

QGIS AND ITS ANALYSIS TOOLS

Anita Graser, 2018-04-18

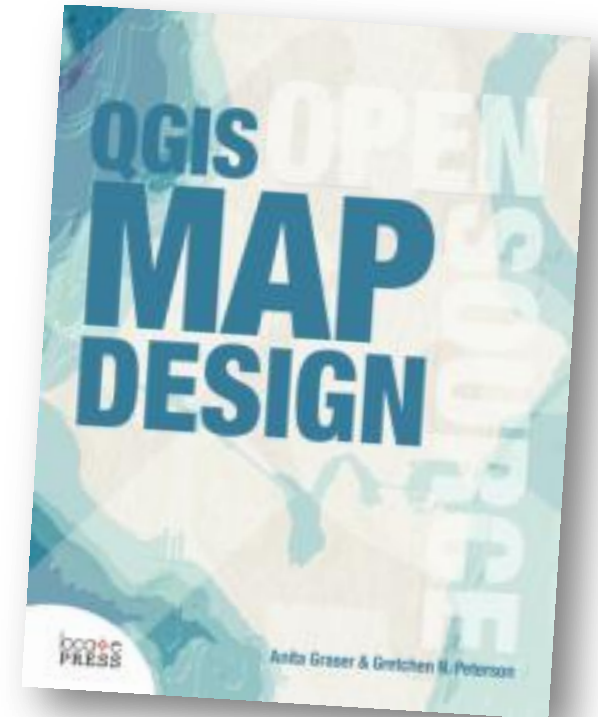
ABOUT

Anita Graser

Scientist @ AIT Austrian Institute of Technology

- QGIS user since 2008
- QGIS Project Steering Committee since 2013
- OSGeo Board of Directors 2015-17
- Moderator on GIS.StackExchange.com
- Author of „Learning QGIS“ (1st ed 2013), „QGIS Map Design“ (2016) & „QGIS 2 Cookbook“ (2016)

@underdarkGIS





ABOUT – QGIS

2002 developed as a C++ Postgis Viewer by Gary Sherman

Early professional users:

- Kanton Solothurn (2005/2006)
- City of Uster (2007)
- Tuscany Regional Administration (2009)

2007 OSGEO incubator project → formation of the PSC

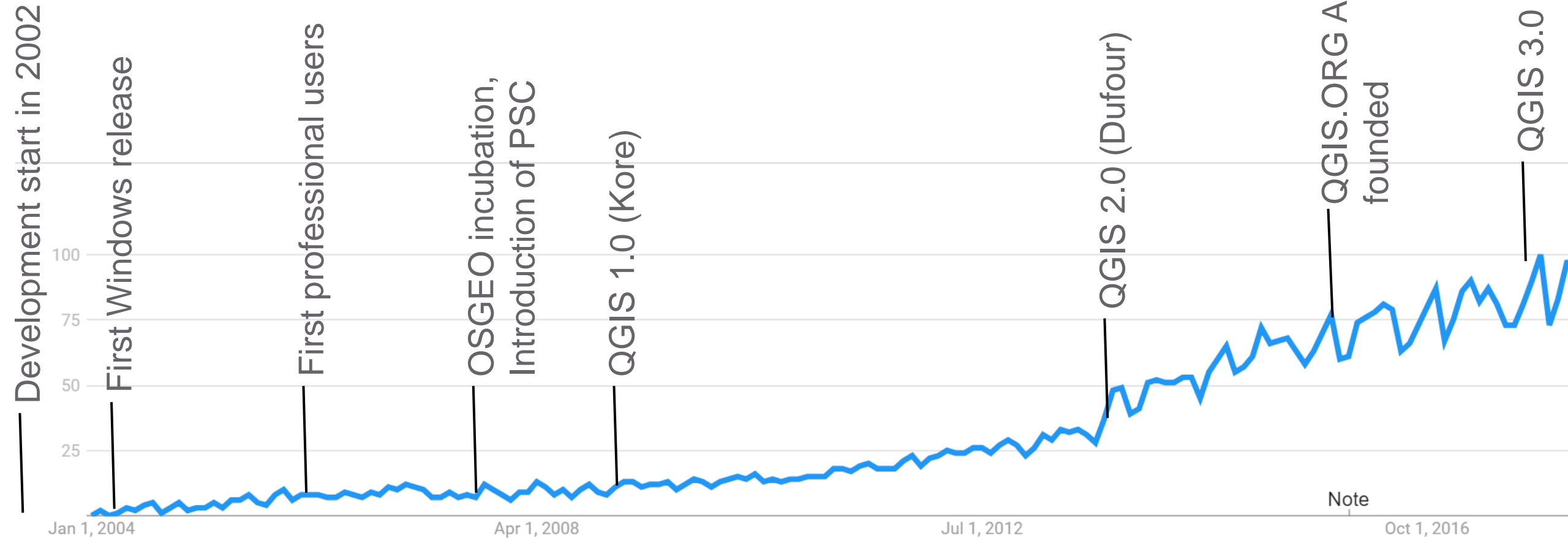
2015 QGIS.ORG founded

QGIS IS AN OSGEO PROJECT



Mission: Foster global adoption of **open geospatial technology** by being an **inclusive software foundation** devoted to an open philosophy and participatory **community driven development**.

QGIS HISTORY



Source of Search volume interests: <https://trends.google.com/>

Note

GOOGLE TRENDS



● QGIS
Search term

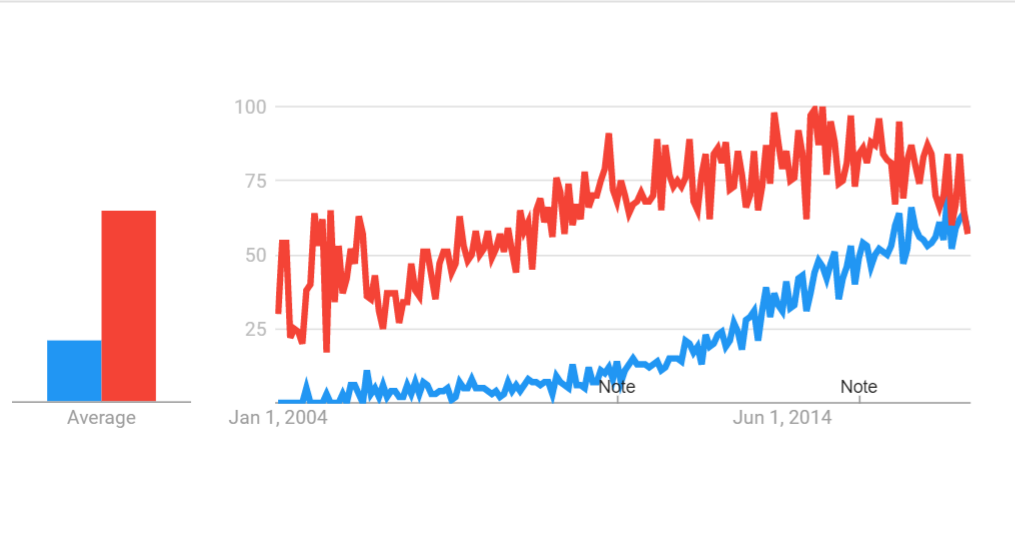
● ArcGIS
System software

+

Germany ▼ 2004 - present ▼ All categories ▼ Web Search ▼

Note: This comparison contains both Search terms and Topics, which are measured differently. [LEARN MORE](#)

Interest over time ⓘ   



● QGIS
Search term

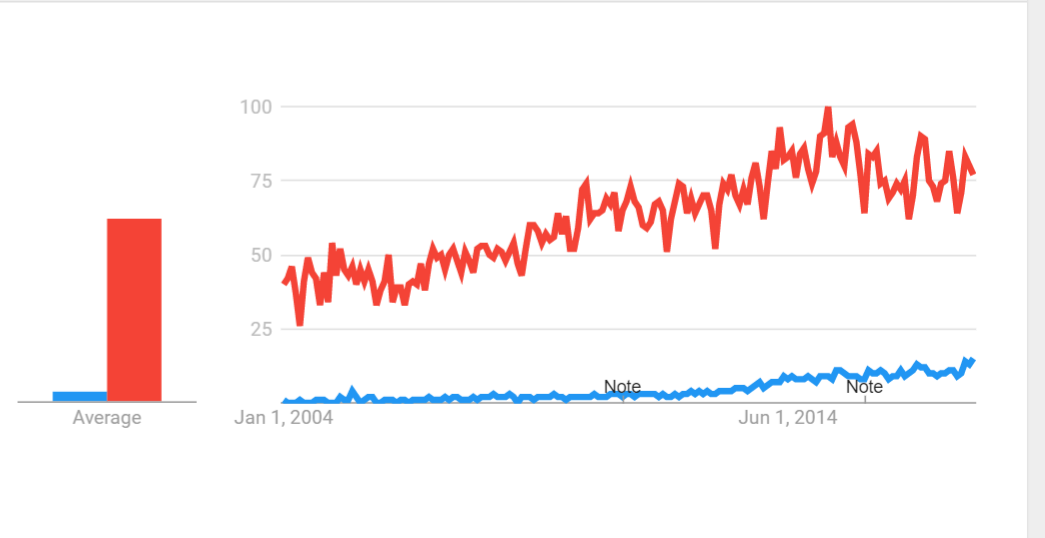
● ArcGIS
System software

+

United States ▼ 2004 - present ▼ All categories ▼ Web Search ▼

Note: This comparison contains both Search terms and Topics, which are measured differently. [LEARN MORE](#)

Interest over time ⓘ   





QGIS TODAY

Most popular Open Source Desktop GIS

Available for: Linux, Windows, OSX (and Android)

Translated in > 40 languages

More than desktop:

- QGIS Server,
- Web clients (QWC2, LizMap),
- Data collection solutions (QField, Intramaps Roam)



UPCOMING ...

