EGU General Assembly 2020

LAND SUPPORT

TFM-ext tool for the groundwater vulnerability assessment within a Geospatial Decision Support System (LandSupport project)

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Presentation outline

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5. The Filtering capacity tool
6. Two case studies (Valle Telesina, IT and Marchfeld area, AU)
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The groundwater vulnerability assessment

Through the EU, high concentrations of nitrates and pesticides represent one of the main risky sources of the pollution for the groundwater resources and have potential long-term impacts on the environment and human health. Consequently, it is important to develop tools which enable us to map the most vulnerable zones with respect to specific land uses.

The scope of the work

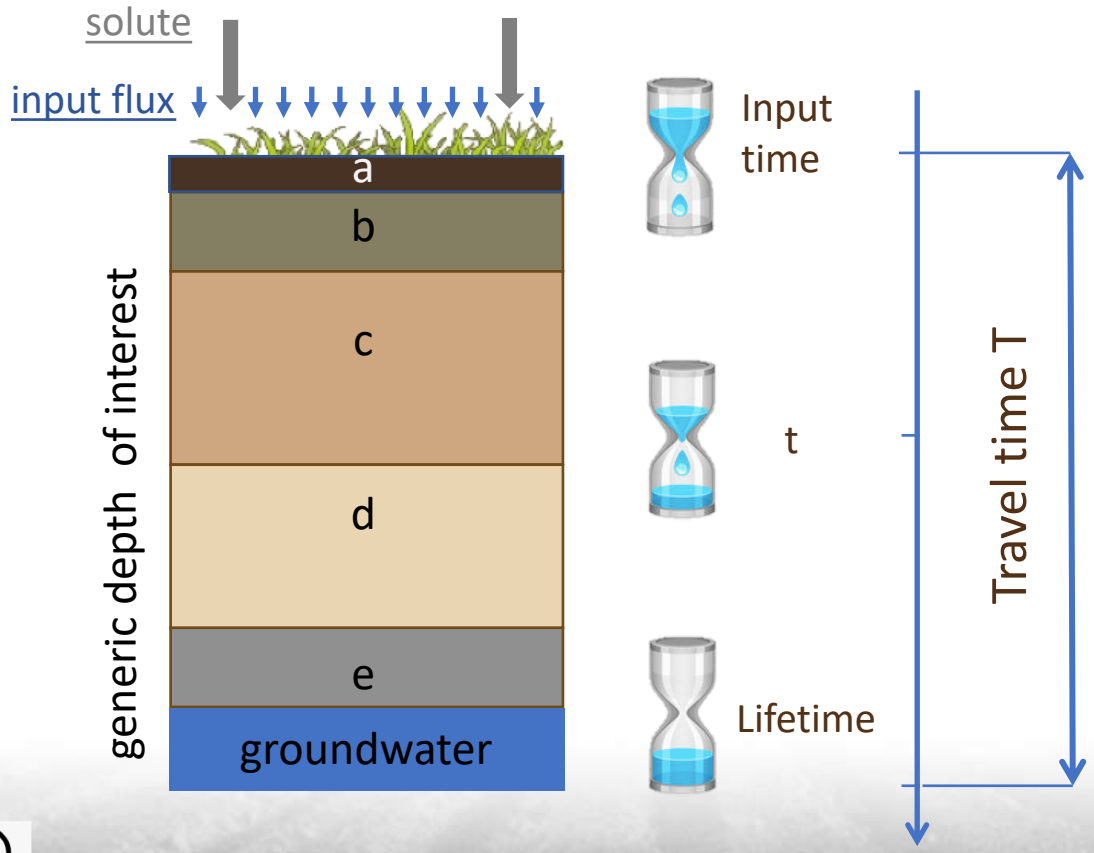
The scope of this work is to present the implementation of the extended Transfer Function Model (TFM-ext) as an operative tool for the groundwater vulnerability assessment within the larger S-DSS developed for LandSupport H2020 project (https://www.landsupport.eu).

The scope of the tool

This tool is aimed at helping Public Authorities (Administrative Regions) and Agriculture cooperatives and consortia who need instruments to better relate agricultural activities to groundwater preservation, analysing the natural filtering capacity of the soils under different land use conditions in order to protect the precious groundwater resource.

The TFM-ext

The TFM-ext is based on the definition of a probability density function for the *travel times* of a solute particles moving in a field soil, (*Jury, 1982*). For more details, see the Abstract EGU2020-3819.



The Filtering capacity tool

The values of mean travel times are associated to the filtering capacity of the soil, which is classified according to the percentage of input mass arrived at the depth of interest after one year, as:

- A high filtering capacity is associated to long travel times and to a small amount of mass arrived at z after one year;
- A low filtering capacity is associated to short travel times and to a big amount of mass arrived at z after one year.

