Ecological Vineyards Governance Activities for Landscape's Strategies

Deliverable T2.2.1

DATA FOR LANDSCAPE ANALYSIS

Responsible Partner

PAT

14/03/2022

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Dissemination Level	PP[1](Partnership document)

1 PU = Public document; PP = Partnership document

Project Summary

ECOVINEGOALS promotes sustainability and resilience in the winemaking industry by encouraging the transition of intensive viticulture towards agroecological management systems that protect natural habitats and landscapes, while reducing chemical and fossil fuel inputs and harmful emissions. The project aims to enhance stakeholders' skills in participatory local governance, to strengthen transnational cooperation and provide specific transnational instruments to promote, support and manage the agroecological transition.

Expected results

- Sharing between partners in the ADRION countries of fundamental concepts and practices necessary for the transition from intensive viticulture management systems, towards agroecological management methods.
- Improvement of the participatory local governance skills of decision makers and all other viticulture stakeholders, both public and private, to jointly develop and define strategies and plans aiming to protect natural habitats and rural landscapes.
- Transnational communication, cooperation, and exchange between regional authorities and civil society organizations concerning common objectives to protect vulnerable environments, to promote ecosystem services, to prevent or mitigate climate change, and to avoid social conflicts in land use.
- An increase in the number and quality of tools and strategies available to support the planning and management of the agroecological transition of viticulture systems in the region.

Partnership:

PP1- LP	**LAG EASTERN VENICE, VEGAL (IT)**
PP2	Autonomous Province of Trento, PAT (IT)
PP3	Chamber of Agriculture and Forestry of SIovenia, KGZS-Zavod GO (SI)
PP4	Research Centre of the SIovenian Academy of Sciences and Arts, ZRC SAZU (SI)
PP5	Agency for Rural Development of Istria Ltd Pazin, AZRRI (HR)
PP6	Association for the promotion of employment, vocational training and education, INFORMO (HR)
PP7	Business Development Center Kragujevac, BDCKG (RS)
PP8	Foundation Business Start-up Center Bar, BSC BAR (ME)
PP9	Municipality of Bar, BAR (ME)
PP10	Mediterranean Agronomic Institute of Chania, CIHEAM MAICh (EL)

Associated Partners (APs):

General Union CISL Cultivators Venice (IT)
Bio district of production and biological community of central-eastern Venice - BIO VENICE (IT)
IAL - Innovation Learning Work S.r.l. - Social enterprise (IT)
AIAB-Italian Organic Agriculture Association (IT)
Agroecologiki SP (EL)
Municipality of Topola (RS)
Šumadija winemakers association (RS)
Ministry of Agriculture and Rural Development (HR)
Agroecology Europe (BL)

1 Sources

1.1 Digital Elevation Model

Having precise terrain information is crucial for all the subsequant morphological terrain analysesand so we decided to acquire the European Digital Elevation Model [1] (European Union, 2015). This dataset, briefly called ”EUDEM”, is a raster source divided in 1000 km × 1000 km tiles at 25 m resolution and a vertical accuracy, calculated as Root Mean Square Error (RMSE) of ± 7 m (Figure 1). The coordinate reference system is *Lambert Azimuthal* (Oil & Gas Producers, 2021a).