Developer meeting in Zanzibar

User conference at FOSS4G in Dar es Salaam

LTR 3.4 release end of October 2018

QGIS TEAM

Do-QGIS
o-c-r-a-c-y

Developers

Translators

Infrastructure
Managers

Documentation
writers

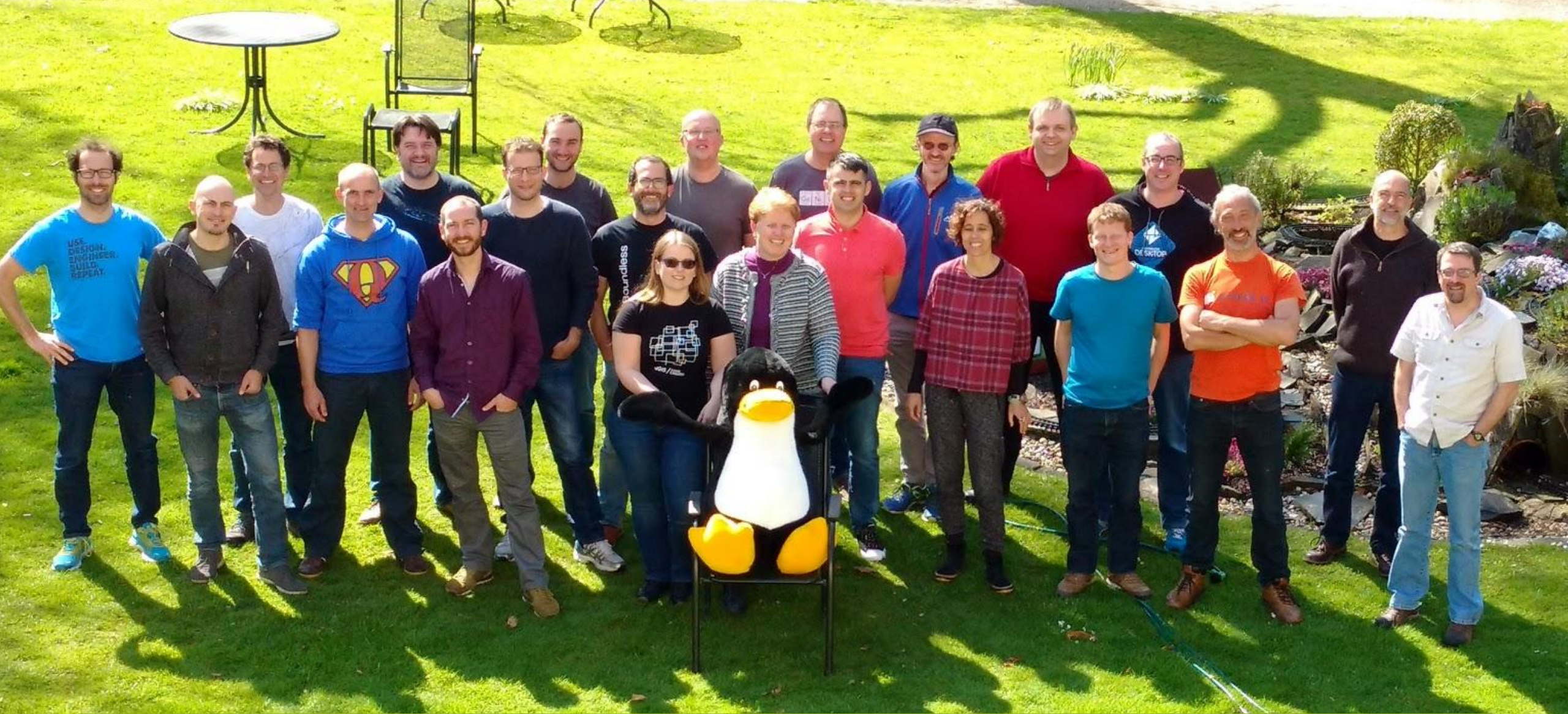
Community
Managers

Designers

Users

Donors &
Sponsors

Project Steering Committee



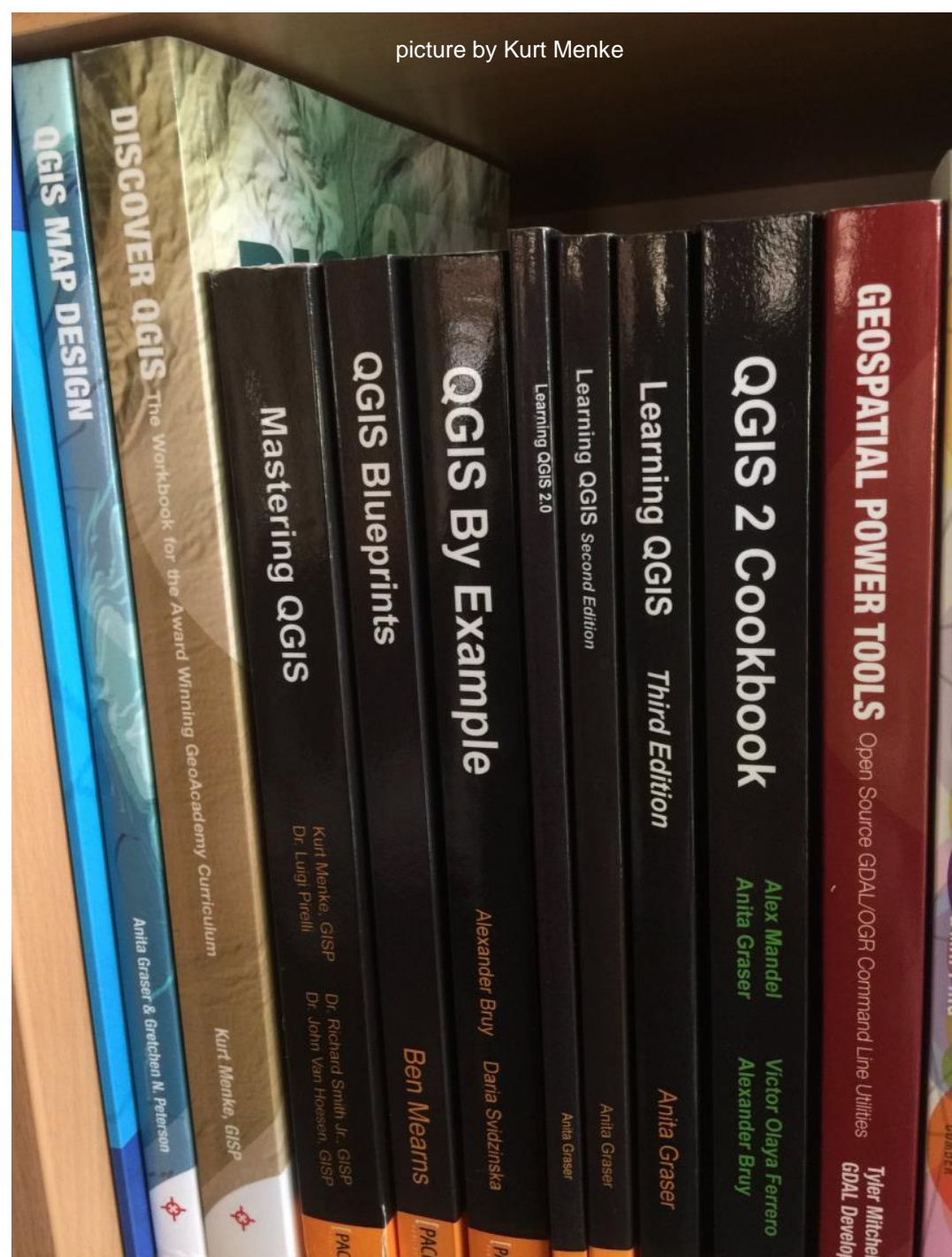
DEVELOPERMEETING, LINUXHOTEL ESSEN

DOCUMENTATION

official documentation

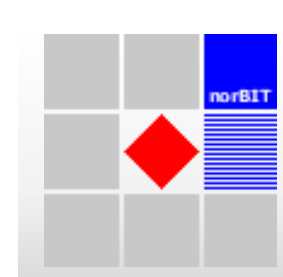
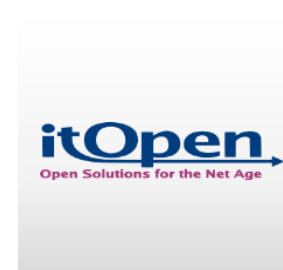
docs.qgis.org

and many books ...



SUPPORT CHANNELS

- Mailing lists
- gis.stackexchange.com
- User groups
- Commercial Support





QGIS USER GROUPS

- Australia
- Brasil
- Denmark
- UK
- France
- Germany
- Georgia
- Italy
- Japan
- Kenya
- Mexico
- New Zealand
- Norway
- Peru
- Poland
- Portugal
- Romania
- Scotland
- Switzerland
- USA
- Wales/Cymru
- South Africa
- Sweden

+ Elected community members

= **QGIS.ORG** voting members ...

