A practical example using Info Species data for the planification of green infrastructures

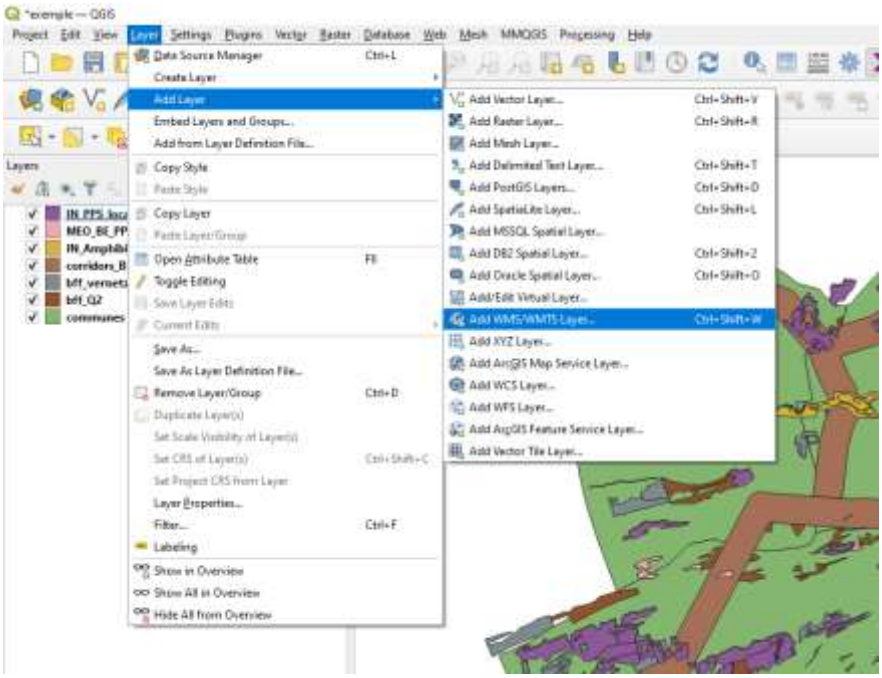
This tutorial has been done with QGIS 3.16.10. Info Species data are available on the website of Info Species and on VDC.

1. Setting QGIS language

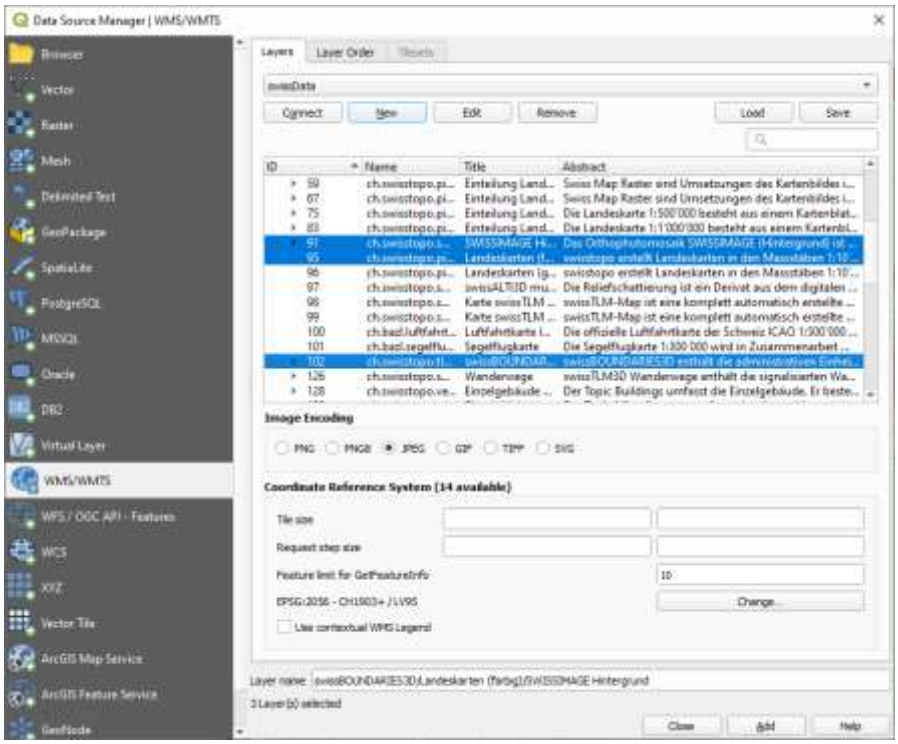
1.1) If you like to switch QGIS in English to match the language of this tutorial go to *Settings* -> *General* -> Check *Override System Locale* and select *American English* -> restart QGIS

2. Add background layers

2.1) If you like to work with the background of swissTopo (aerial pictures of topographical maps) go to : *Layer* -> *Add Layer* -> *Add WMS/WMTS Layer* -> click on *New* -> Insert the name (e.g. swisstopo) and the URL : https://wms.geo.admin.ch/ (German) or https://wms.swisstopo.admin.ch/?lang=fr (French) :



Add the following layers : *Cartes nationales (couleur)* [ID 95] and *SWISSIMAGE Fond de plan* [ID 91] :



3. Add Info Species data

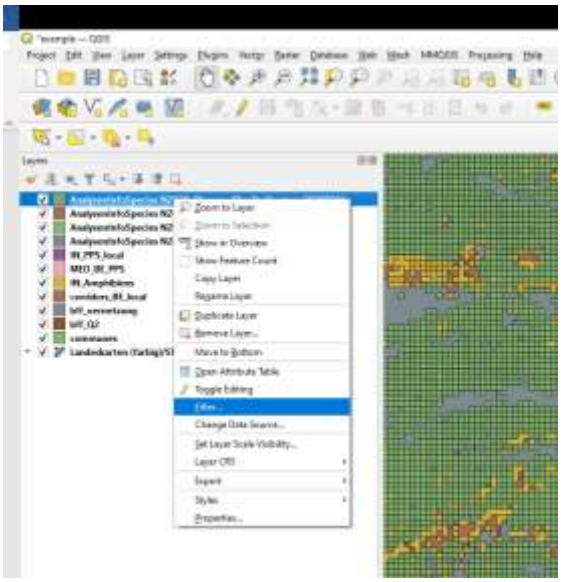
3.1) Drag and drop the Geopackage file in QGIS and select the *polgons* layers. There are four layers (*ObservedQualityHectares*, *ObservedQualityPolygons*, *PotentialQualityHectares*, *AdditionalSurfaceNeeded*)

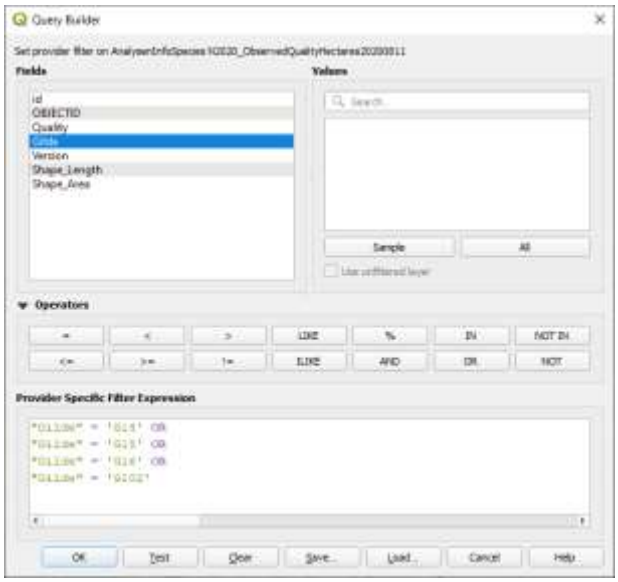
3.2) Filter the desired Guild (14,15,16, 102) for each layer.