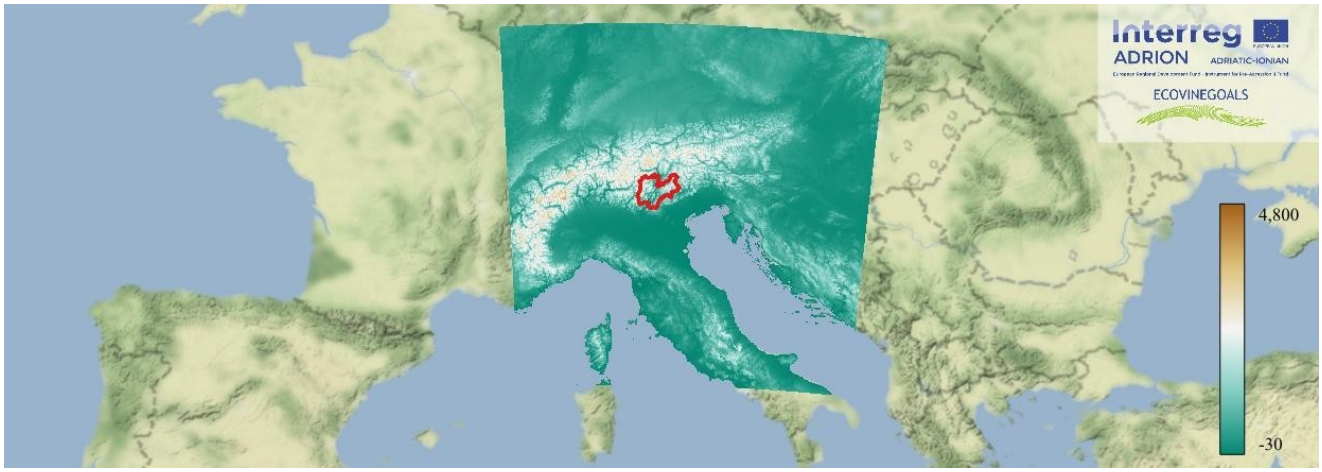

Figure 1. Representation of the EUDEM portion used for the project. For display purposes, only the map has been sampled up to 250 m resolution. Eventually, the map has been projected in geographical coordinates. The red line delimits the administrative boundaries. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

1.2 Administrative Boundaries

The *pilot area* has been defined by the ECOVINEGOALS project as the union of the 7 cadastral municipalities of Grumes, Valda, Faver, Cembra, Lisignago, Segonzano, and Giovo. The Land Registry of the Provence of Trento publishes the geographical delineations[2]. The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.3 Road infrastructure

Updated to 2021, the dataset is available at ”Portale Geocartografico Trentino” and counts 5085 linear elements [3] . The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

[1] http://land.copernicus.eu/pan-european/satellite-derived-products/eu-dem/eu-dem-v1.1/view

[2] Ther is no match between Land Registry and Adminstrative boundaries. However, the corresponsdence is published in www.catasto.provincia.tn.it/Elenco_cc/pagina100.html

[3] https://siat.provincia.tn.it/geonetwork/srv/eng/catalog.search#/metadata/p_TN

1.4 Hydrography

Data encompasses temporary or permanent surface water courses as rivers, streams, canals, and ditches as defined in ”Legge Provinciale 11” (Provincia Autonoma di Trento, 2007). It counts 125 135 linear elements. The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.5 Land Cover

1.5.1 CORINE Land Cover

ECOVINEGOALS defines CORINE Land Cover (Heymann, 1993) as the primary source of information. It classifies the entire pan-european region into 44 distinct classes of landuse using a *Minimum Mapping Unit* (MMU) of 25 ha or, alternatively, 100 m for the linear elements. For the analyses, we used both the 2018 update [4] (Figure 2) that counts 1 618 918 geometries and the version redacted in 1990 for reference (2 375 406 geoemtries). The coordinate reference system is *ETRS89 extended* on ETRS89 (Oil & Gas Producers, 2021a).