... **elect**

- PSC
- Board
- Chair
- Financial auditors

... **decide on**

- Grants
- Matters that need community decisions

... **approve**

- Yearly report
- Financial report
- Budget



QGIS USER EXAMPLES – WORLDWIDE

Government, e.g. US Census

4 Getting Started

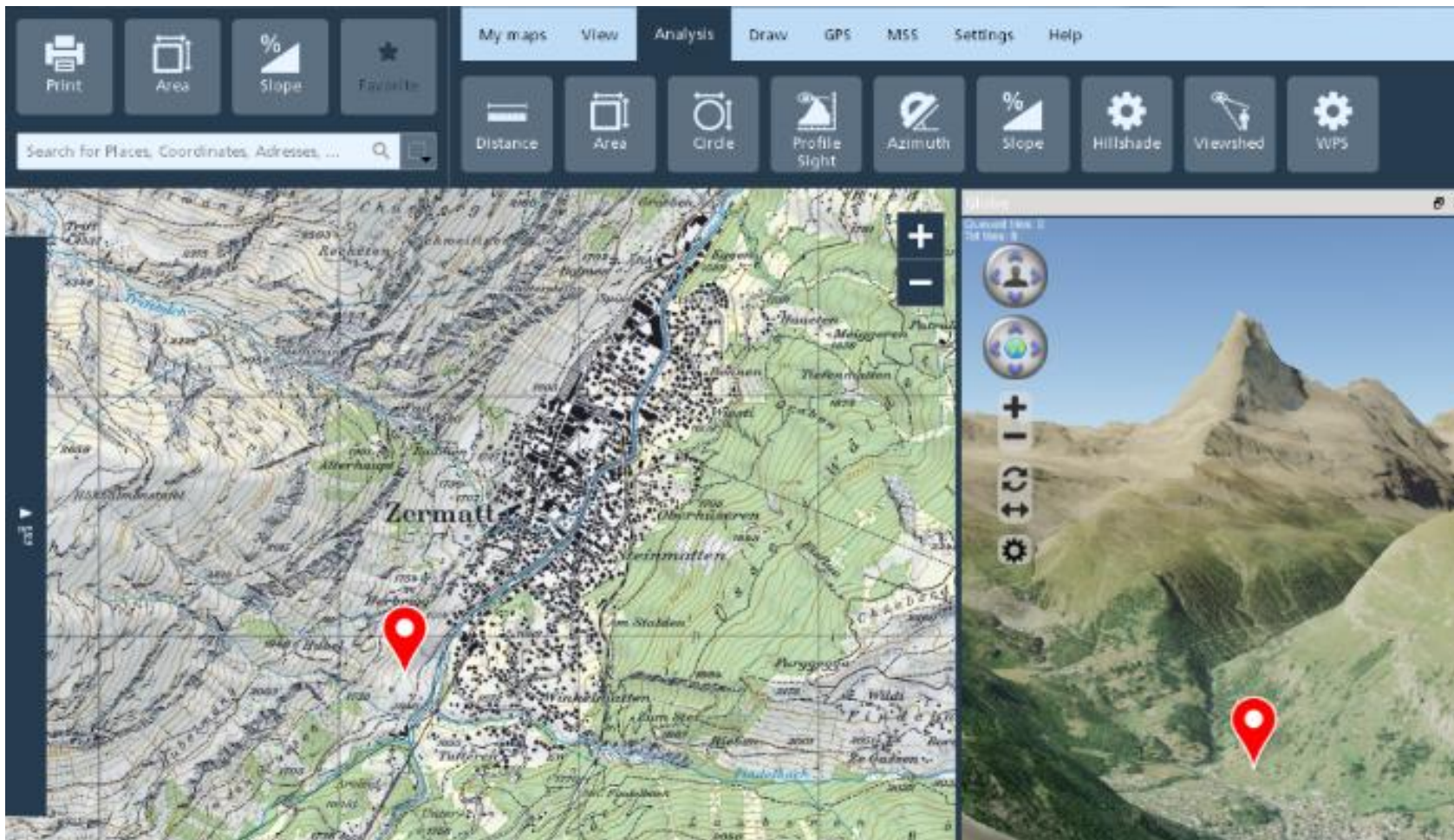
4.1 System and Hardware Requirements

The Geographic Update Partnership Software (GUPS) is based on QGIS (formerly known as Quantum GIS), a free and open-source desktop geographic information system application. You can learn more about **QGIS** at <http://www.qgis.org/en/site/>.

Table 2 below lists the hardware and software requirements to install and run the GUPS, submit files through the Secure Web Incoming Module (SWIM) website, and play the training videos available in the GUPS application.

QGIS USER EXAMPLES – WORLDWIDE

Military, e.g. at the Swiss Army



QGIS USER EXAMPLES – WORLDWIDE

Journalists

QGIS @ Financial Times

http://qgis.org/en/site/about/case_studies/qgis_at_financial_times.html

ORF.at

<https://github.com/orfon/bulkvectorexport>

Spiegel.de

<http://www.spiegel.de/wissenschaft/natur/gewitter-atlas-so-haeufig-sind-blitze-in-deutschland-a-1104658.html>

Animation

Dora's journey – one of thousands by trafficked women each year





CHALLENGES

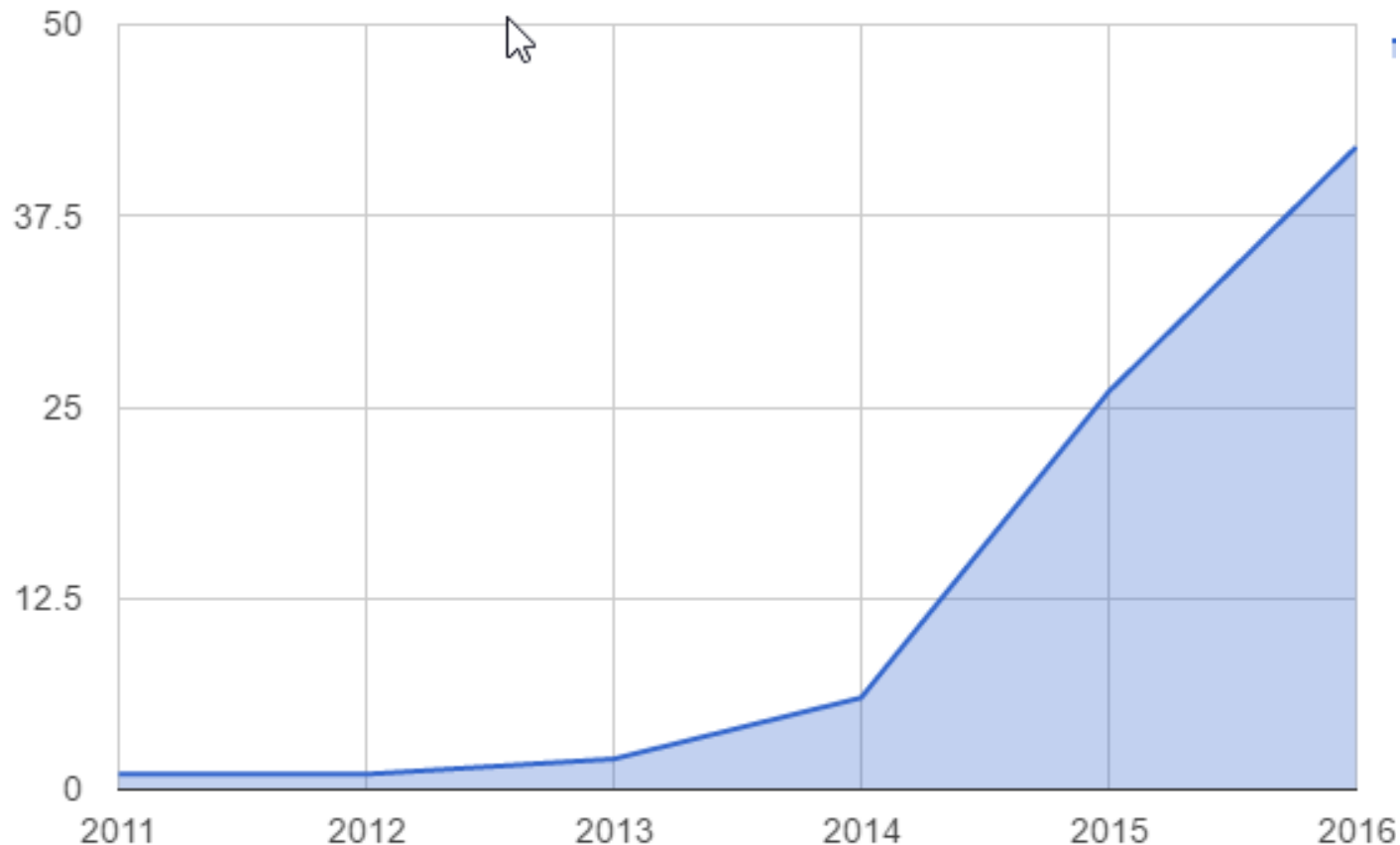
- QGIS is developed “bottom up”
 - driven by user demand
- QGIS.ORG does not have any employees
 - no direct influence of board & PSC on developers
- QGIS developers run their own businesses or are employed by FOSSGIS companies
- QGIS.ORG funds are limited (approx. 100k € in 2017)
 - Marketing resources
 - Documentation
 - Bug fixing and Quality Assurance

PROJECT FINANCES



Financial Report for 2017

Number of QGIS sponsors per year



The reporting period starts on **January 1, 2017** and ends on **December 31, 2017**. Accrued expenses for work that has been done in 2017 but where the invoices were received in 2018 were included. The currency of all items is Euro (€).

Balance sheet

Account balance on January 1, 2017	45'370.00
Account balance on December 31 2017 (incl. QGIS-IT)	63'123.43
Accrued expenses (deferrals) made in 2018 for work done in 2017	10'595.26
Account balance QGIS-IT (included in main account balance)	906.00

Income:

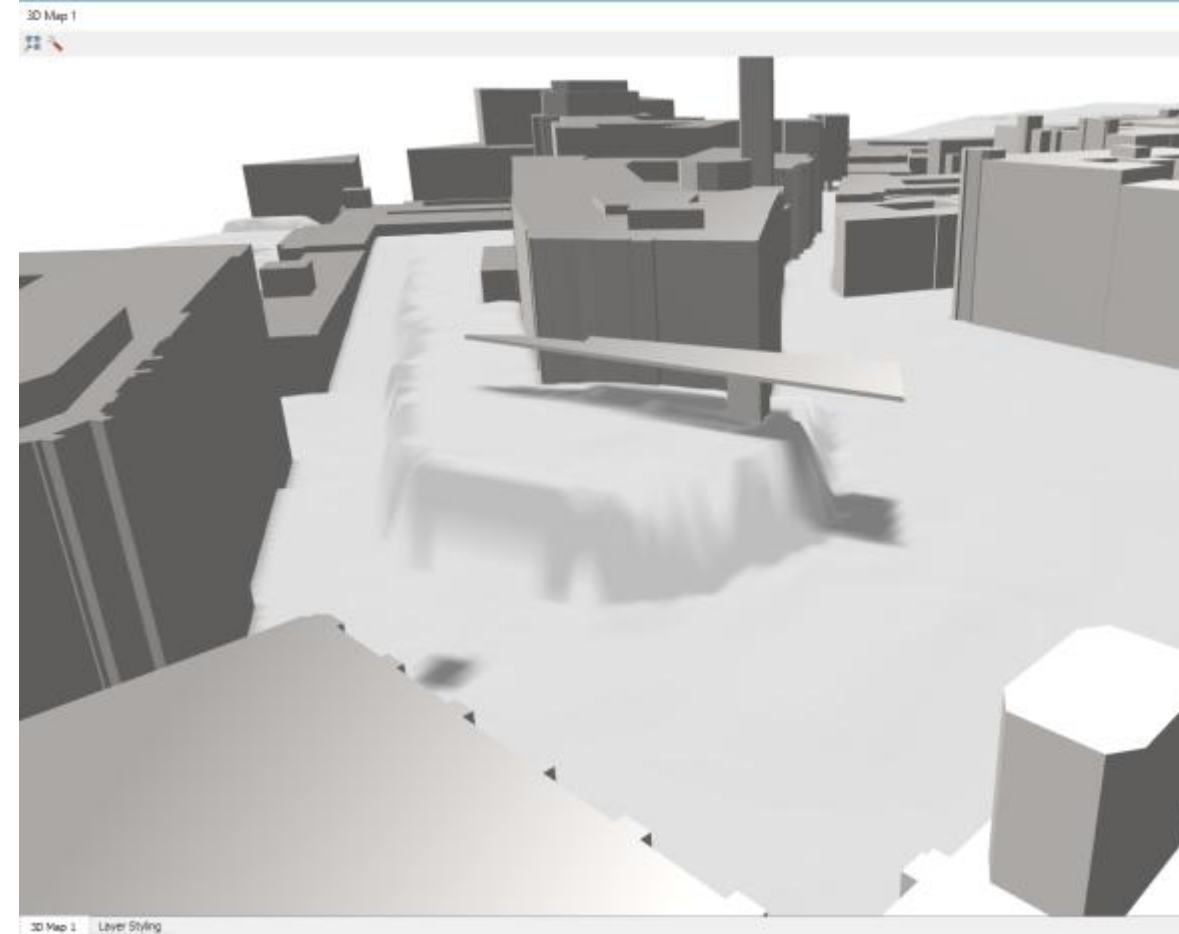
Sponsoring payments	64'206.05
PayPal donations (excl. sponsorships and QGIS-IT income)	20'984.13
Direct donations to bank account (wire transfer)	10'183.52
Dedicated contributions for QGIS bug fixing	7'800.00
Dedicated contributions to QGIS dev meetings	6'269.25
QGIS training certificates	1'120.00
Liquidation of old bank account still run by Swiss QGIS user group	444.80
QGIS Shop income	147.52
QGIS books royalty scheme (Packt Publishing)	89.68
Paypal test payment	0.17
QGIS-IT membership fees	465.00
Total Income	111'710.12

Expenses

Bug fixing and QA (incl. bug tracking queue management)	50'966.62
Expenses developer meetings	9'075.67
Infrastructure Expenses (incl. benchmarks QGIS Server)	1'899.46
QGIS grants program (incl. payment from 2016)	34'800.00
QGIS documentation (processing)	4'000.00
Cost around logo, trademark and trade registry	2'937.90
Bank account and transfer fees	272.30
QGIS-IT expenses	600.00
Total Expenses	104'551.95

QGIS GRANTS

- Improved UI-controls consistency
 - Extended unit test coverage for geometry classes
 - QGIS 3D
 - Improved deep relations with PostgreSQL editing
- + Processing algorithm documentation



PROCESSING

QGIS' analysis toolbox

The screenshot displays the QGIS interface. The main map area shows a street network in Seattle, with a network analysis overlay in shades of orange and red. The overlay highlights specific routes, including the Alaskan Way Viaduct and the Downtown Seattle Transit Tunnel. The Processing Toolbox panel is open on the right side, showing a search bar and a list of tools. The 'Recently used' section includes 'Topological coloring', 'Add autoincremental field', and 'Test_optional_parameters'. Other tool categories listed include Cartography, Database, File tools, Graphics, Interpolation, Layer tools, Network analysis, Raster analysis, Raster terrain analysis, Raster tools, Vector analysis, Vector creation, Vector general, Vector geometry, Vector overlay, Vector selection, Vector table, GDAL, GRASS, and Models. The bottom status bar shows the coordinate system as EPSG:102348, the scale as 1:10,036, and the magnifier as 100%.

Processing Toolbox

Search...

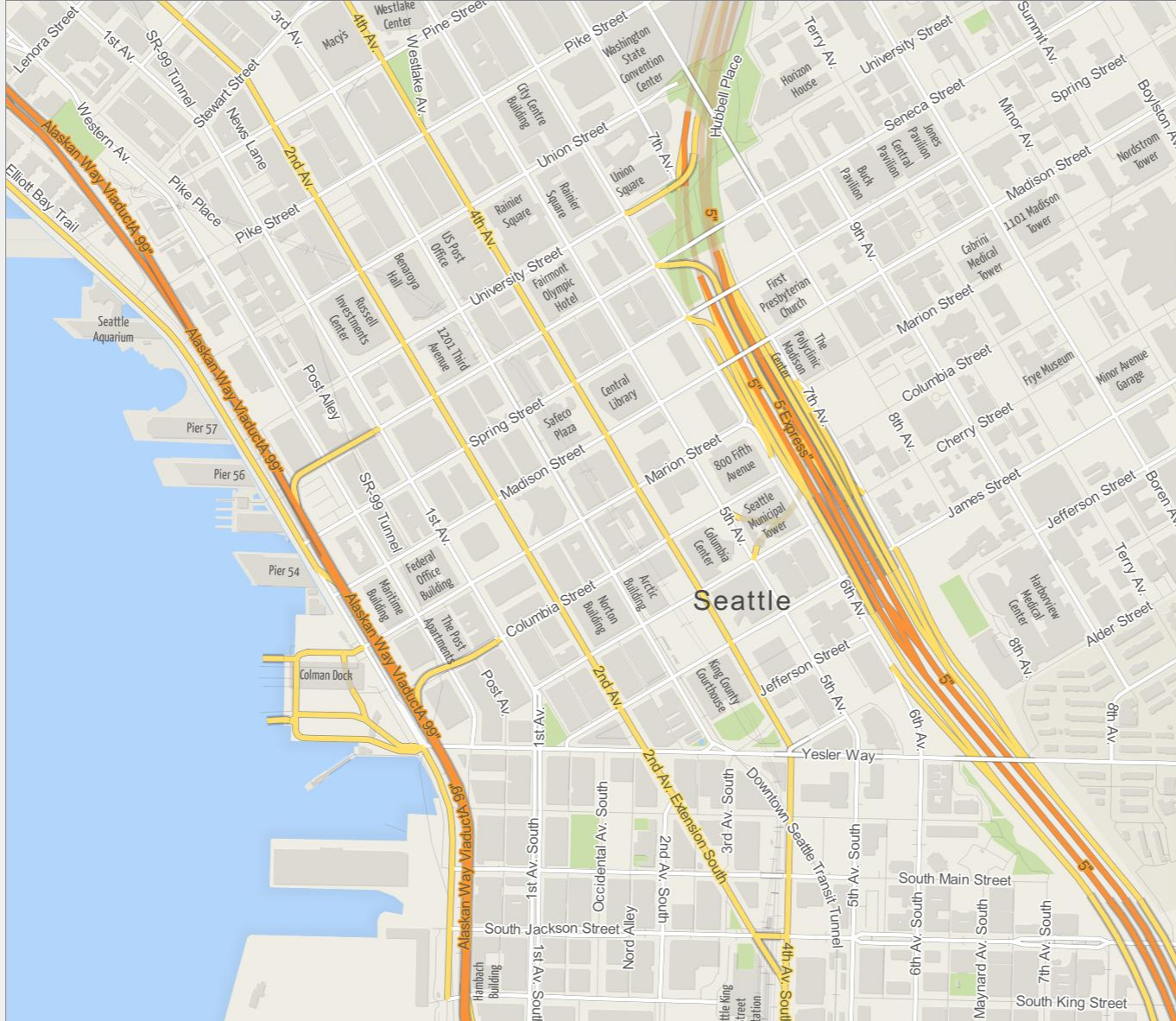
- Recently used
 - Topological coloring
 - Add autoincremental field
 - Test_optional_parameters
- Cartography
- Database
- File tools
- Graphics
- Interpolation
- Layer tools
- Network analysis
- Raster analysis
- Raster terrain analysis
- Raster tools
- Vector analysis
- Vector creation
- Vector general
- Vector geometry
- Vector overlay
- Vector selection
- Vector table
- GDAL
- GRASS
- Models

Coordinate: -122.3449,47.6097 Scale: 1:10,036 Magnifier: 100% Rotation: 0.0° Render: EPSG:102348



Layers

- bbox**
- lines**
- lines copy
- lines copy
- multilinestrings
- Hillshade**
 - 149
 - 206
- multipolygons**
 - water
 - forest & park
 - industrial
 - residential
 - building
 - coastline
- points**
 - 200000 - 0
 - 0 - 200000