On each layer, right click -> *Filter* -> and insert the following filter expression:

"Gilde" = 'G14' OR
"Gilde" = 'G15' OR
"Gilde" = 'G16' OR
"Gilde" = 'G102'

This will keep the 4 guilds (or trames) we use in this tutorial :



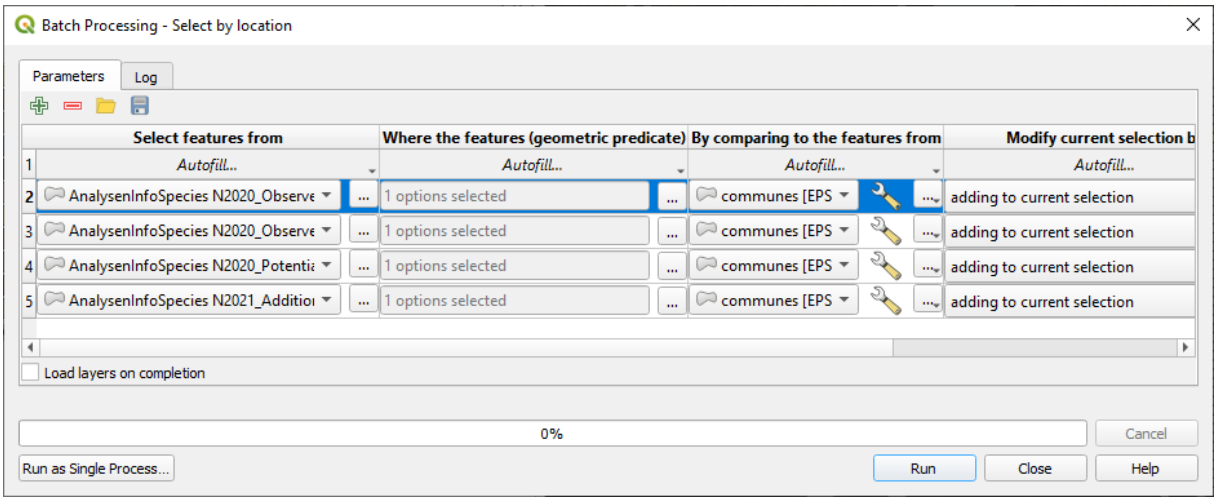


4. Snap to the study area

4.1) Here, we apply a spatial selection to restrict our data only to the study area, which consists in a few cities around Biel.

Go to *Vector -> Research Tools -> Select by Location* and then click on *Run as Batch Process* (bottom left of the window)

Because we will apply the process on the four layers, we need to add 3 supplementary process in the process list. Simply click 3 times on the button. We will specify the input layers for each of the 4 processes.

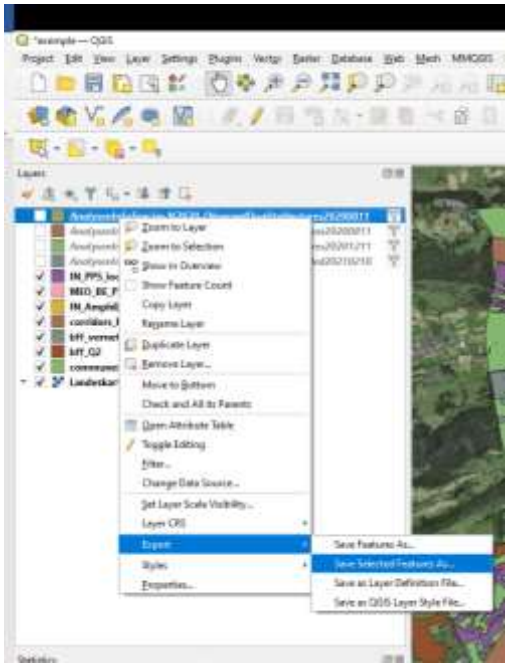


- In the first colum (**Select features from**), specify the for layers you want to filter (*ObservedQualityHectares*, *ObservedQualityPolygons*, *PotentialQualityHectares*, *AdditionalSurfaceNeeded*)
- In the second column (**Where the features**), click on the … and check *intersect*. Click then on *Autofill -> Fill down*
- In the third column (**By comparing to the features from**) select the layer *communes* in the first row and then click on *Autofill -> Fill down*
- In the fourth column (**Modify current selection by**) select *adding to current selection* in the first row and then click on *Autofill -> Fill down*

Before running your process, it can be useful to save the settings of your spatial filtering. You can do it by clicking on the save button and saving your file in the folder *\Cours_211008\data_save\batch.json*. You can now click on *Run* to apply the spatial filtering

4.2) Save the selected features.

In each layer, the features intersecting the study area are now selected. We can save this selection of each layer. Right click on the layer -> *Export* -> *Save selected Feature As*



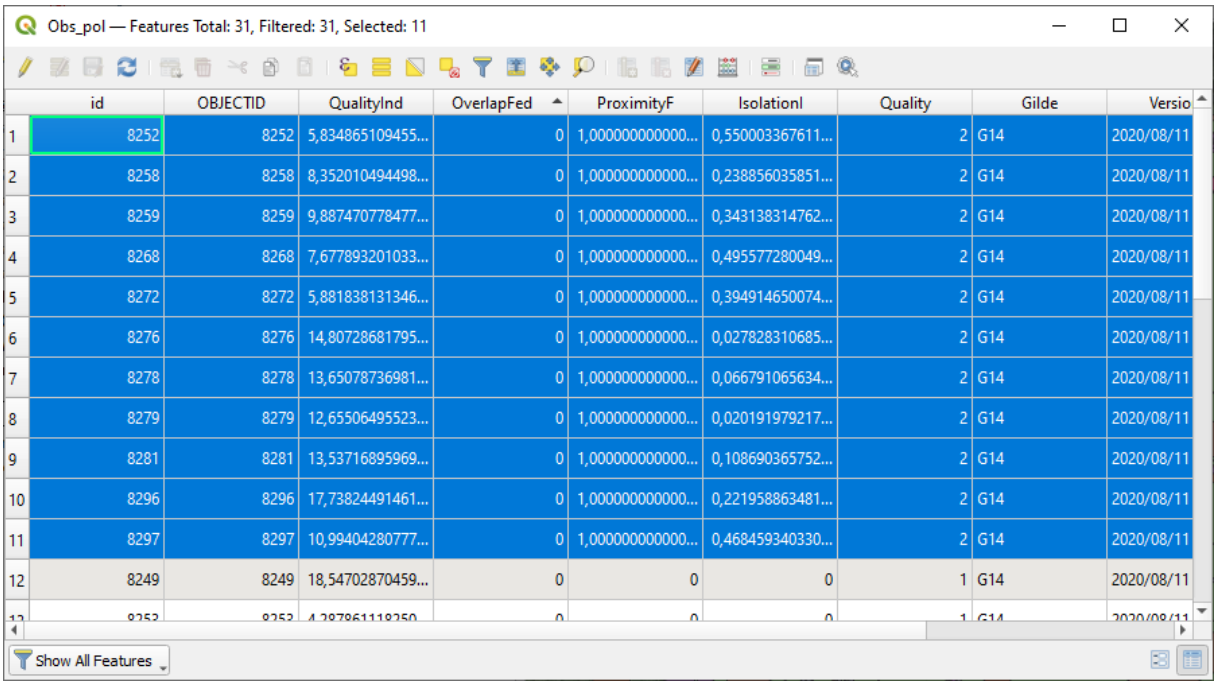
In this example I saved these four selections under this directory with the following names:

\Cours_211008\data_save\Obs_ha.shp
\Cours_211008\data_save\Obs_pol.shp
\Cours_211008\data_save\Pot_ha.shp
\Cours_211008\data_save\BSS.shp

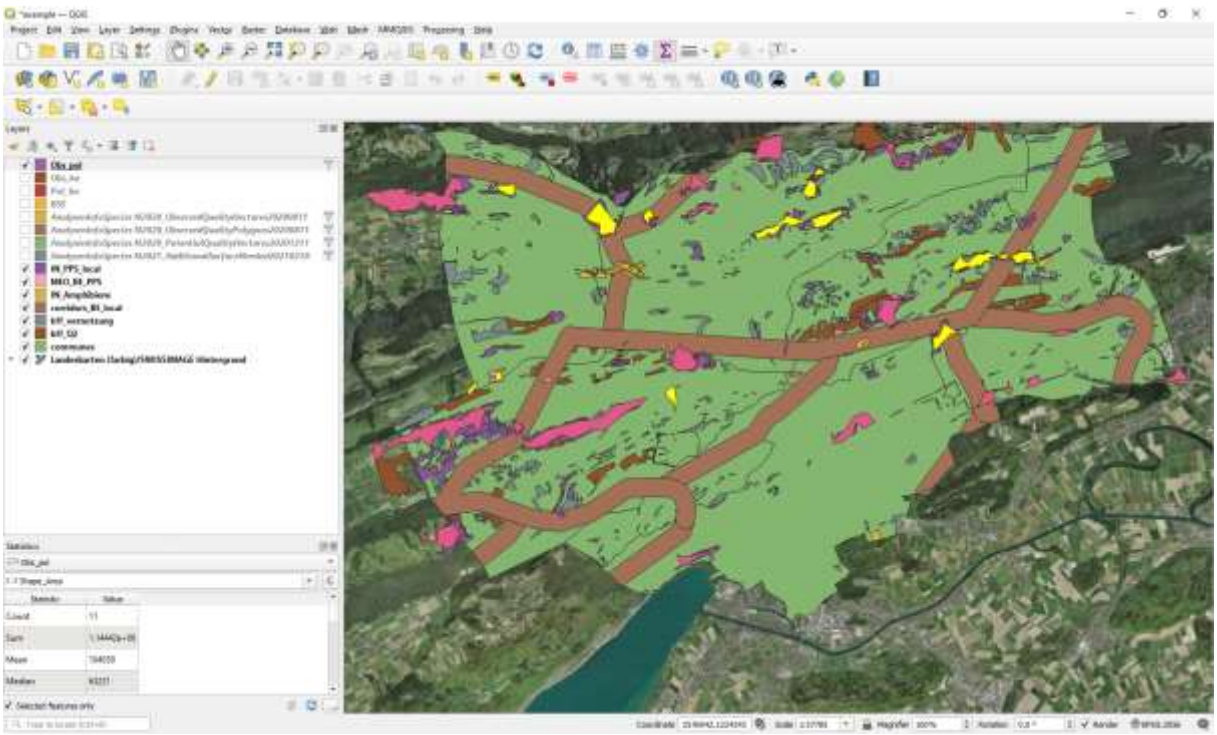
5. including the current green infrastructure

5.1) Now we can check the protection status for the observed quality of guild 14. Because we are working only with guild 14 at this step, we can filter our layers by keeping only data for guild 14 (see step 3).

First, we can select polygons that do not overlap with the federal inventories and which show a very high quality index. You can use the *Attribute table* to dot this and rank the polygons with the fields *OverlapFed* (which measure the overlap of each polygon with the federal inventories) and *Quality*. We can see that there are 11 polygons with a very high quality (*Quality* = 2), not intersecting any federal inventories. This represents 114 ha. These polygons may represent interesting central area as they are an aggregation of several (at least 5) hectares of quality.



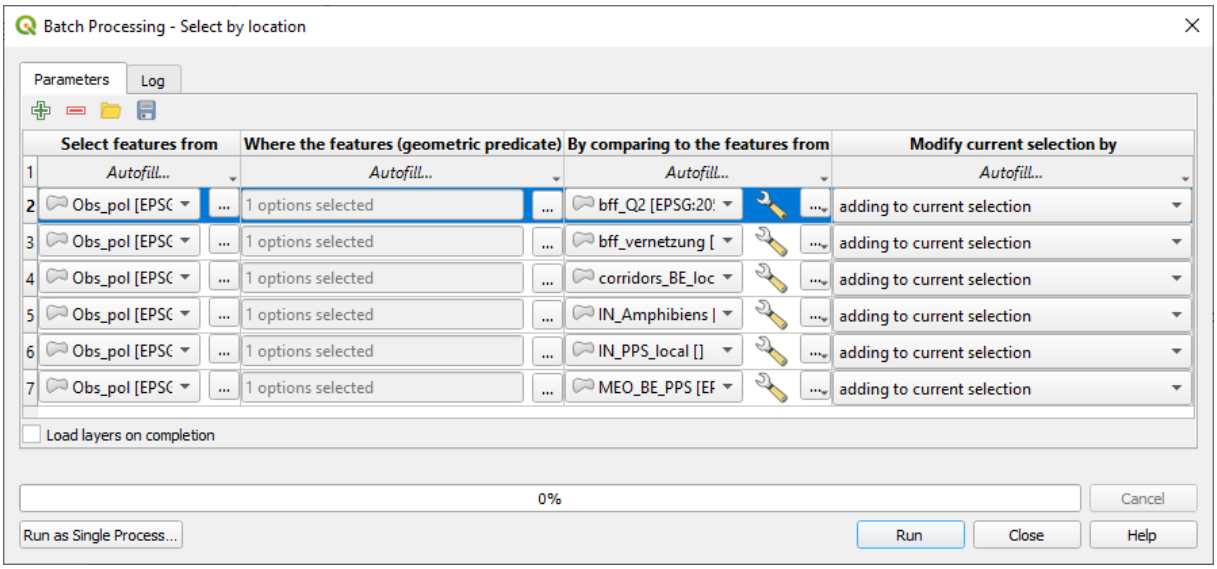
	id	OBJECTID	QualityInd	OverlapFed	ProximityF	IsolationI	Quality	Gilde	Versio
1	8252	8252	5,834865109455...	0	1,000000000000...	0,550003367611...	2	G14	2020/08/11
2	8258	8258	8,352010494498...	0	1,000000000000...	0,238856035851...	2	G14	2020/08/11
3	8259	8259	9,887470778477...	0	1,000000000000...	0,343138314762...	2	G14	2020/08/11
4	8268	8268	7,677893201033...	0	1,000000000000...	0,495577280049...	2	G14	2020/08/11
5	8272	8272	5,881838131346...	0	1,000000000000...	0,394914650074...	2	G14	2020/08/11
6	8276	8276	14,80728681795...	0	1,000000000000...	0,027828310685...	2	G14	2020/08/11
7	8278	8278	13,65078736981...	0	1,000000000000...	0,066791065634...	2	G14	2020/08/11
8	8279	8279	12,65506495523...	0	1,000000000000...	0,020191979217...	2	G14	2020/08/11
9	8281	8281	13,53716895969...	0	1,000000000000...	0,108690365752...	2	G14	2020/08/11
10	8296	8296	17,73824491461...	0	1,000000000000...	0,221958863481...	2	G14	2020/08/11
11	8297	8297	10,99404280777...	0	1,000000000000...	0,468459340330...	2	G14	2020/08/11
12	8249	8249	18,54702870459...	0	0	0	1	G14	2020/08/11