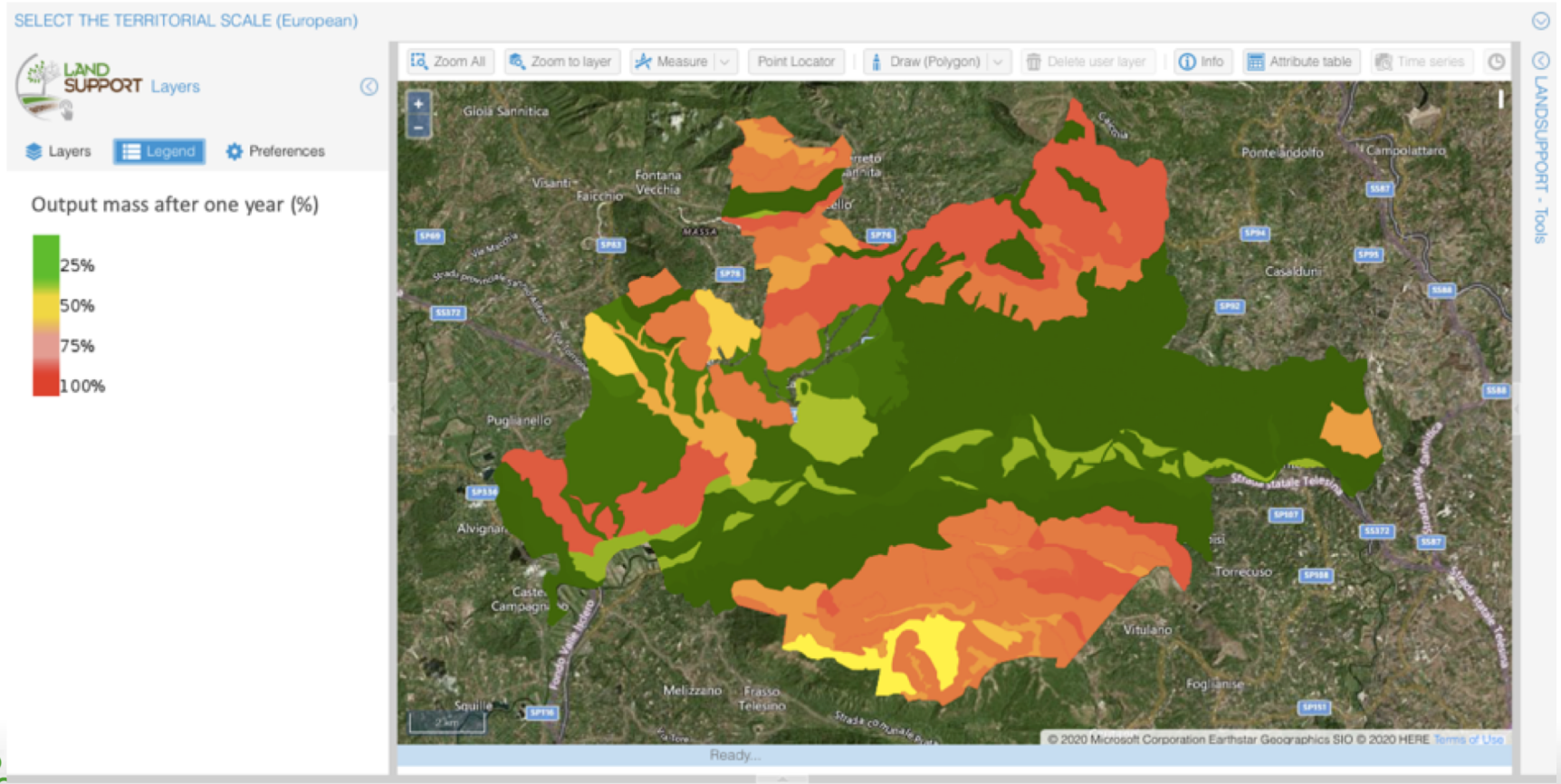
Two case studies

Two applications of the TFM-ext model, considering non-reactive solutes, were done:

- Valle Telesina, a hilly area of 200 km^2 in Southern Italy
- Marchfeld area, a region of around 1000 km^2 in eastern Austria

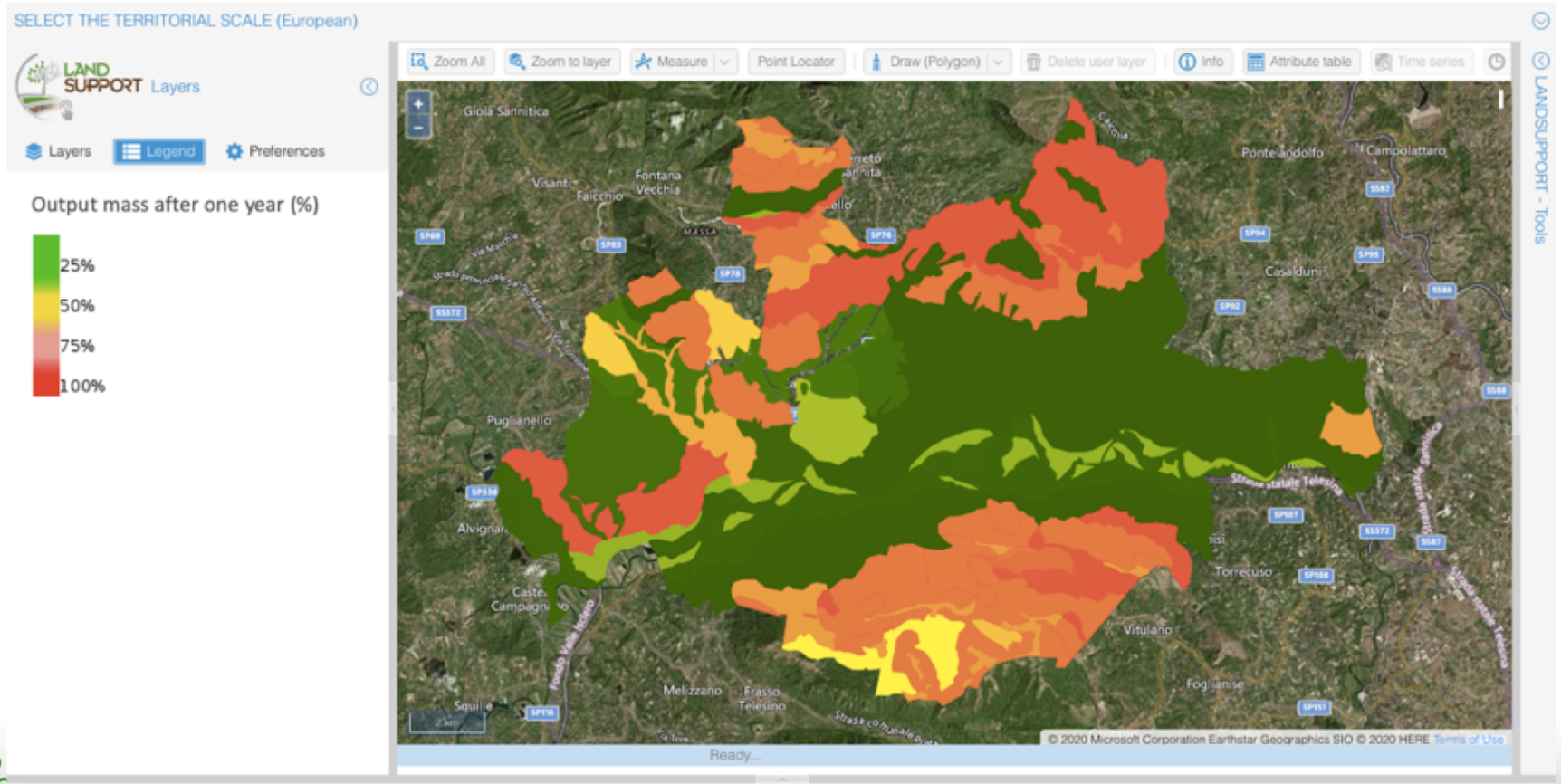
Valle Telesina, Italy

From the regional handbook and regulations for farmers, 6 different crop scenarios, bare soil, alpha-alpha, maize, vine, olive and wheat, and the related fertilization management were considered for the Telesina Valley. Figure shows the results for a preliminary application considering the maize scenario.



