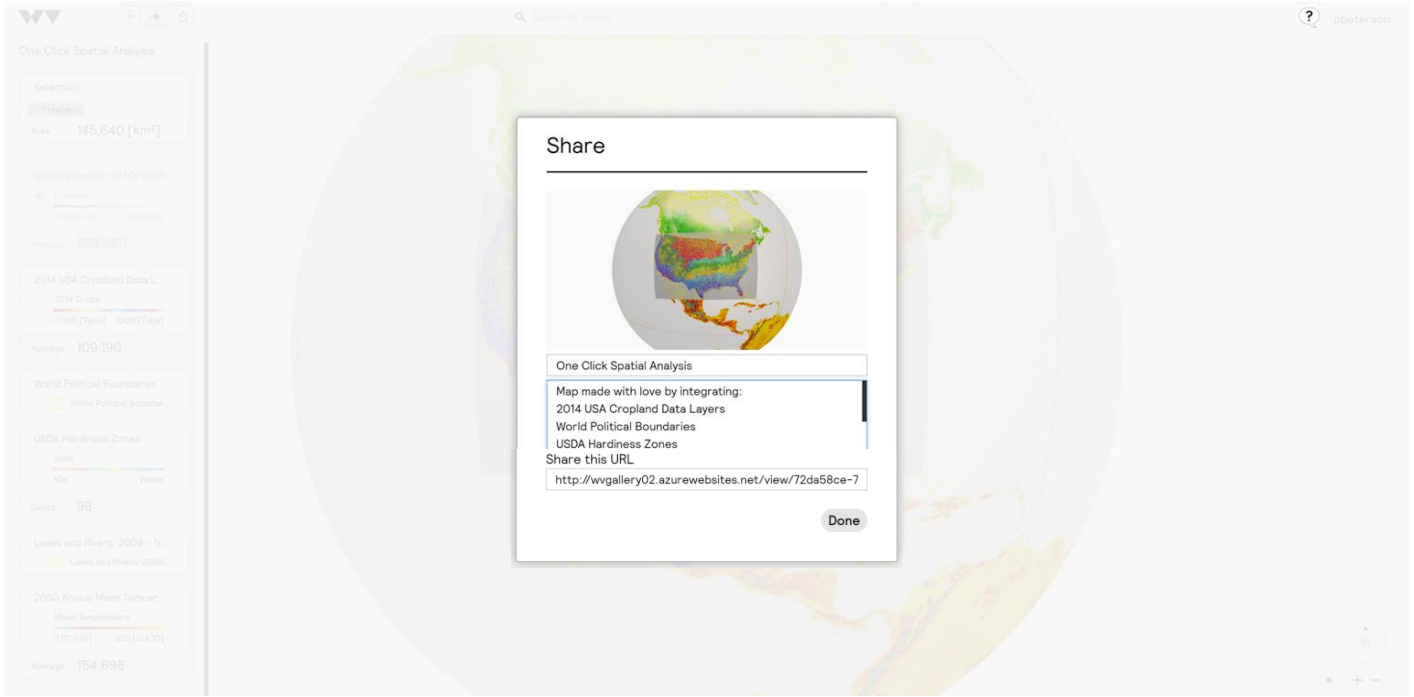
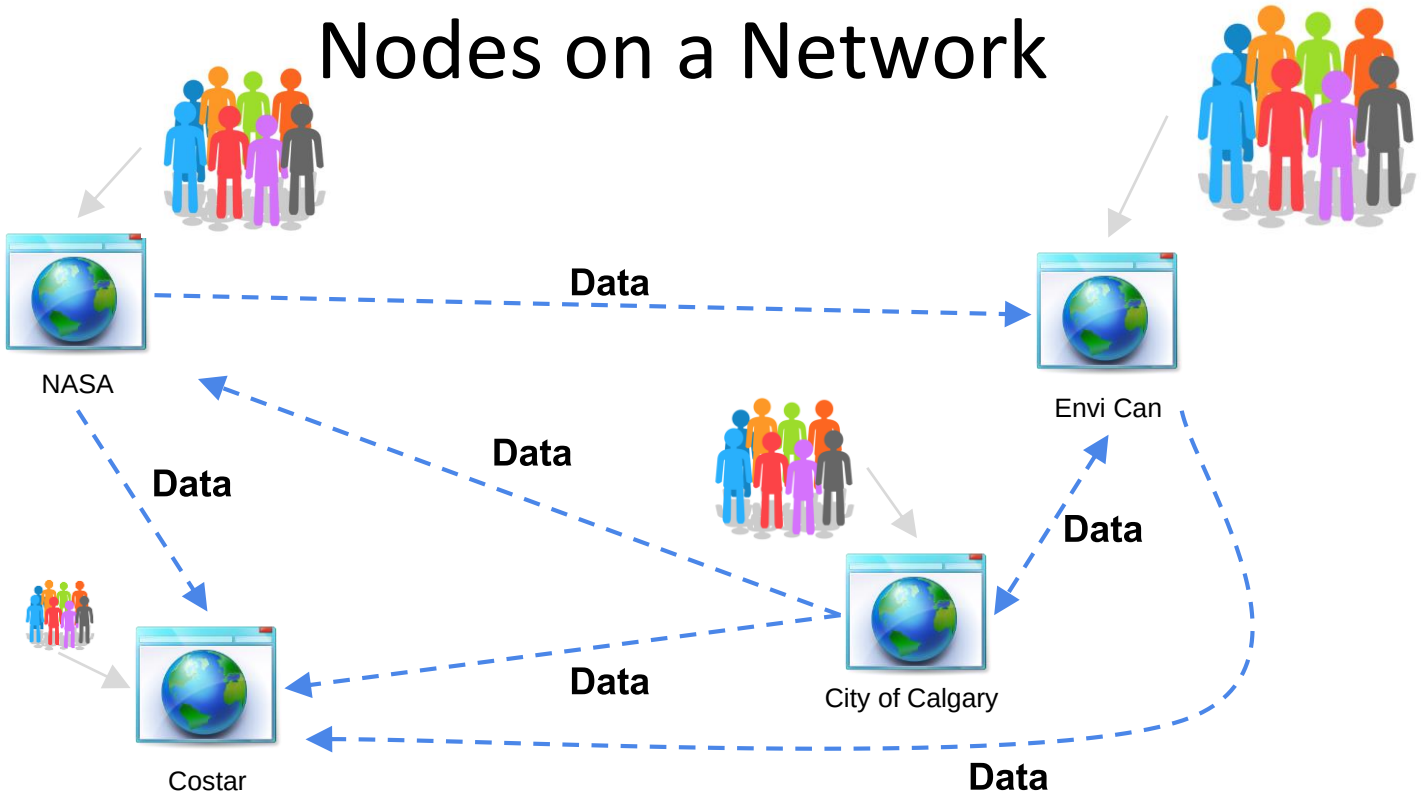
Share it: Another node on the network



Which now is another globe of data to be discovered

Build a Community: Where Maps are Data Nodes on a Network



You can learn more about PYXIS DGGS here:

Try it yourself - https://worldview.gallery/view/new

Learn More - http://sdk.pyxisinnovation.com/home

Watch Videos - https://vimeo.com/54177885

Our Web Page – www.pyxisinnovation.com