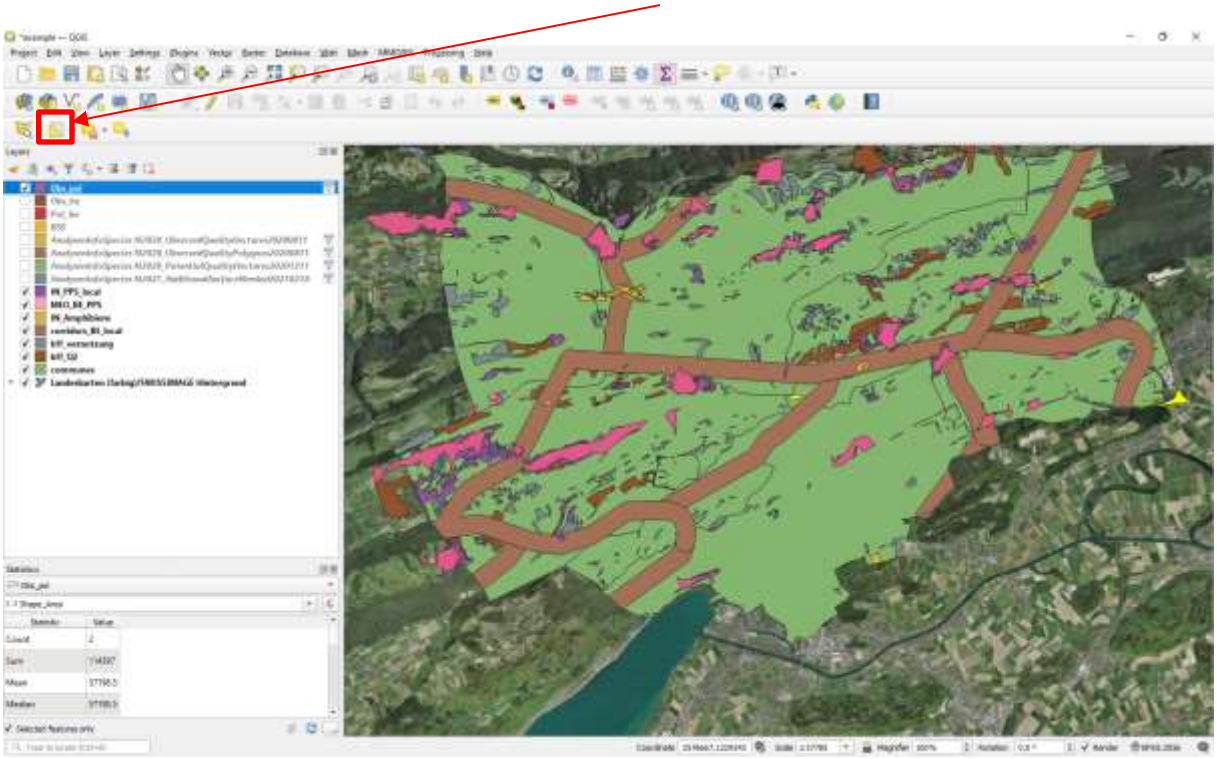
5.2) It is possible that these polygons without any federal status are covered by other regional green infrastructures. We can check it by overlapping our green infrastructures in our study area with the polygons of observed quality:

- clean the selection

- apply the same selection process as in step 4.1. In this example, I included corridors, BFF (Q2 and connectivity), national and regional inventories. It might not be relevant to include corridors for guild 14. You can save your batch process because we will apply the same type of selection further. It is more efficient to specifiy the settings from an initial model.



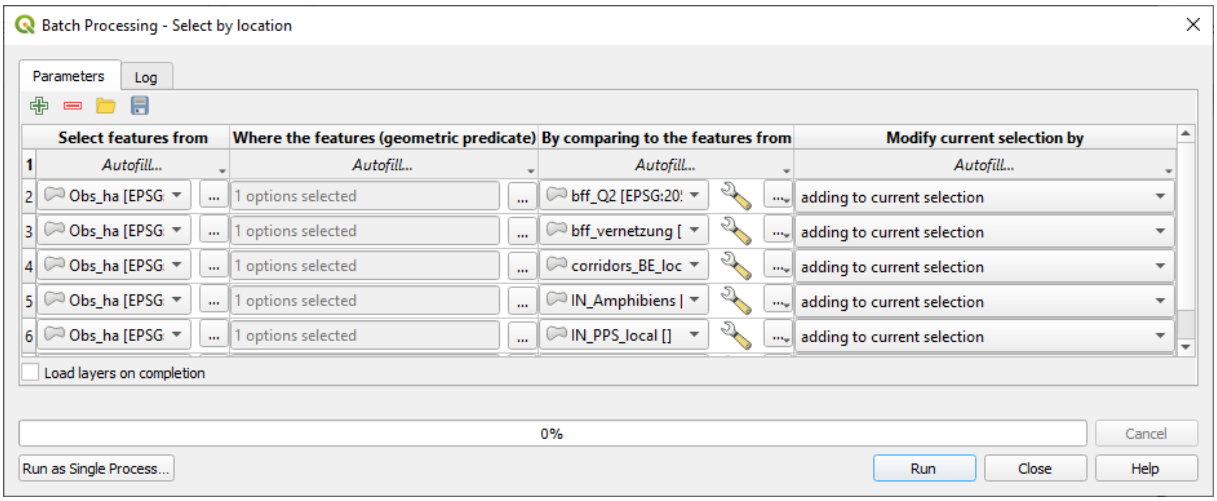
To select the unprotected polygons, you just need to revert the selection:

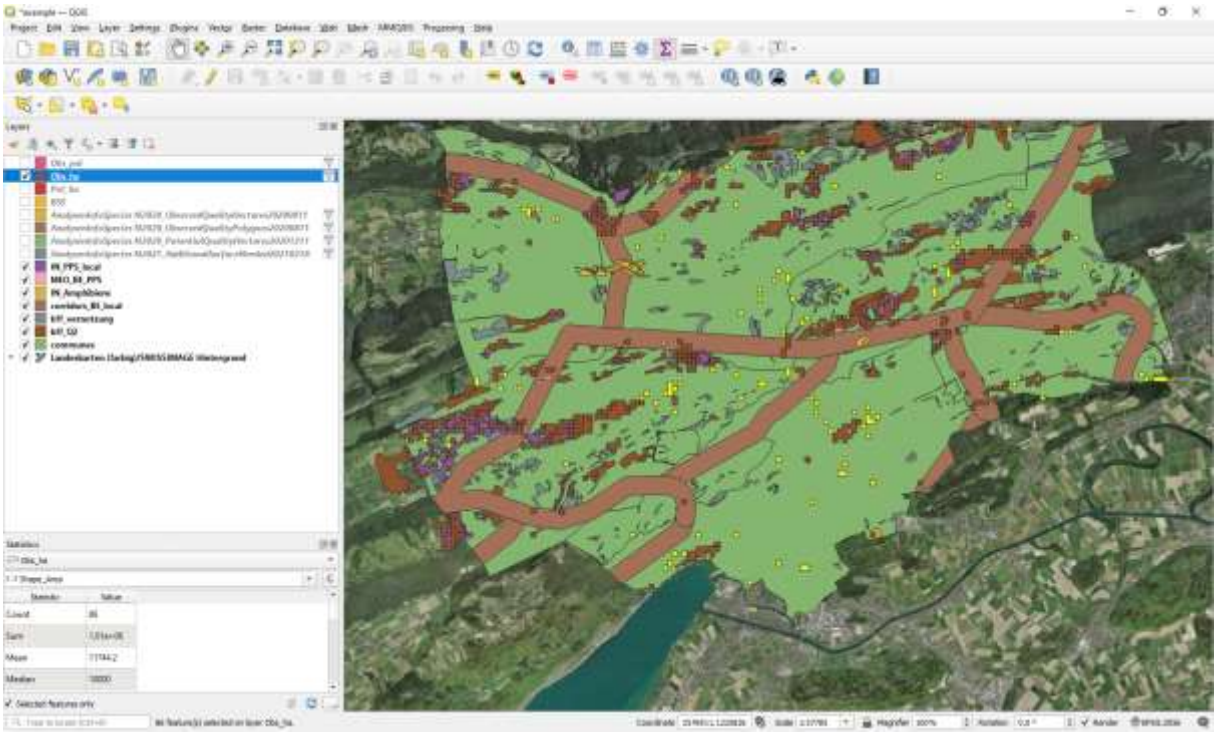


There are only two polygons (area = 11 ha) not covered by these objects

5.3) We can verify the protection status of each hectare of the observed quality. This finer resolution than the polygons might show interesting isolated or sparse sites that can play a crucial role in the connecting network.

- Apply the same selection process as in the step 5.2 on the hectares of observed quality (and do not forget to clean up the selection before doing the process):

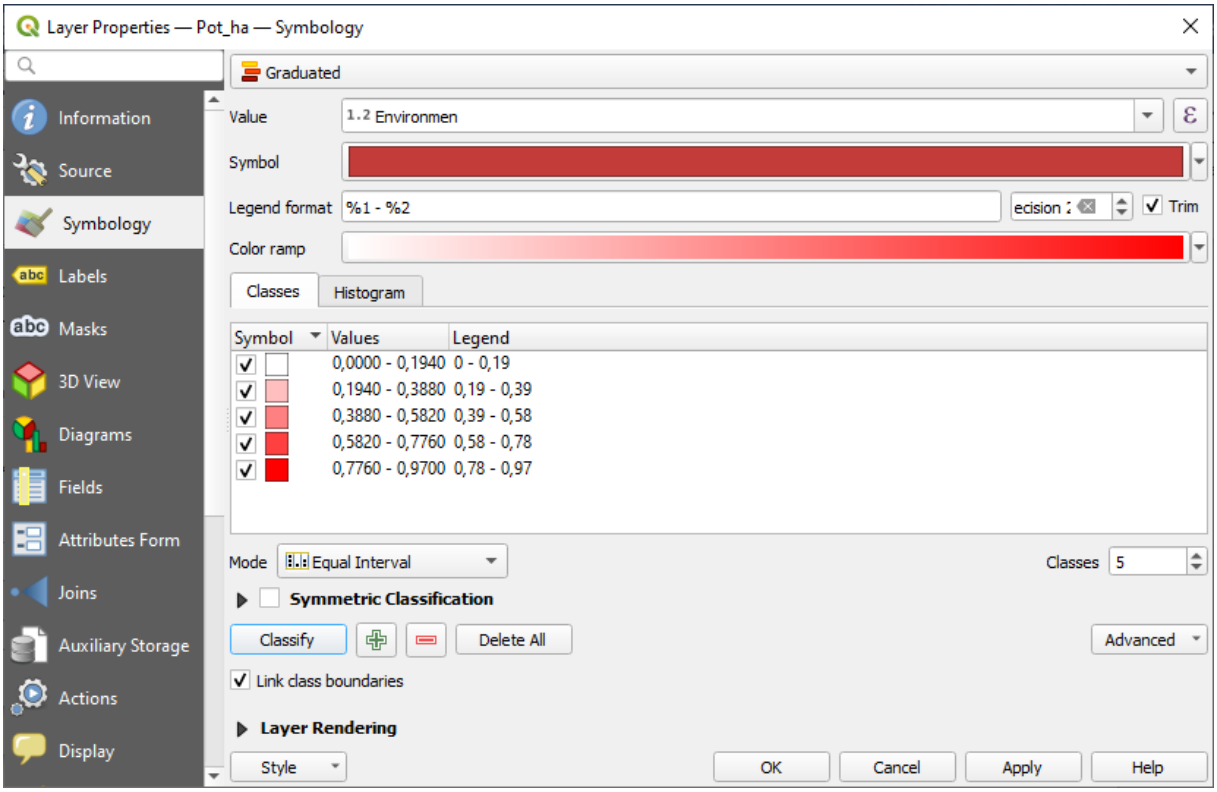




We can detect 101 ha not included in the current green infrastructures, including 28 with very high quality (thanks to the field *Quality* in the attribute table).