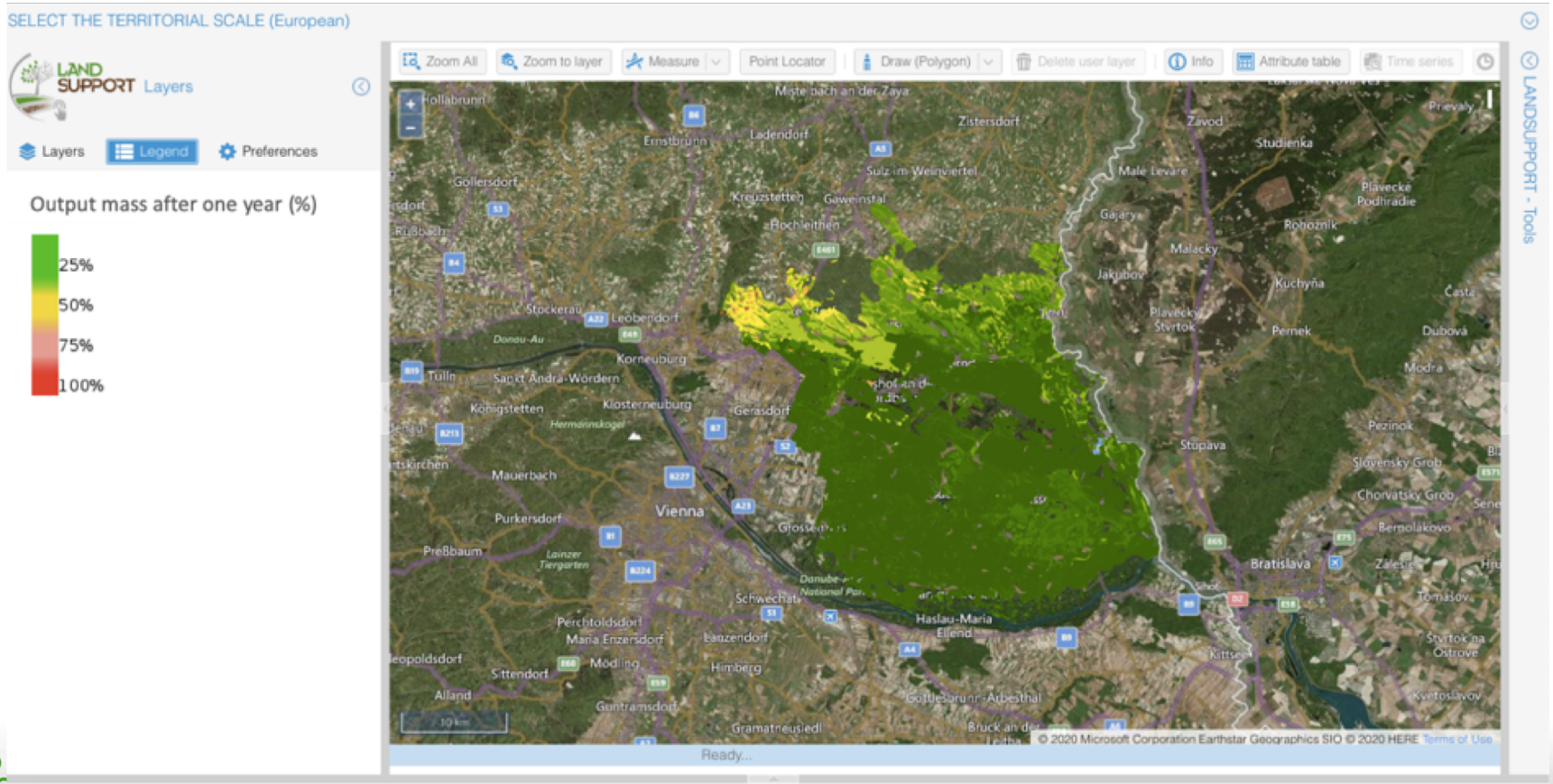
Valle Telesina, Italy

Most of the soil units have mean travel times above 200 days, which means that the majority of the soils have a good filtering capacity. The different colours are mainly due the different depth considered in the computation, which, for the mountain and hilly parts are the depths of the soil profiles, i.e., 150 cm, and not the groundwater depths.