Processing Toolbox

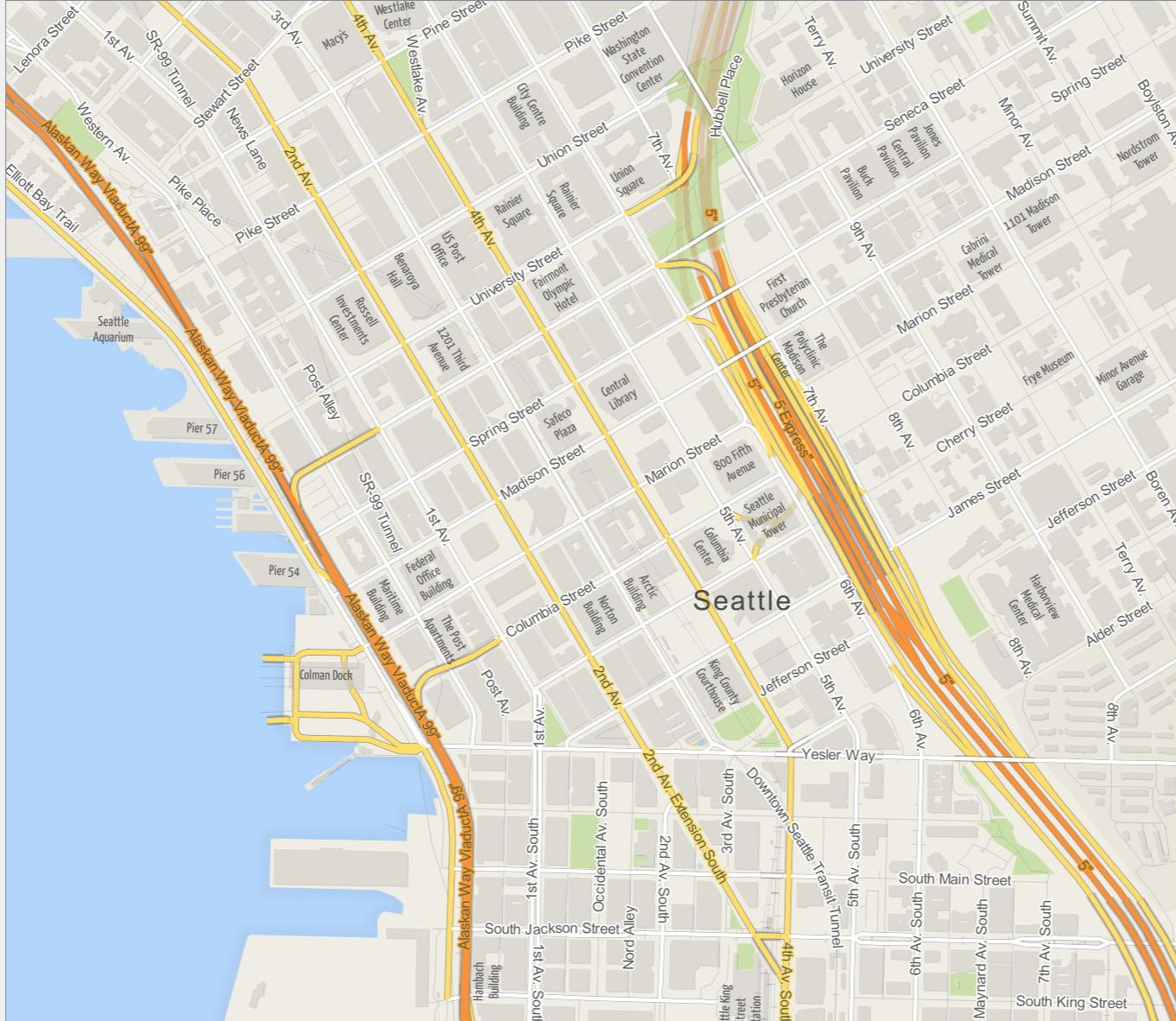
- Recently used**
 - Topological coloring
 - Add autoincremental field
 - Test_optional_parameters
- Cartography**
 - Topological coloring
- Database**
 - Import into PostGIS
 - Import into Spatialite
 - Package layers
 - PostGIS execute SQL
 - Spatialite execute SQL
- File tools**
 - Download file
- Graphics**
 - Bar plot
 - Box plot
 - Mean and standard deviation plot
 - Polar plot
 - Raster layer histogram
 - Vector layer histogram
 - Vector layer scatterplot
 - Vector layer scatterplot 3D
- Interpolation**
 - Heatmap (Kernel Density Estimation)
 - IDW interpolation
 - TIN interpolation
- Layer tools**
 - Extract layer extent
- Network analysis**

Processing Toolbox Layer Styling



Layers

- bbox**
- lines**
- lines copy
- lines copy
- multilinestrings
- Hillshade**
 - 149
 - 206
- multipolygons**
 - water
 - forest & park
 - industrial
 - residential
 - building
 - coastline
- points**
 - 200000 - 0
 - 0 - 200000



Processing Toolbox

sh

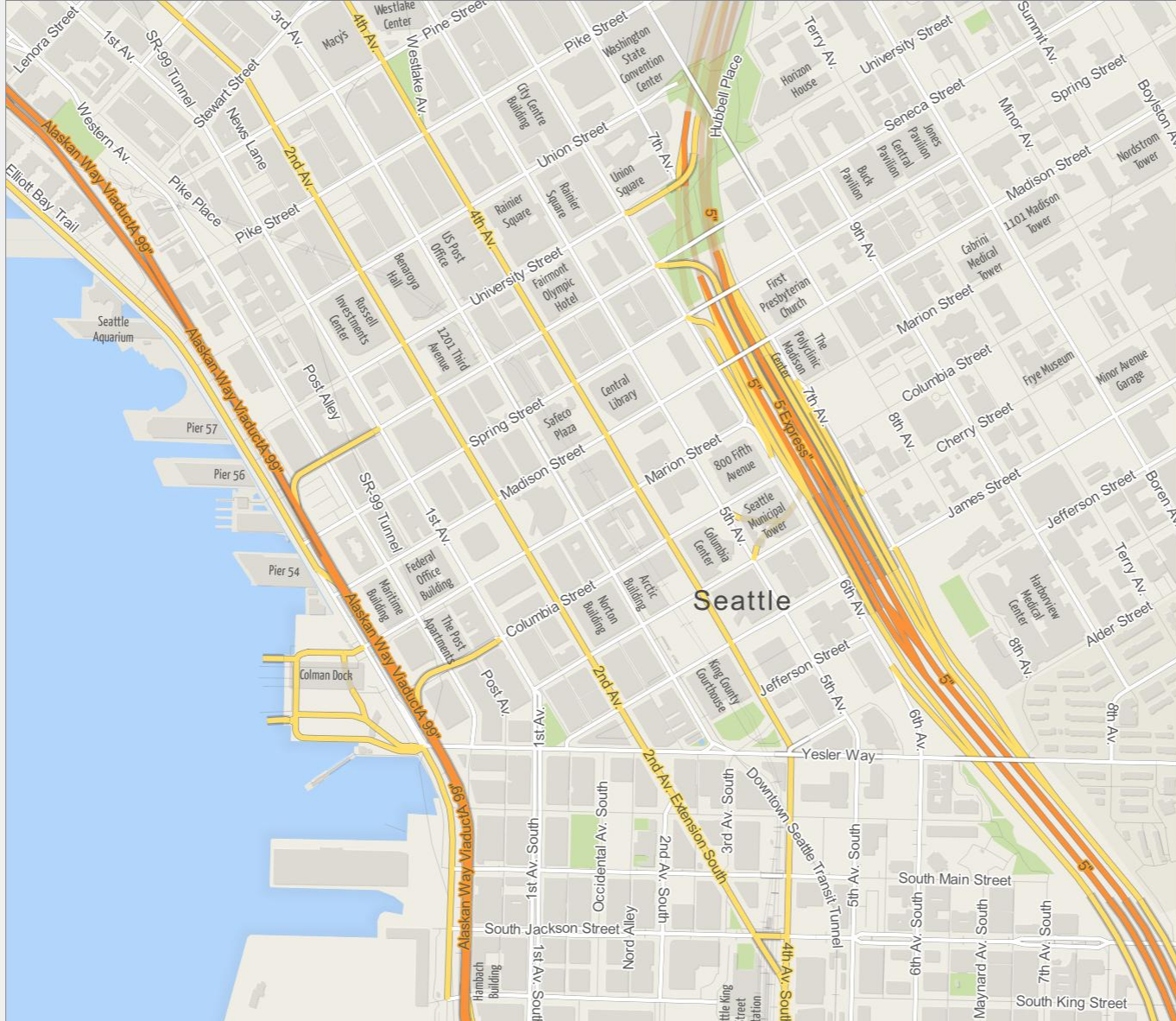
- Network analysis**
 - Shortest path (layer to point)
 - Shortest path (point to layer)
 - Shortest path (point to point)
- Raster terrain analysis**
 - Hillshade
- Vector creation**
 - Create grid
- Vector geometry**
 - Translate
- GDAL**
 - Raster analysis**
 - Hillshade
- GRASS**
 - Imagery (i.*)**
 - i.pansharpen - Image fusion algorithms to s...
 - Raster (r.*)**
 - r.basins.fill - Generates watershed subbasins...
 - r.buffer - Creates a raster map layer showin...
 - r.buffer.lowmem - Creates a raster map laye...
 - r.li.shannon - Calculates Shannon's diversity ...
 - r.li.shannon.ascii - Calculates Shannon's dive...
 - r.li.shape - Calculates shape index on a raste...
 - r.li.shape.ascii - Calculates shape index on a ...
 - r.relief - Creates shaded relief from an eleva...
 - r.relief.scaling - Creates shaded relief from a...
 - r.shade - Drapes a color raster over an shad...
 - r.sunmask.datetime - Calculates cast shadow...
 - r.sunmask.position - Calculates cast shadow ...
 - r.viewshed - Computes the viewshed of a po...

Processing Toolbox Layer Styling



Layers

- bbox**
- lines**
- lines copy
- lines copy
- multilinestrings
- Hillshade**
 - 149
 - 206
- multipolygons**
 - water
 - forest & park
 - industrial
 - residential
 - building
 - coastline
- points**
 - 200000 - 0
 - 0 - 200000



Processing Toolbox

sho

- Network analysis**
 - Shortest path (layer to point)
 - Shortest path (point to layer)
 - Shortest path (point to point)
- GRASS**
 - Raster (r.*)**
 - r.buffer - Creates a raster map layer showing b...
 - r.buffer.lowmem - Creates a raster map layer sh...
 - r.walk.coords - Creates a raster map showing th...
 - r.walk.points - Creates a raster map showing th...
 - r.walk.rast - Creates a raster map showing the a...
 - Vector (v.*)**
 - v.net.allpairs - Computes the shortest path betw...
 - v.net.distance - Computes shortest distance via ...
 - v.net.path - Finds shortest path on vector network
 - v.net.timetable - Finds shortest path using timet...
 - v.split - Split lines to shorter segments by length.