6. Using the potential quality to find optimal connecting area

6.1) First, for representation purpose, we can show the environmental suitability (or an other index) by adjusting the symbology : right click -> *properties* -> *symbology* :



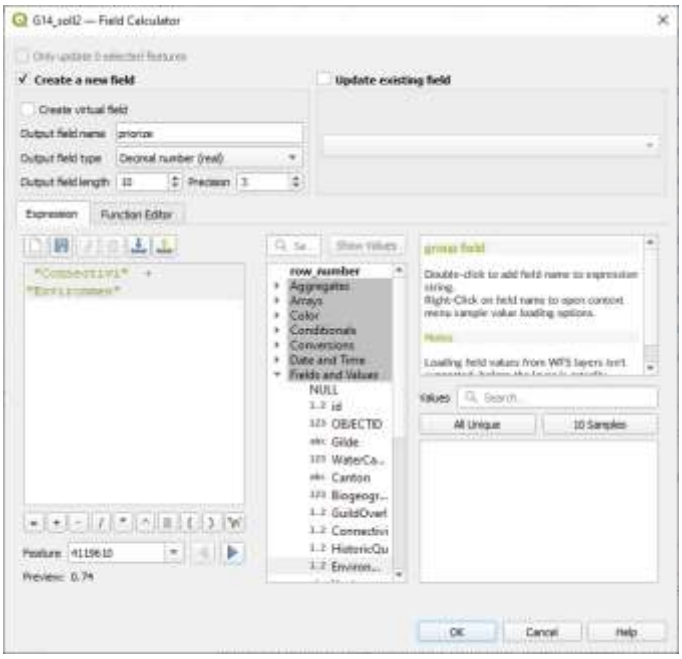
6.2) For this example, we can draw a connectivity network by selecting area in the potential quality, connecting the observed quality.

Note that you could rasterize the environmental suitability of the potential quality and then implement it as the inverse of a cost surface in tools like r.cost or r.walk (available in the GRASS module of QGIS). Then you can use r.drain to draw a least cost path accros the potential quality.

- With the selection button, select the potential area you want to include to connect the observed quality, then save your selection. In my example, I saved under \Cours_211008\data_save\G14_soll.shp

You can use the indices of the potential quality as priorization index. In this example, we combine environmental suitability and the connectivity of each cell to create a new field called prio. Note that depending on the goal of the conservation planning, there are many ways to use and combine the priorization indices.

Open the attribute table and then click on the *Field calculator* button:



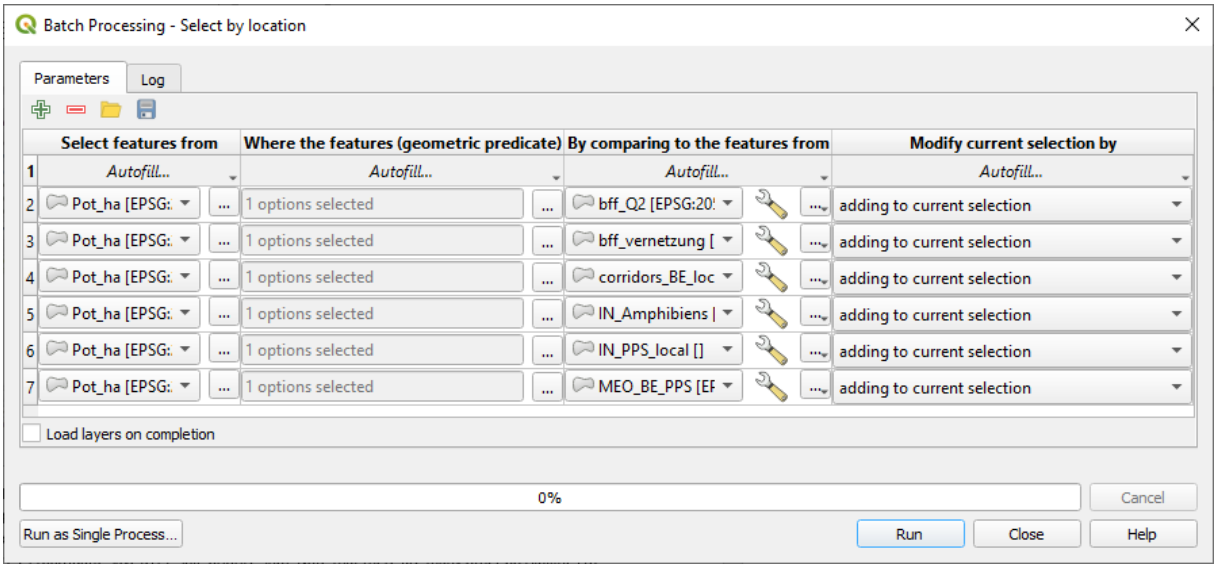
6.3) Now we can rank the hectares following this criterion and select the desired number. For example, we can select the *Additional Area Needed* for [these cities](#) (= 93 Ha, simply select the 93 first rows of the ranked potential. In my example, I saved under \Cours_211008\data_save\G14_soll_priorize.shp.

G14_soil2 — Features Total: 202, Filtered: 202, Selected: 93

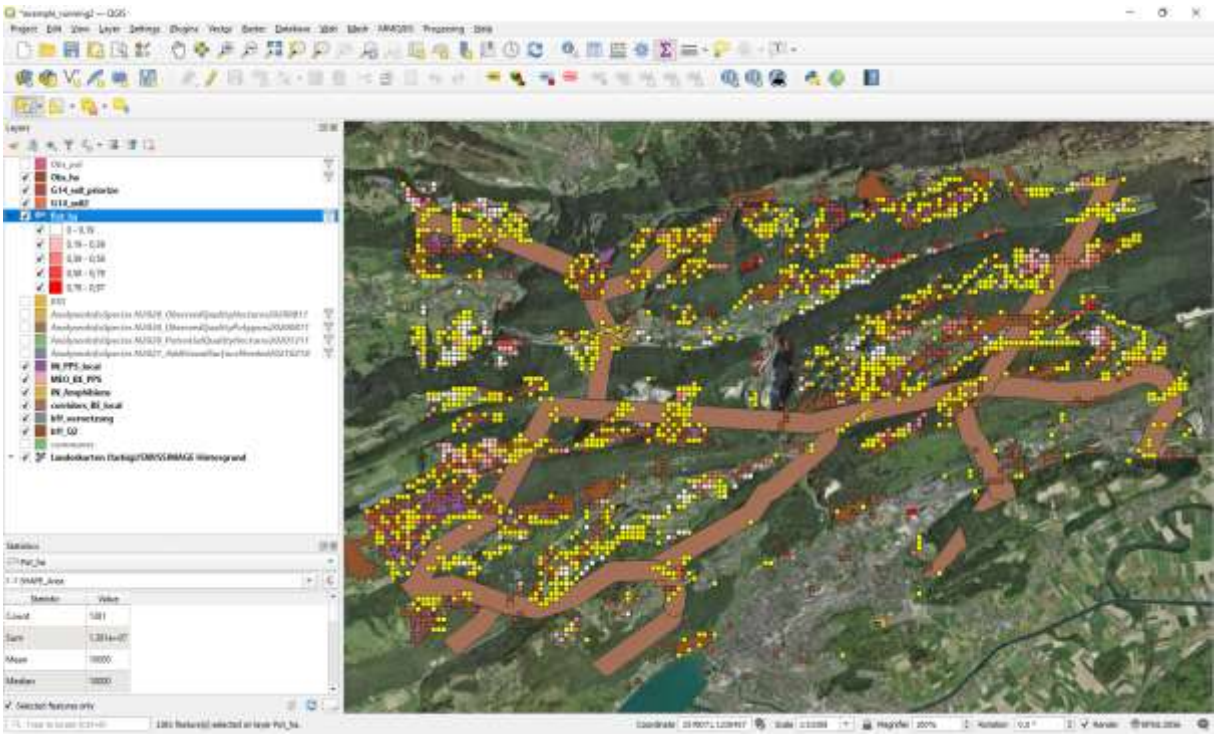
	eograp	GuildOverl	Connectivi	HistoricQu	Environmen	Version	SHAPE_Leng	SHAPE_Area	priorize
1	11	0,34	0,96	0	0,86	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,820
2	11	0,34	0,97	0	0,84	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,810
3	11	0,34	0,87	0,02	0,92	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,790
4	11	0,34	0,96	0	0,82	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,780
5	11	0,34	0,96	0	0,81	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,770
6	11	0,34	0,98	0	0,77	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,750
7	11	0,34	0,98	0	0,76	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,740
8	11	0,34	0,92	0	0,81	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,730
9	11	0,34	0,92	0	0,81	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,730
10	11	0,34	0,94	0,03	0,79	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,730
11	11	0,34	0,84	0,02	0,89	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,730
12	11	0,34	0,98	0	0,75	2020/12/11 00:0...	400,0000000000...	10000,0000000...	1,730