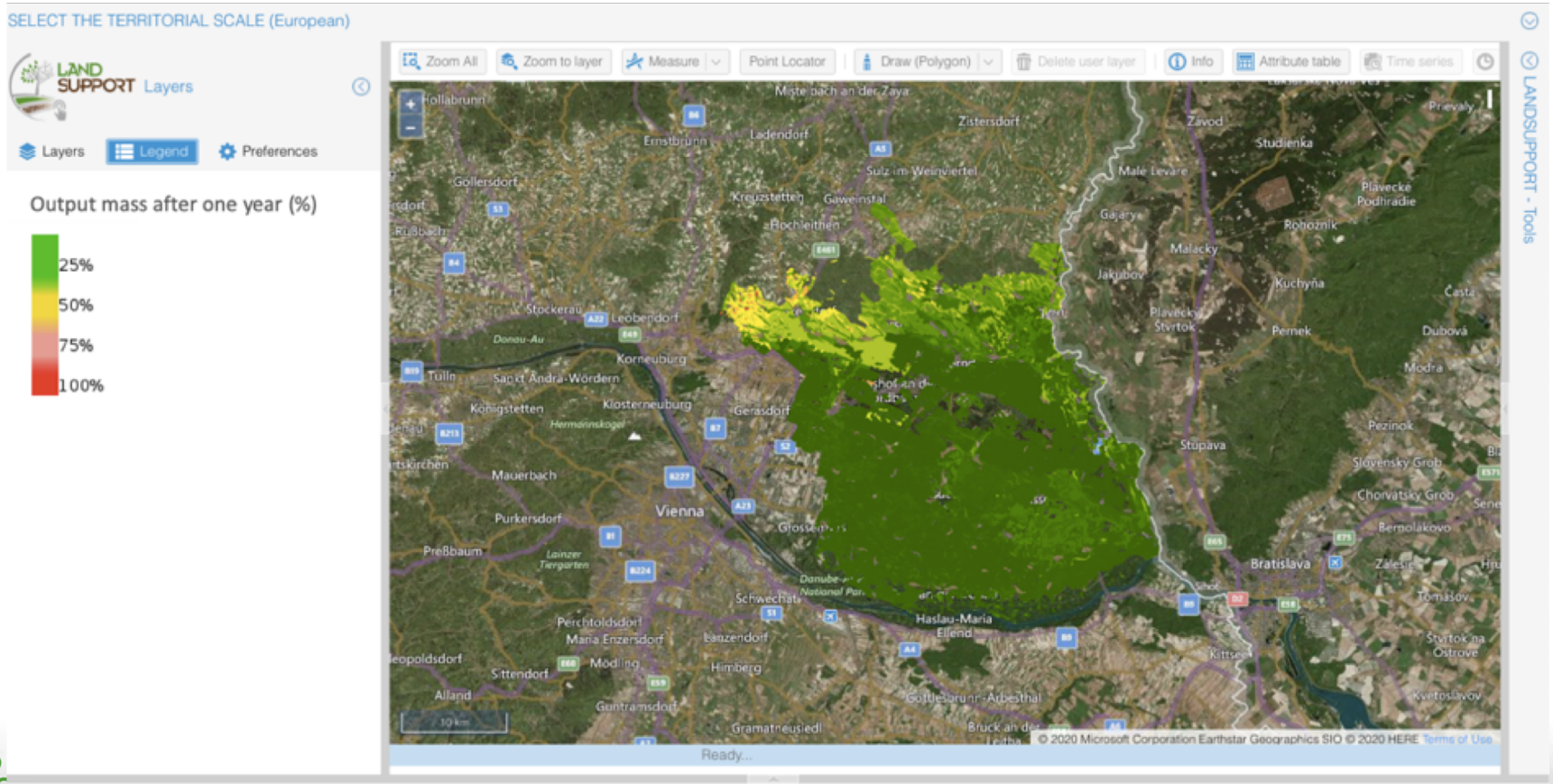
Marchfeld, Austria

An analogous application was done for the Marchfeld case study, where the regional handbook and regulations for farmers suggested to consider potatoes, sunflowers, soy, maize, wheat and bare soils and the related fertilization management.



Marchfeld, Austria

Results reported in Figure show that the Marchfeld soils have, in general, a high filtering capacity, with very long mean travel times, around 300 days. Some yellow to red spots are present in the North-Western part of the area, where the depths of the soil profiles, i.e., 200 cm, was considered.



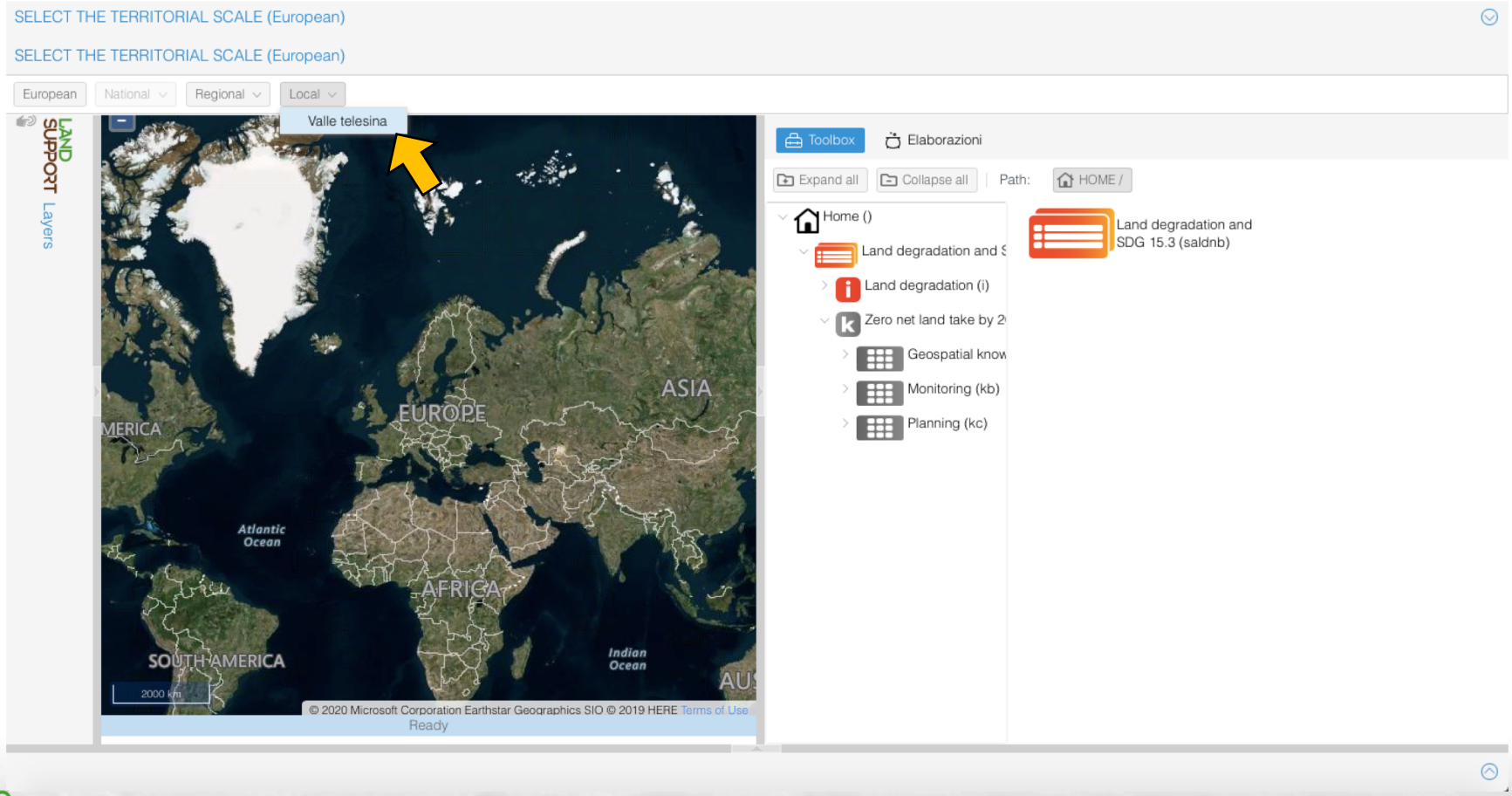
The operative use of the tool (1/8)

Operatively, the end-user can evaluate the filtering capacity of the soils, by:

- Defining the Region Of Interest (ROI);
- Choosing between different land use scenarios.