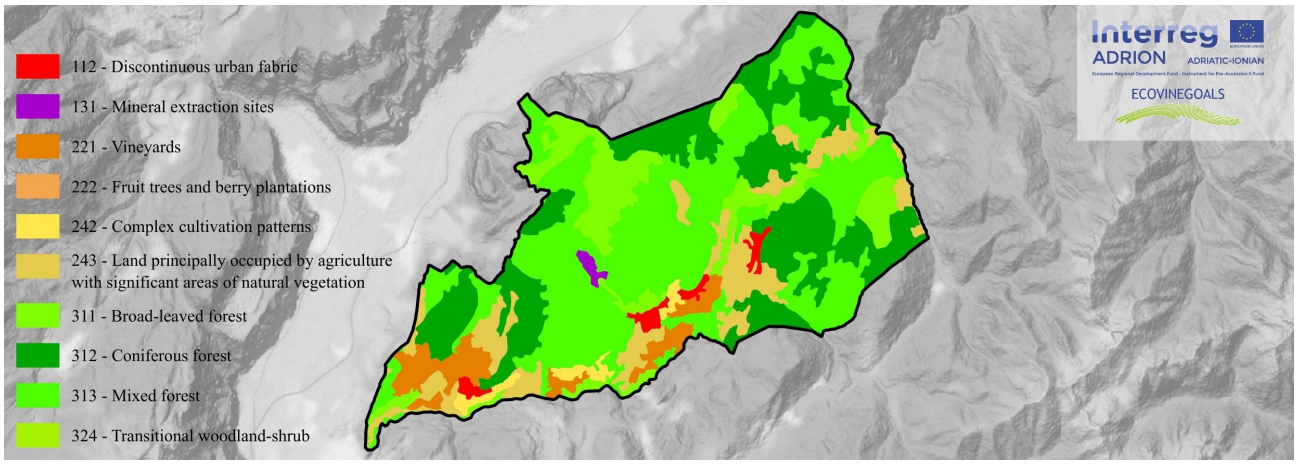

Figure 2. The CORINE Land Cover dataset (ver. 2018) draped on the pilot area. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

1.5.2 Landuse APPAG

Alternatively to the CORINE Land Cover, the ”Agenzia Provinciale per i Pagamenti” (APPAG) provided us two extraction from the ”SuoliValleDiCembra” dastasource for both year 2012 and 2020. These datasources counts 153 626 polygons classified in 59 different classes of land cover (Pugliano and Dallaporta, 2021). The coordinate reference system is *Monte Mario* West with Gauss Boaga projection on Rome 40 (Oil & Gas Producers, 2021c).

[4] https://land.copernicus.eu/pan-european/corine-land-cover

1.5.3 Organic farming

The database of the agricultural parcels cultivated with the organic method is not georeferenced and collects informations about the cadastral parcels within which one or more organic productions insist (Dallaporta, 2021). As for the APPAG dataset, data are grouped by year (88 165 record for 2020 and 2424 for 2012). To georeference the dataset each record must be linked to the corresponding cadastral polygon[5] which coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6 Natural and protected areas

This geographical thematism is split up in the following data sources available on "Portale Geocartografico Trentino"[6].

1.6.1 "Ambito Territoriale Ottimale"

This thematism (14 polygons) represents the area of competence of an integrated public service for waste or wastewater management (Repubblica Italiana, 2006). These areas are identified with a specific Regional Law (in the case of the integrated water service with reference to river basins). The local authorities act on them and structures with legal personality that organize entrust and control the management of the services (Provincia Autonoma di Trento, 2002). The coordinate reference system is *Universal Transverse Mercator* on WGS84 (Oil & Gas Producers, 2021d).

1.6.2 National Parks

The definition includes all terrestrial, river, lake and marine areas that contain one or more intact ecosystems or, even if partially altered by anthropic interventions, contain one or more physical, geological, geomorphological, biological formations of international importance o national for naturalistic, scientific, aesthetic, cultural, educational and recreational values, such as to require the intervention of the State for the purpose of their conservation for present and future generations. "Natural Parks" are protected area, through the promulgation of State or Regional Laws, the purposes of which are the conservation and maintenance of the present biodiversity level, the characteristics of the landscape and the cultural resources present in it. The dataset counts 3 polygons. The reference geodetic system of the data is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6.3 Habitat