Show All Features

6.4) We can also simply check how much of the potential distribution is already included in the current infrastructure with a spatial filtering : *vector -> research -> select by location*

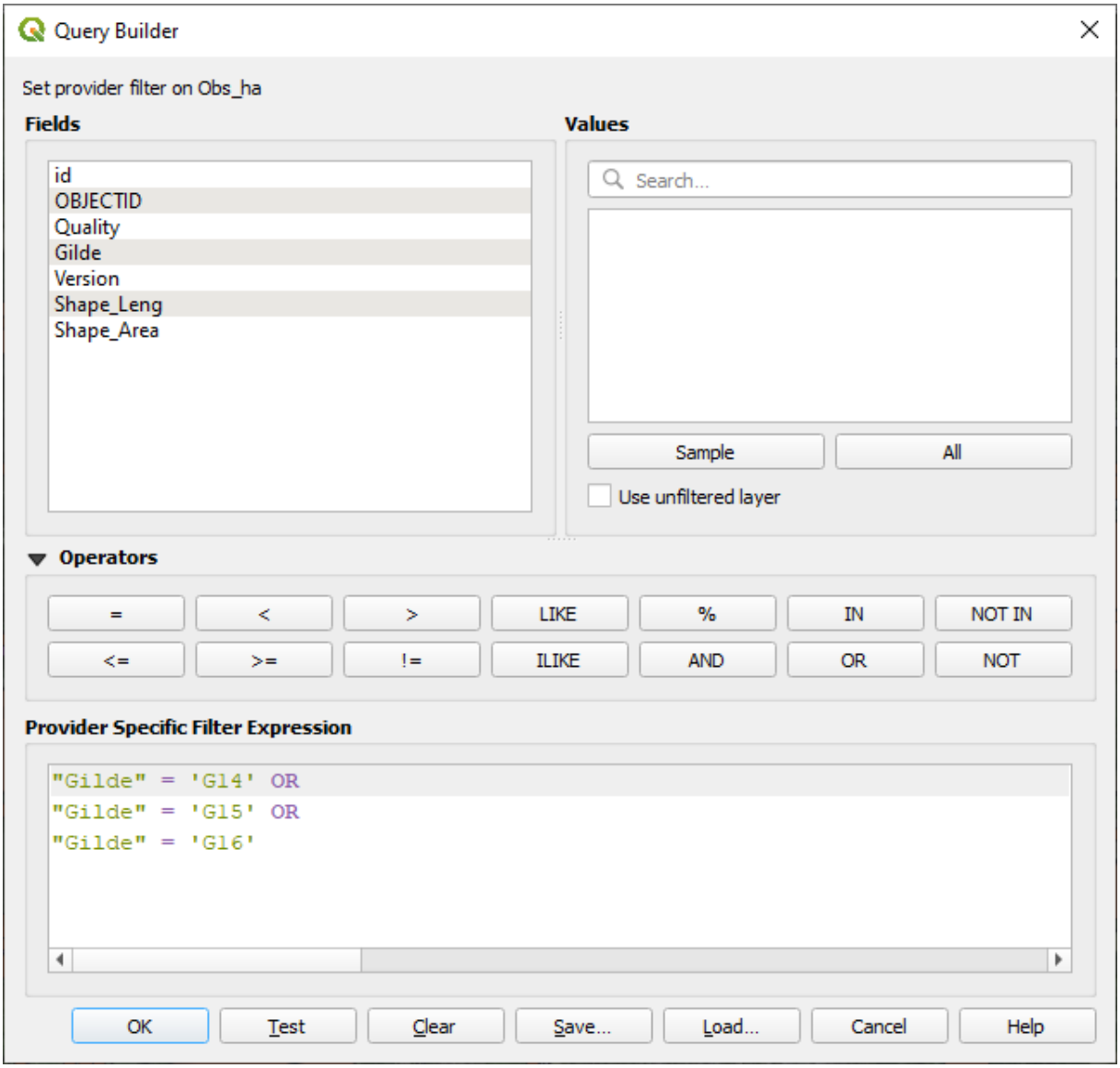


We can see that 1381 Ha are already included in the infrastructure. The current infrastructure matches the potential distribution a lot (if we assume that it makes sense to include the corridors in this infrastructure for this guild).