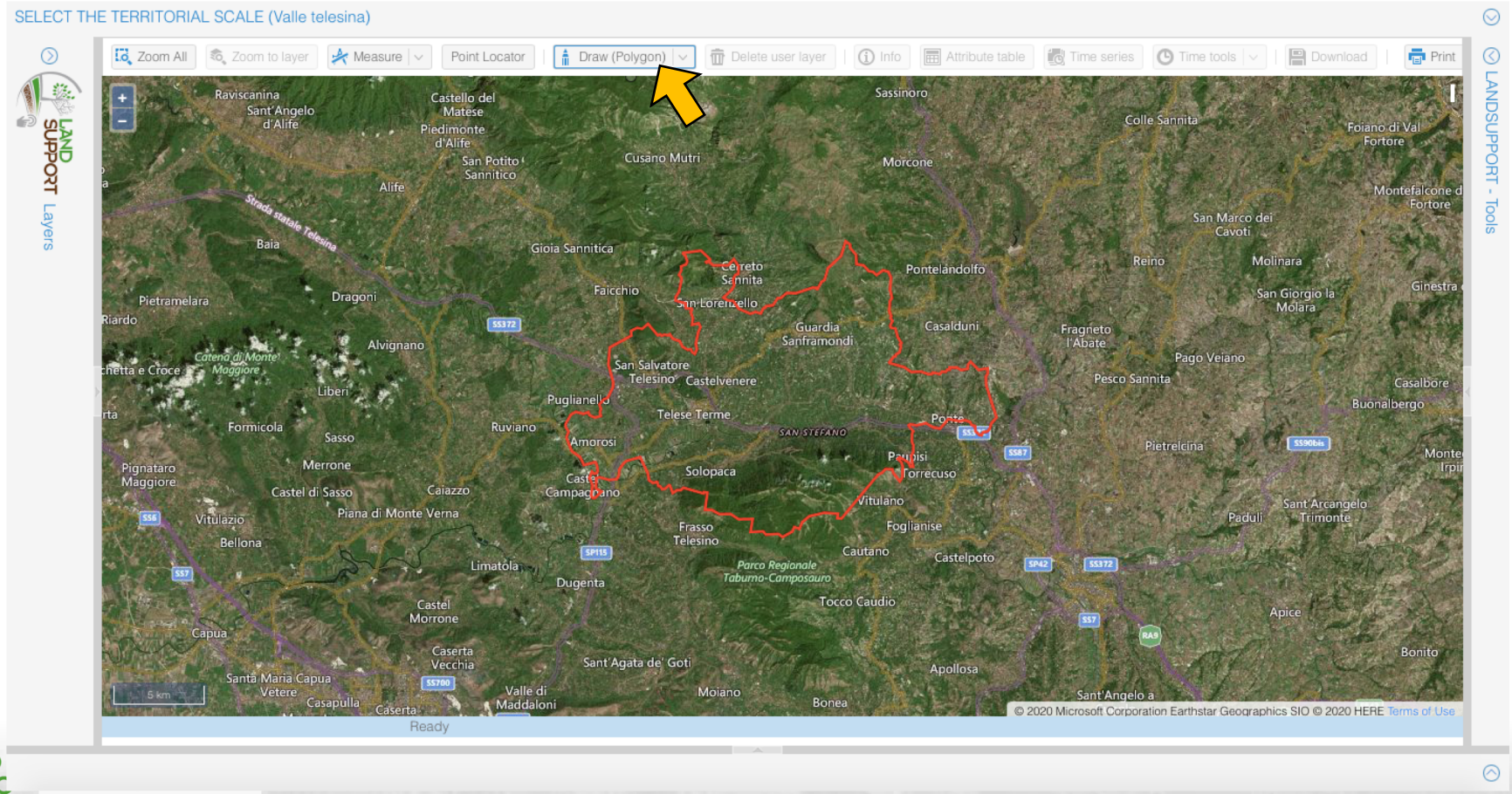
The operative use of the tool (2/8)

Select the territorial scale: *Local* for the Valle Telesina, Italy or *Regional* for the Marchfeld area, Austria.