Processing Toolbox | Layer Styling

PROCESSING TOOLS



QGIS Topological coloring

Parameters Log

Input layer

Selected features only

Minimum number of colors: 4

Minimum distance between features: 0.000000

Balance color assignment: By feature count

Colored: [Create temporary layer]

Open output file after running algorithm

0% Cancel

Run as Batch Process... Run in Background Close Help

Topological coloring

This algorithm assigns a color index to polygon features in such a way that no adjacent polygons share the same color index, whilst minimizing the number of colors required.

An optional minimum distance between features assigned the same color can be set to prevent nearby (but non-touching) features from being assigned equal colors.

The algorithm allows choice of method to use when assigning colors. The default method attempts to assign colors so that the count of features assigned to each individual color index is balanced.

The 'by assigned area' mode instead assigns colors so that the total area of features assigned to each color is balanced. This mode can be useful to help avoid large features resulting in one of the colors appearing more dominant on a colored map.

The 'by distance between colors' mode will assign colors in order to maximize the distance between features of the same color. This mode helps to create a more uniform distribution of colors across a map.

A minimum number of colors can be specified if desired. The color index is saved to a new attribute named color_id.

PROCESSING MODELER



The screenshot displays the QGIS Processing Modeler window. On the left, the 'Model properties' section shows the model name 'Test_optional_parameters' and the group 'Sandbox'. Below this is the 'Algorithms' list, which includes categories like Raster tools, Vector analysis, and Vector geometry. The 'Vector geometry' category is expanded, showing various tools such as Aggregate, Boundary, and Buffer.

The main workspace shows a workflow diagram with the following components and connections:

- Two input layers: 'layer' and 'optional_value', both highlighted in yellow.
- An algorithm: 'Group values by', which has two input parameters: 'Start values at Field name' and 'Input layer'. The 'Input layer' parameter is set to 'In'.
- A second algorithm: 'Add autoincremental fi...', which has an 'Out Incremented' output parameter.
- An output layer: 'out', highlighted in green, which receives the output from the 'Add autoincremental fi...' algorithm.

The workflow is connected as follows: 'layer' and 'optional_value' are connected to the 'Group values by' algorithm. The 'Group values by' algorithm is connected to the 'Add autoincremental fi...' algorithm. Finally, the 'Add autoincremental fi...' algorithm is connected to the 'out' output layer.

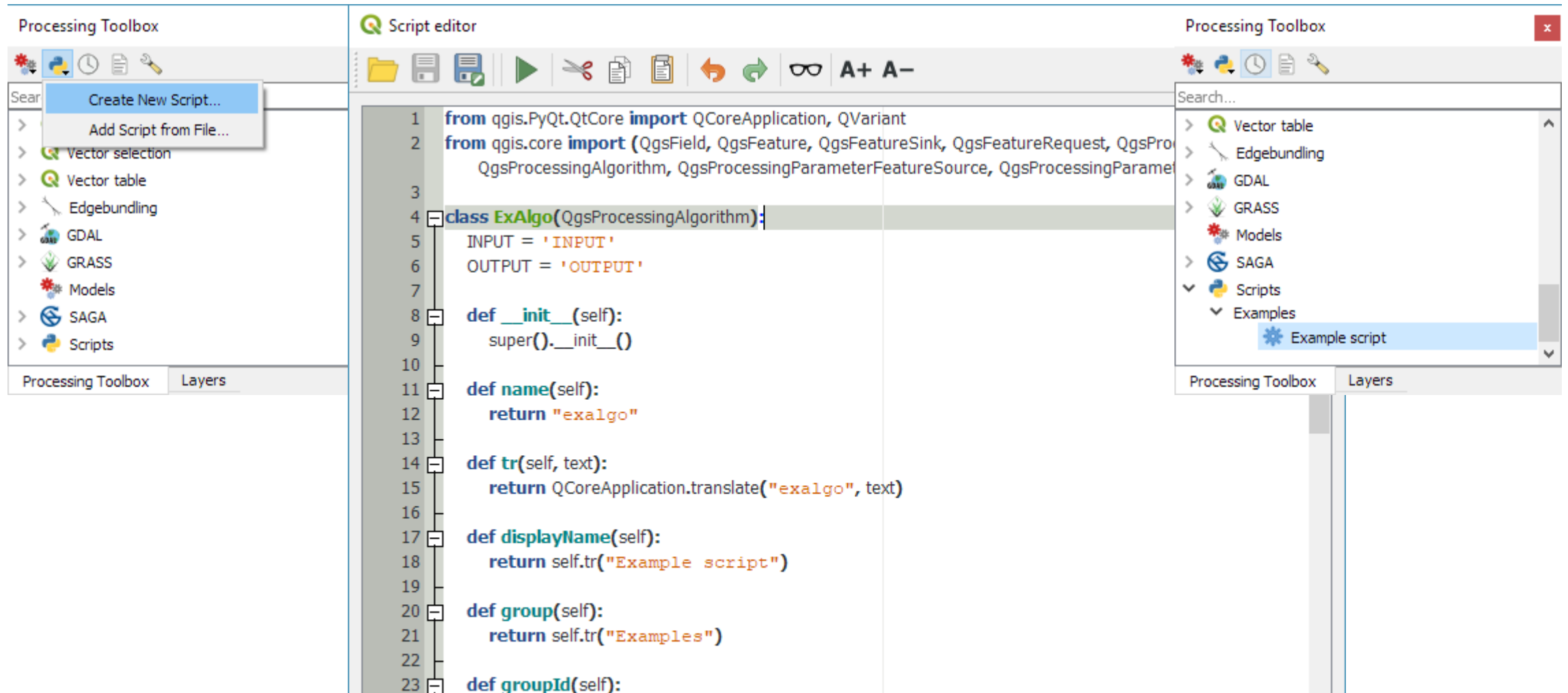
PROCESSING & PYQGIS



```
Python Console ×  
Python Console  
2 Use iface to access QGIS API interface or Type help(iface) for more info  
3 >>> processing.run("native:addautoincrementalfield", {'INPUT':'D:/Documents/Geodata/qgis_sample_data/shapefiles/airpo  
   rts.shp', 'FIELD_NAME':'AUTO', 'START':0, 'GROUP_FIELDS':[], 'OUTPUT':'memory:'})  
4 {'OUTPUT': <qgis._core.QgsVectorLayer object at 0x000001C6DED1F5E8>}  
5 >>> processing.run("native:addautoincrementalfield", {'INPUT':'D:/Documents/Geodata/qgis_sample_data/shapefiles/airpo  
   rts.shp', 'FIELD_NAME':'AUTO', 'OUTPUT':'memory:'})  
6 {'OUTPUT': <qgis._core.QgsVectorLayer object at 0x000001C6DED1F288>}  
7  
  
>>>
```