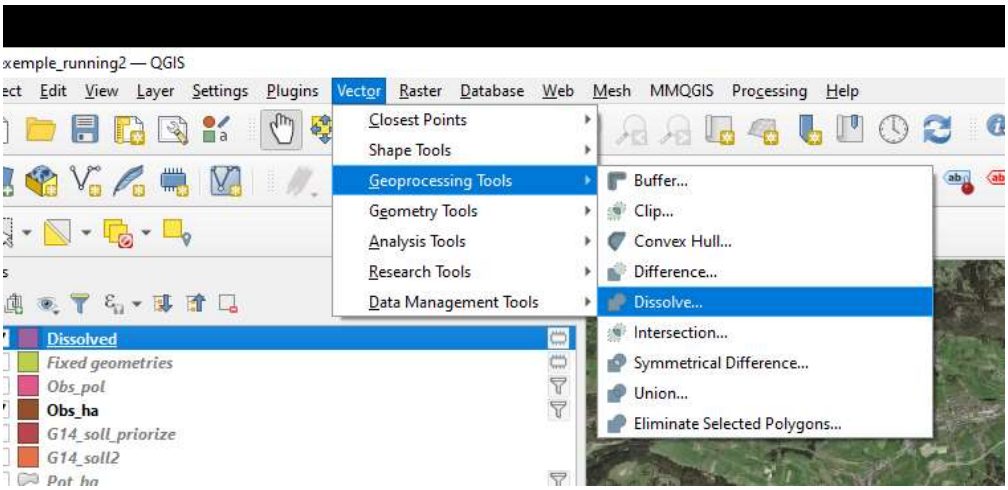


7. Including several guilds (e.g. G14, G15, G16)

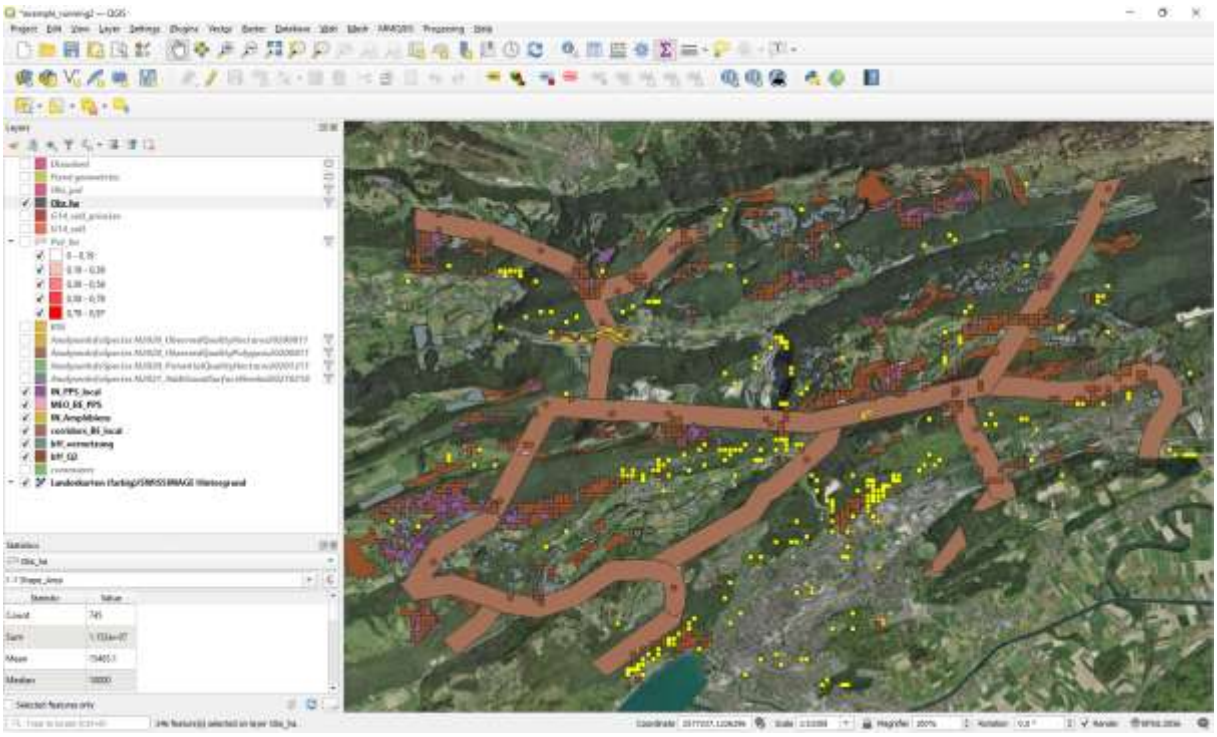
7.1) If we want to plan the green infrastructure at a broader level than the “guild”, we can combine several guilds together. In this example, we will combine the ha of observed quality for the guilds 14, 15 and 16. You just need to specify these guilds in the filtering process:



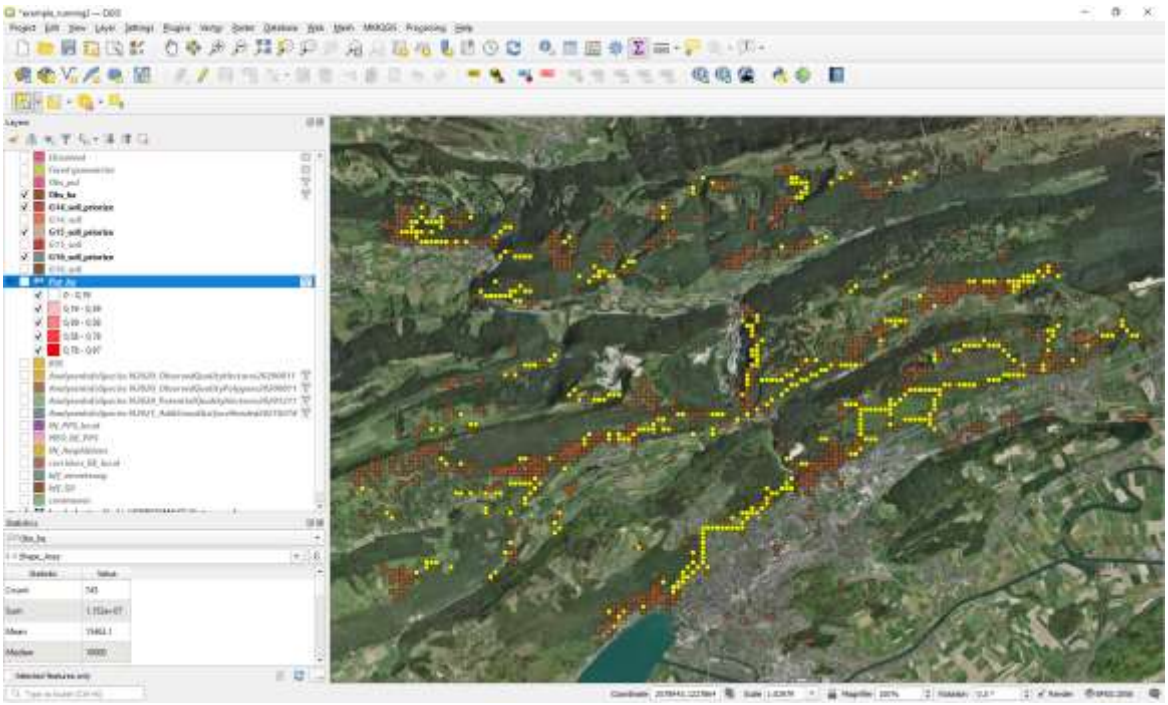
In the study area, there are 1152 ha that shows habitat quality for at least one of these guilds. Note that if you remove redundant overlapping hectares across these three guilds, the area is 920 ha. To work with one unified layer, without overlapping hectares, you need to dissolve your layer: *Vector -> Geoprocessing Tools > Dissolve*



If we overlay the current green infrastructure with the observed quality for these three guilds (see 5.3), we find 287 (out of 1152) ha that are not included.



7.2) If we want to select suitable sites to connect the observed quality, we can do the same approach we did for the guild 14 (see 6.3) to guilds 15 and 16 and then combine the results. So for example, you can draw corridors among the potential quality of each guild and then prioritize according to connectivity and environmental suitability (see 6.3). We end up with the following three layers that we can merge: G14_soll_priorize.shp, G15_soll_priorize.shp and G16_soll_priorize.shp :



8. Working with the “trames”

8.1) Trames are an ensemble of guilds. There is one “wet trame” (G101 = guild 5 to guild 9) and one “dry trame” (G102 = guild 14 to guild 16). For each trame, species of the different guilds were pooled, and the same analysis was done as the guild. These trames allows a broader habitat resolution than the guilds and may facilitate the planification of the green infrastructures. If you filter your layers and keep only the guild 102 you get the ensemble of the guilds 14, 15 and 16. Note that it may be different from the “sum” of guilds 14 to 16 (step 7), because a trame sets its own parameters (e.g. to cluster hectares into polygons) and has its own distribution models for the potential quality.