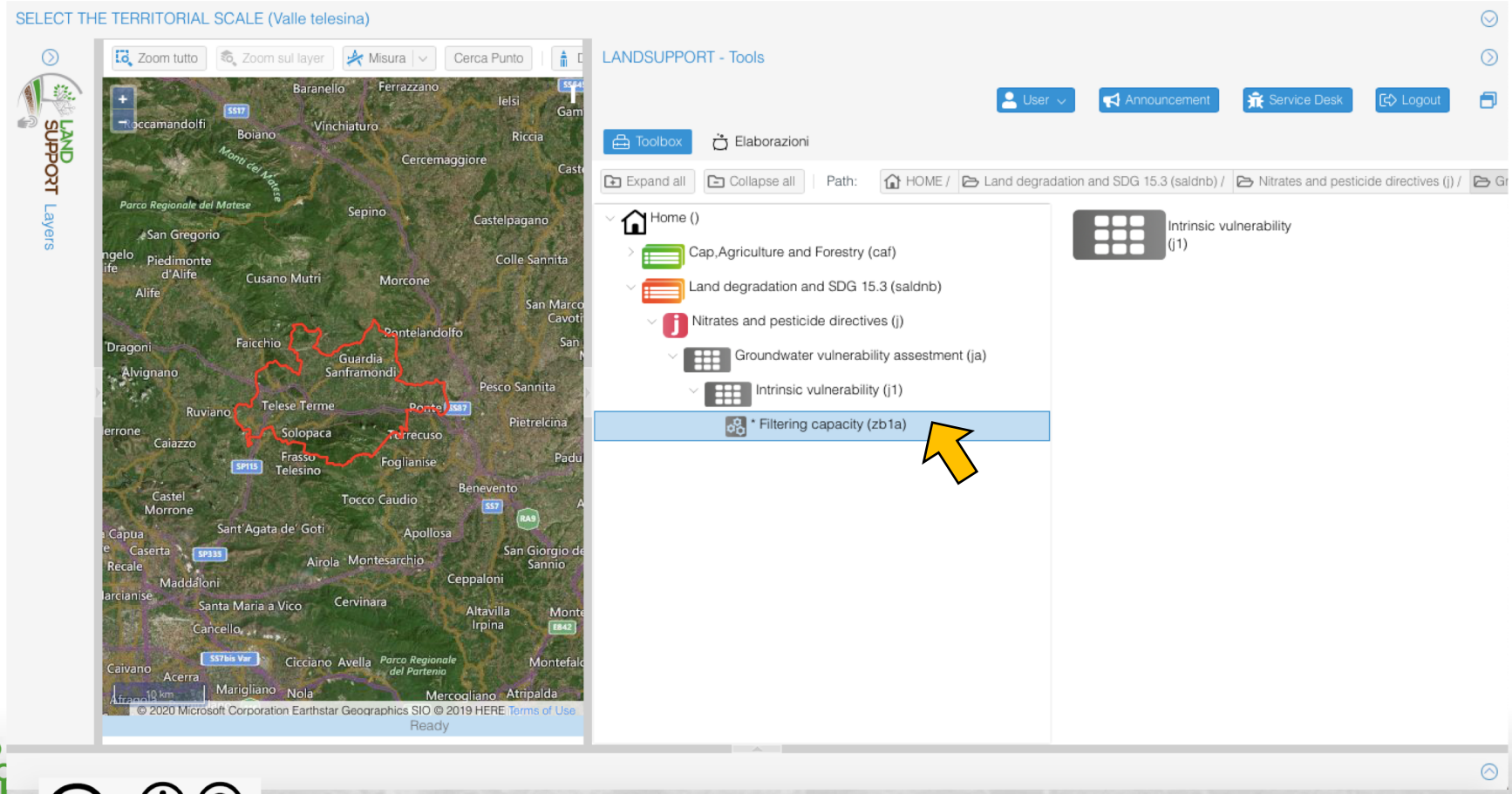
The operative use of the tool (3/8)

Click on the "Draw (Polygon)" button on the top bar and draw the desired area (ROI). It is also possible to assign it a name and a value (e.g., a number). Use the "Save" button to store the ROI in the memory of the system.



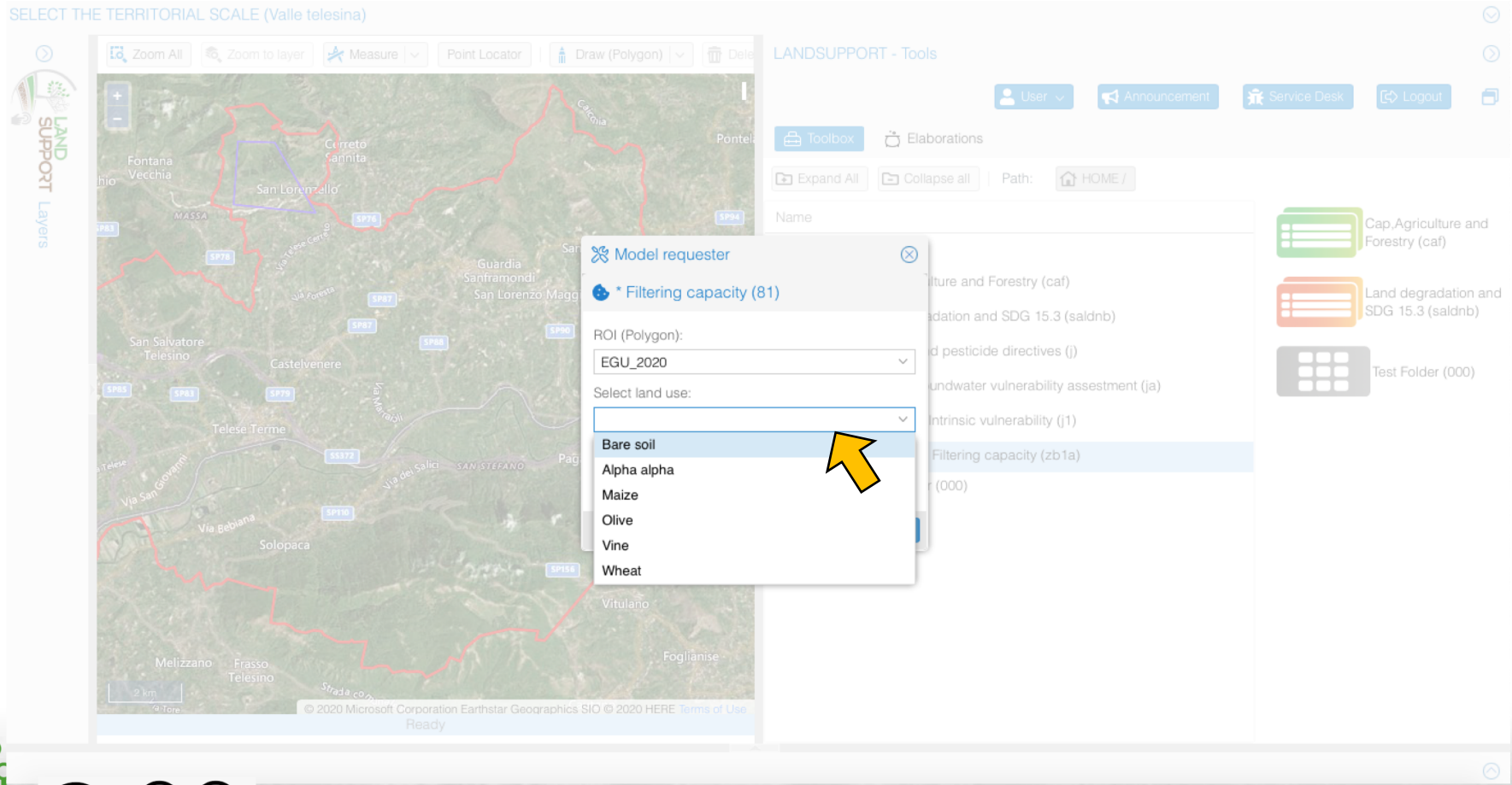
The operative use of the tool (4/8)

Among the Groundwater vulnerability assessment tools, in the Land degradation and Sustainable Development Goals 15.3 (https://sustainabledevelopment.un.org/?menu=1300), select the Filtering capacity tool.