Python Console Time Manager

CUSTOM SCRIPTS

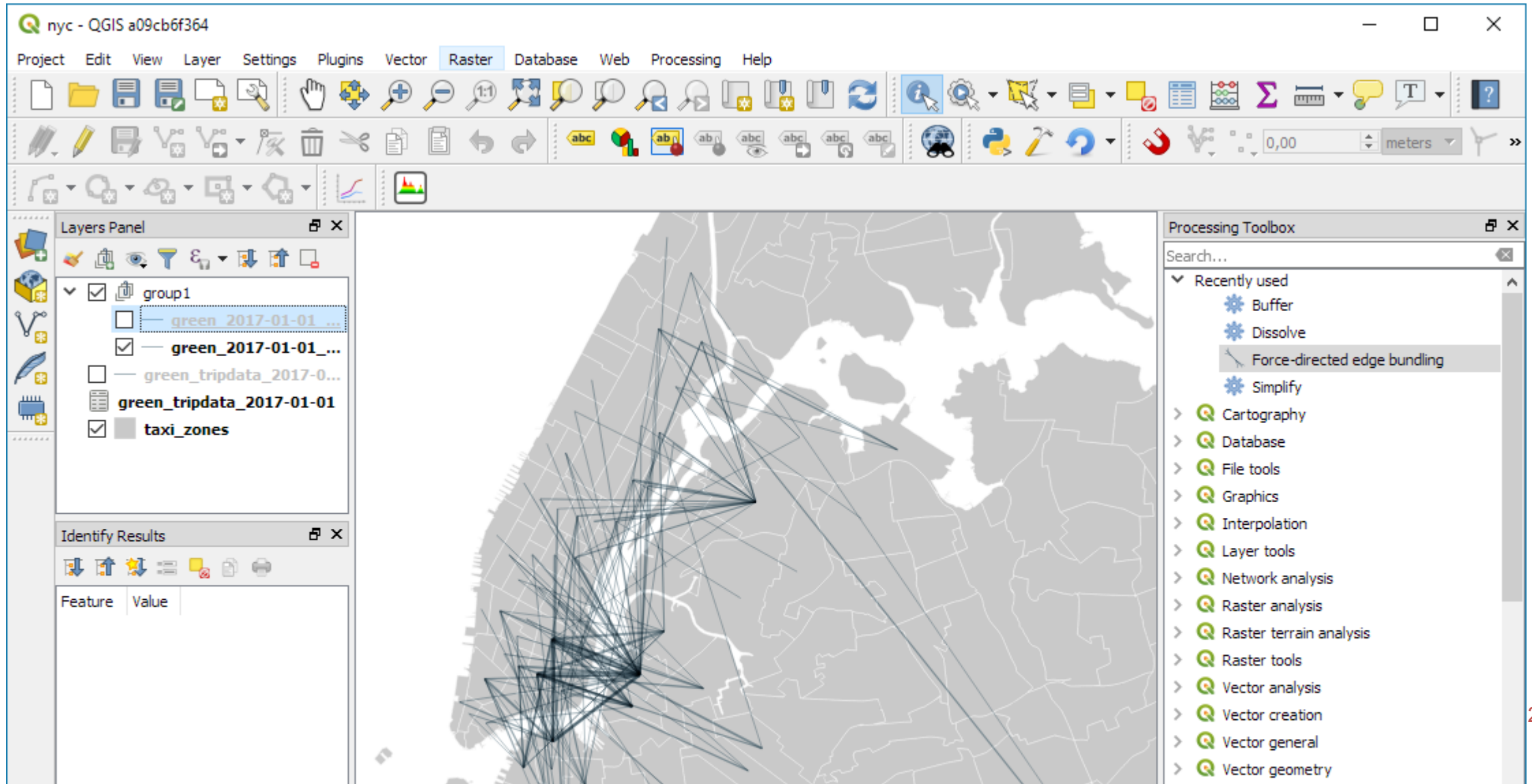


The screenshot displays the QGIS interface with the Script editor and Processing Toolbox. The Script editor shows a Python class named `ExAlgo` that inherits from `QgsProcessingAlgorithm`. The class includes methods for initialization, name, translation, display name, group, and group ID.

```
1 from qgis.PyQt.QtCore import QApplication, QVariant
2 from qgis.core import (QgsField, QgsFeature, QgsFeatureSink, QgsFeatureRequest, QgsPro
   QgsProcessingAlgorithm, QgsProcessingParameterFeatureSource, QgsProcessingParame
3
4 class ExAlgo(QgsProcessingAlgorithm):
5     INPUT = 'INPUT'
6     OUTPUT = 'OUTPUT'
7
8     def __init__(self):
9         super().__init__()
10
11    def name(self):
12        return "exalgo"
13
14    def tr(self, text):
15        return QApplication.translate("exalgo", text)
16
17    def displayName(self):
18        return self.tr("Example script")
19
20    def group(self):
21        return self.tr("Examples")
22
23    def groupId(self):
```

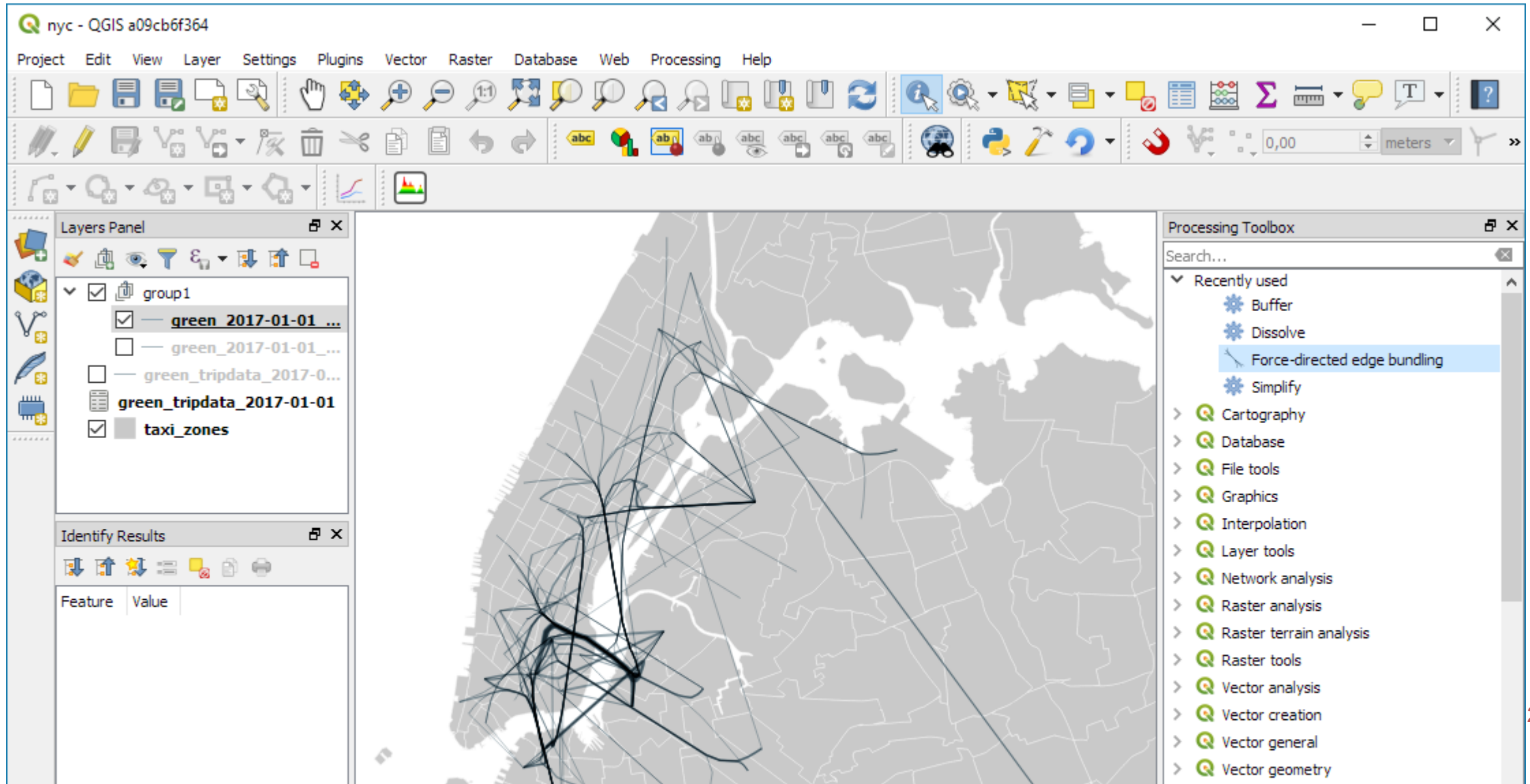
The Processing Toolbox on the left shows a search bar and a list of tool categories. The 'Scripts' category is expanded, and 'Example script' is highlighted. The Processing Toolbox on the right shows a search bar and a list of tool categories, with 'Example script' highlighted under the 'Scripts' category.

CUSTOM SCRIPT EXAMPLE



The screenshot displays the QGIS desktop application window titled "nyc - QGIS a09cb6f364". The interface includes a menu bar (Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Processing, Help) and a toolbar with various icons. The main map area shows a grey background with a network of blue lines representing taxi routes. On the left, the Layers Panel shows a group named "group1" containing several layers: "green_2017-01-01 ..." (unchecked), "green_2017-01-01..." (checked), "green_tripdata_2017-0..." (unchecked), "green_tripdata_2017-01-01" (checked), and "taxi_zones" (checked). Below the Layers Panel is the Identify Results panel, which is currently empty. On the right, the Processing Toolbox is open, showing a search bar and a list of tools. The "Recently used" section includes Buffer, Dissolve, Force-directed edge bundling (highlighted), and Simplify. Other tool categories are listed below, such as Cartography, Database, File tools, Graphics, Interpolation, Layer tools, Network analysis, Raster analysis, Raster terrain analysis, Raster tools, Vector analysis, Vector creation, Vector general, and Vector geometry.

CUSTOM SCRIPT EXAMPLE



The screenshot displays the QGIS desktop environment. The main map area shows a grey background with a network of black lines, likely representing a transit or taxi network. The interface includes a menu bar (Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Processing, Help), a toolbar with various icons, and several panels:

- Layers Panel:** Shows a group named 'group1' containing several layers: 'green 2017-01-01 ...' (checked), 'green_2017-01-01 ...' (unchecked), 'green_tripdata_2017-0...' (unchecked), 'green_tripdata_2017-01-01' (unchecked), and 'taxi_zones' (checked).
- Processing Toolbox:** Located on the right, it lists various processing tools. Under the 'Recently used' section, 'Force-directed edge bundling' is highlighted.
- Identify Results:** Located at the bottom left, it shows a table with columns 'Feature' and 'Value'.

ANALYSIS EXAMPLES

e.g. modeling geologically unstable zones

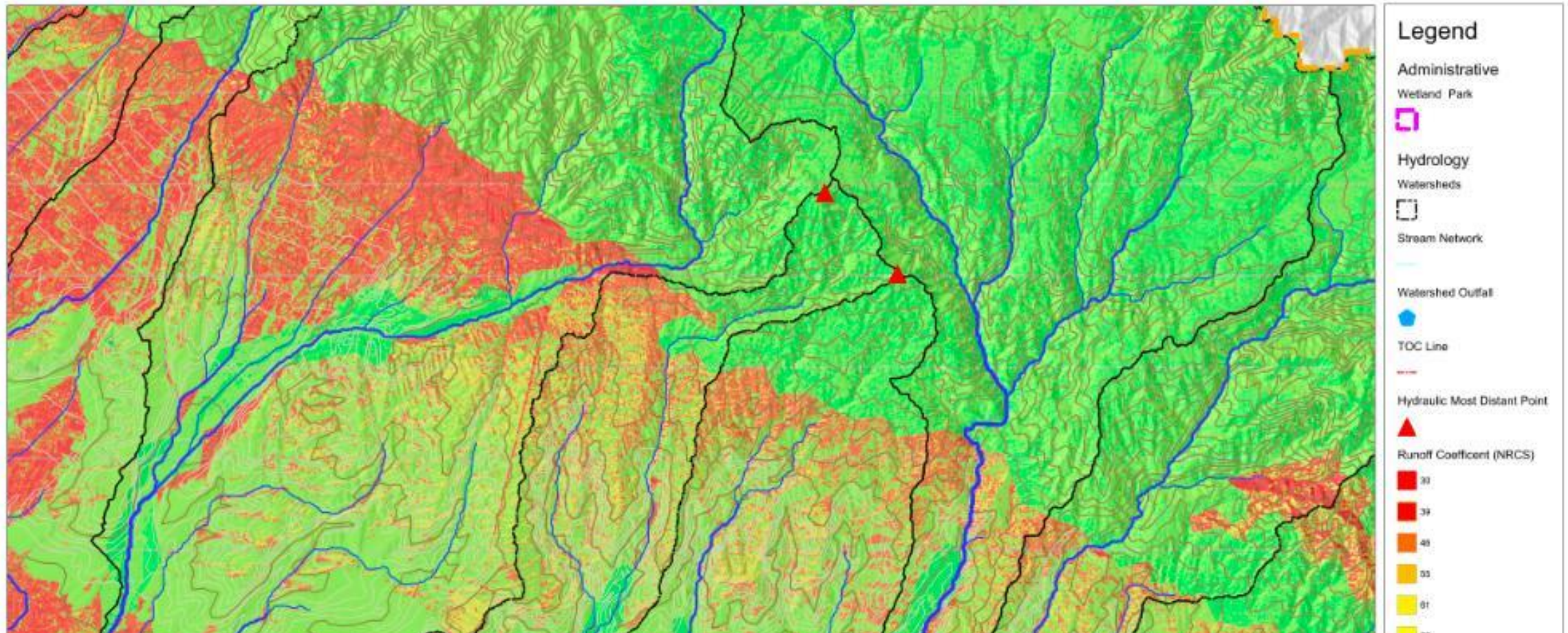
The image displays a QGIS 2.8.1-Wien interface with a map of Rome showing geologically unstable zones. The map features a hillshade, a hillshade, and a hillshade. The Processing modeler window is open, showing a workflow for modeling geologically unstable zones. The workflow includes the following steps:

- Contour Lines
- Contour Z Field
- Raster Resolution
- Intersect Features
- v.to.rast.attribute - Convert...
- r.surf.contour - Surface gen...
- Slope
- r.mapcalculator - Calculate ...
- Polygonize (raster to vector)
- Intersection

The map shows a hillshade, a hillshade, and a hillshade. The Processing modeler window is open, showing a workflow for modeling geologically unstable zones. The workflow includes the following steps:

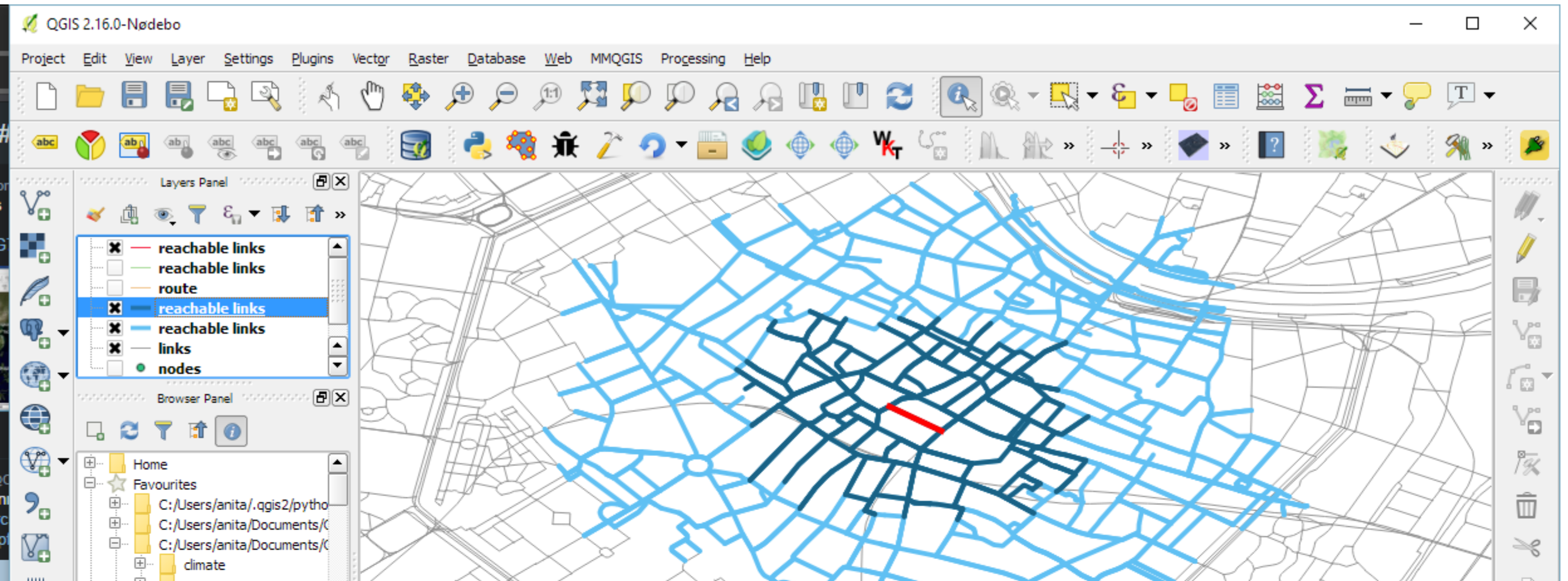
ANALYSIS EXAMPLES

e.g. hydrological analysis



ANALYSIS EXAMPLES

e.g. network analysis



ANALYSIS EXAMPLES

e.g. graph-based diagrams

linz_trees - QGIS 32ba5bf23f

Project Edit View Layer Settings Plugins Vector Raster Database Web Processing Help

Layers Panel

- LinZ BaumdatenBe...
- Geoland Basemap...

Statistics Panel

LinZ BaumdatenBearbeitet O...

Statistic	Value
Count	20611
Count (distinct)	2
Count (missing)	0
Minimum	L
Maximum	N

DataPlotly

Plot Type

- Scatter Plot
- Scatter Plot
- Box Plot
- Bar Plot
- Histogram
- Pie Plot
- 2D Histogram
- Polar Plot
- Ternary Plot
- Contour Plot

Layer

X Field: 123 Stammumfang

Y Field: 123 Hoehe

Properties

- Marker Color: [Green]
- Stroke Color: [Green]
- Marker type: Points
- Point Type: [Black Circle]
- Line Type: [Solid Line]

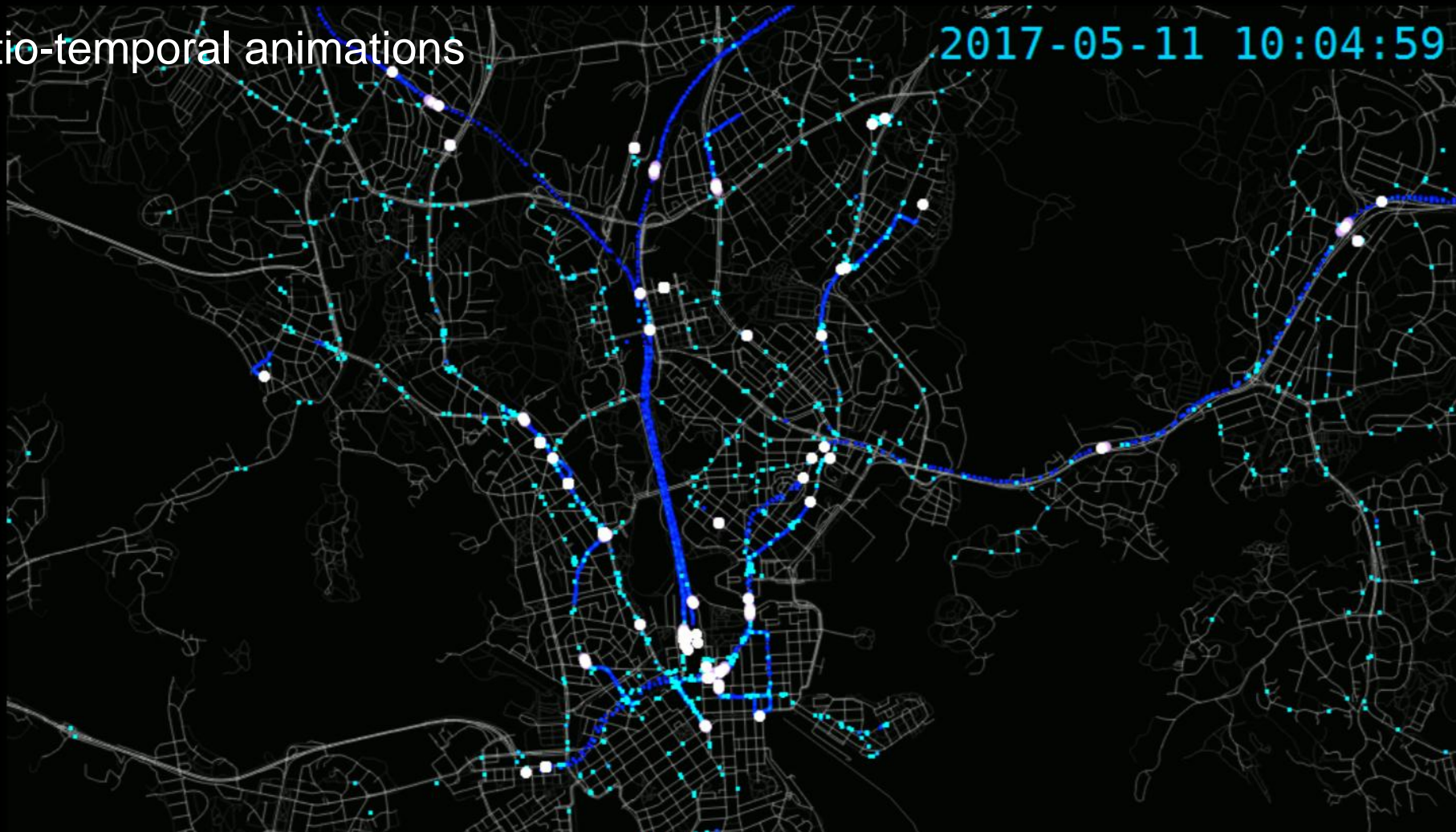
Stammumfang + Hoehe + Schirmdurchmesser

Reload Live Update

DataPlotly Processing Toolbox Layer Styling

ANALYSIS EXAMPLES

e.g. spatio-temporal animations





HOW TO CONTRIBUTE

- Report issues
- Help translating/documenting
- Raise funding
- Answer user questions
- Help fixing issues
- Help developing

CONTACT



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