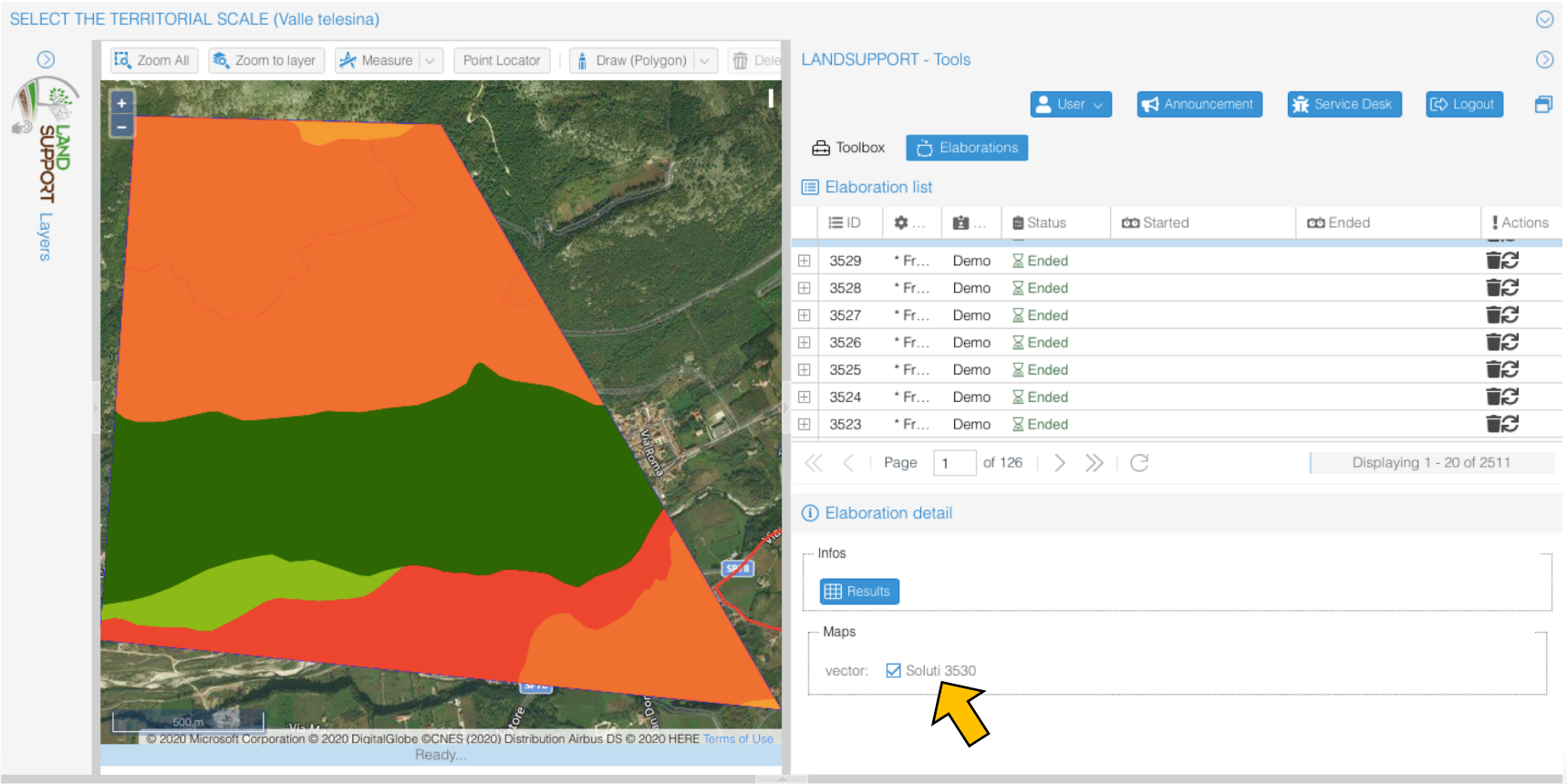
The operative use of the tool (5/8)

In the pop-up window, select the ROI and the land use, between the already available in the menu.



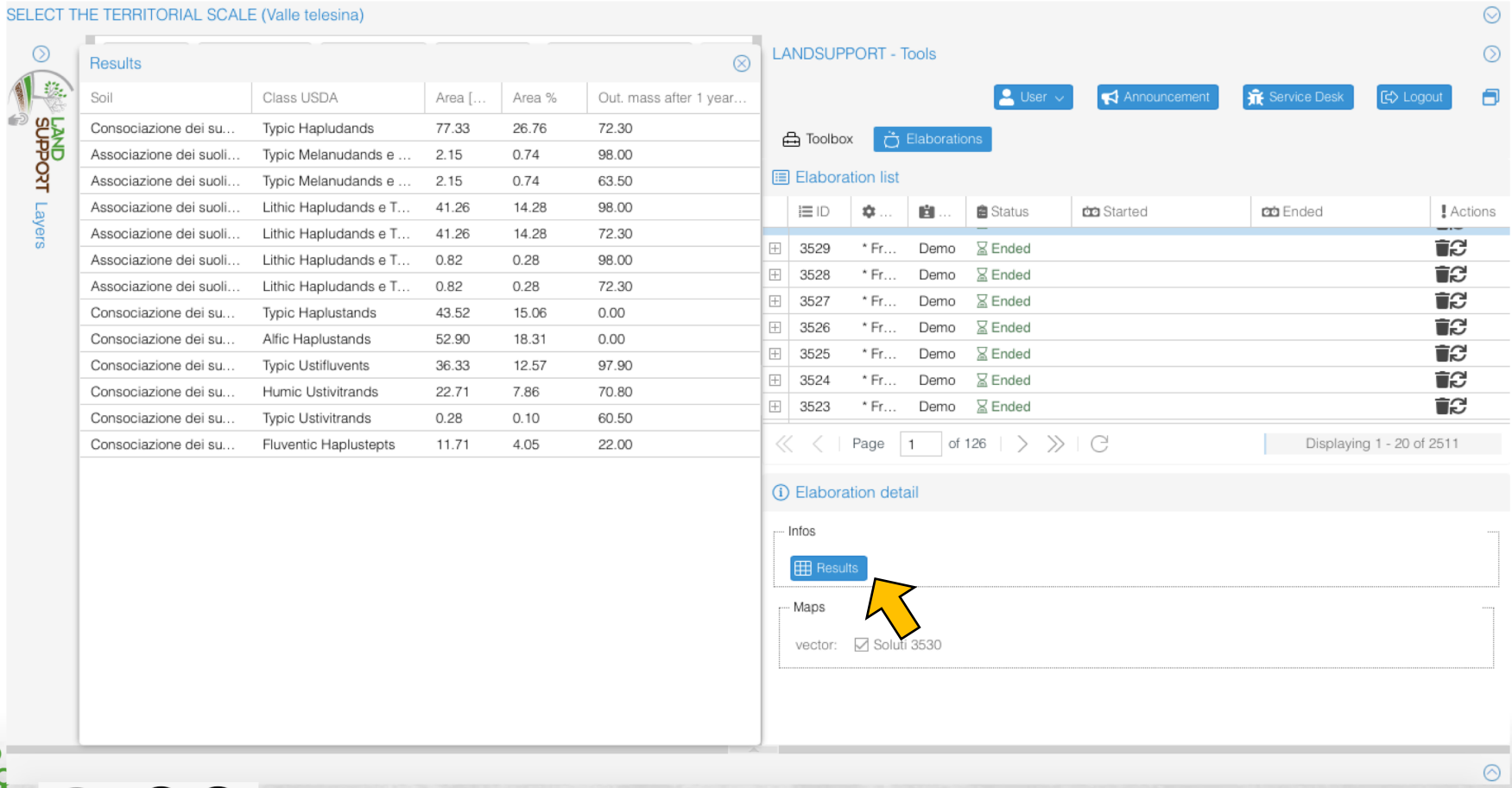
The operative use of the tool (6/8)

In the Elaboration results panel, after selecting the run, the user can visualize both the summary and the map with the results.



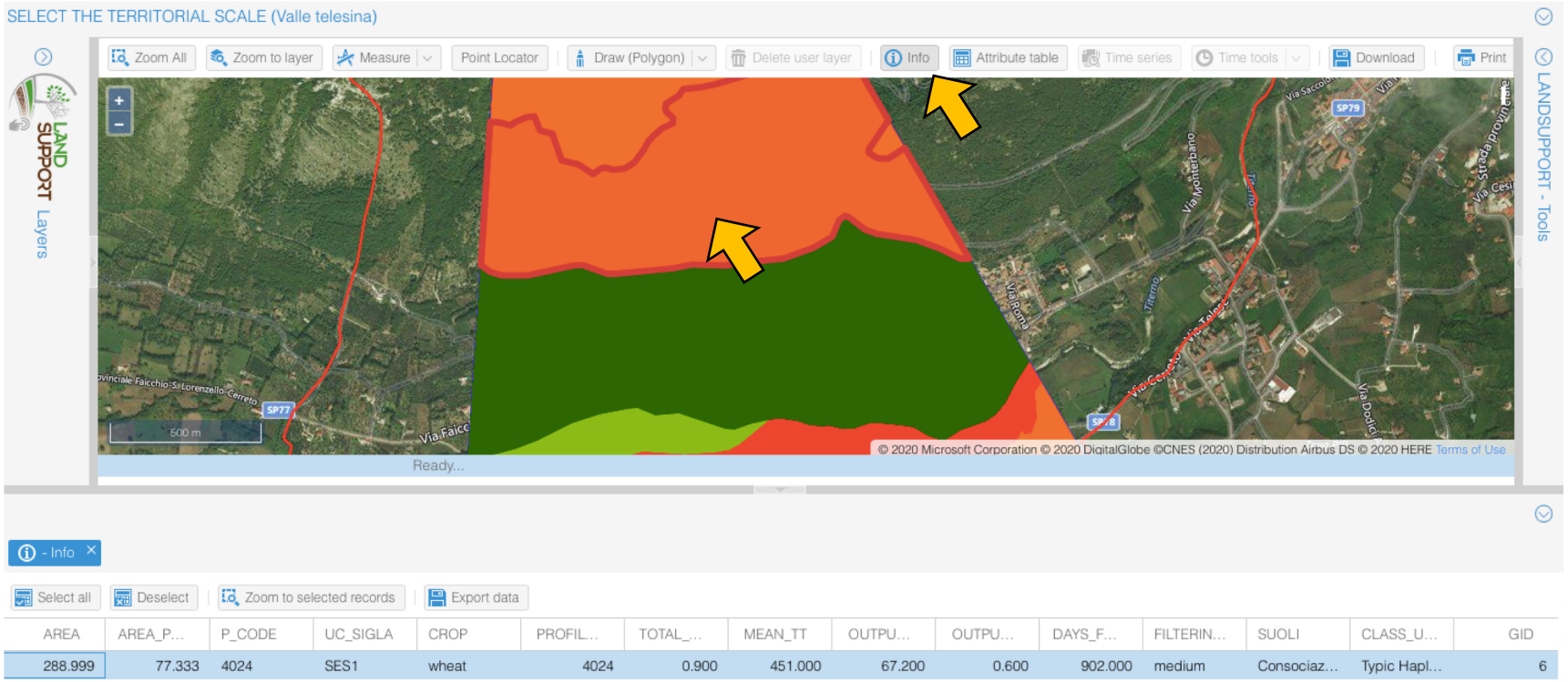
The operative use of the tool (7/8)

The summary results table shows, for each soil polygon within the ROI, the classification, the area and the percent output mass after one year of simulation.



The operative use of the tool (8/8)

To get more information, it is possible to click on a specific point on the map and see the results for that soil polygon.



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Upcoming improvements and features

- Integration of the reactive solutes (pesticides and fertilizers);
- End-User defined concentration scenarios;
- End-User defined period of simulation;
- End-User defined depth of simulation;
- Post processing of the results: amount of solute arrived at the investigated depth after every year of simulation and cumulative output percent over the entire period;
- Integration within the best practice tool in support for the evaluation of the ecosystem services within LandSupport project;
- Integration with other LandSupport tools, e.g., crop growth model.

Principal references

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THANK YOU