In ecology, an Habitat is an area limited in size (for example a pond, a peat bog, a plateau) of an environment where plant and animal organisms of the same or different species live, which together form a biocenosis. Habitat and biocenosis form a functional unit called ecosystem. The

[5] http://www.catasto.provincia.tn.it/attivita_cartografica/Formazione_cartografia_numerica/

[6] http://www.territorio.provincia.tn.it/portal/server.pt/community/cartografia_sistema_aree_protette_del_trentino/753/cartografia_sistema_aree_protette_del_trentino/21153

habitat is therefore the component of the ecosystem characterized by abiotic (non-living) factors, such as soil or substrate, with its physical and chemical characteristics, temperature, humidity, light and so on, but not considered separate from the biological component. The dataset counts 29 multipolygons. The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6.4 ”Riserve Naturali Provinciali”

The dataset counts 46 delineations multipolygons of protected, natural areas. They are made up of terrestrial, river, lake or marine areas that contain one or more naturalistically relevant species of fauna and flora, or have one or more ecosystems important for biological biodiversity or for the conservation of genetic resources. The value of the naturalistic elements present places them among the ”Riserve regionali”. They have been defined with the Provincial Law 11 (Provincia Autonoma di Trento, 2007). The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6.5 Sites of Community Importance

The delineation (or SCI) follows the Community Directive also known as the ”Habitat Directive”, implemented in Italy since 1997 (European Union, 1992). The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6.6 Special Conservation Area

Briefly named, a SPA is a subset of a SCI in which the conservation measures necessary for the maintenance or restoration of natural habitats and populations of the species for which the site has been designated by the European Commission and have been applied. It counts 135 multiplygons. The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6.7 Natura 2000

Is a network of 62 394 sites of community interest (SCI), and special protection areas (SPA) created by the European Union for the protection and conservation of habitats and species, animals and plants, identified as priorities by the Member States of the European Union. The sites belonging to the Natura 2000 Network are considered of great value as natural habitats, by virtue of the exceptional specimens of fauna and flora they host. Protected areas are established within the framework of the so-called ”Habitat Directive” (European Union, 1992), which also includes the areas designated under the so-called ”Birds Directive” (European Union, 2010). The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.6.8 ”Riserve locali”

They consist of territories of limited extension of municipal interest, managed for the purpose of their morphological, biological and ecological conservation. Local reserves are the biotopes of municipal interest already identified pursuant to ”Legge Provinciale” no. 14/86 (Provincia Autonoma di Trento, 1986), while the location followed what is defined by the L.P. May 23, 2007, n.11 (Provincia Autonoma di Trento, 2007). The dataset counts 223 points. The coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b).

1.7 Infrastructures

To support the identification of potential buffer zones between viticulture and settlements to introduce agroecological practices, we acquired a dataset developed in year 2020 (reference year 2019)[7] (Tecilla et al., 2020) that identifies only those parts of the territory transformed by the human activities, but also those in which - at the same time and precisely because of the anthropic intervention - their agricultural use or their naturalness (Dallaporta and Bonsiolli, 2021) is no longer detectable. The dataset counts 65 236 multipolygons. he coordinate reference system is *Universal Transverse Mercator* on ETRS89 (Oil & Gas Producers, 2021b), the license of the data is Open Data Commons [8].

2 Data analysis

2.1 Digital Elevation Model and administrative boundaries

We cropped the European Digital Elevation Model first on the whole extension of the Provence of Trento (Figure 3) and on the pilota area (Figure 4) whose planimetric extension is 9198.83 ha. The slope map, which shows for each pixel the inclination expressed in degrees with respect to the horizontal plane, has been calculated from the resulting DTM (Figure 5) with the method proposed by Horn (1981). The aspects have been computed as the angle between the normal to the local plane and the East (Figure 6). Consequently, the North is positioned at 180° and the South at 270°. Exposure values of zero indicate flat areas with zero slope.

2.1.1 Global solar radiation and insolation

Starting from the digital terrain model, the apsect and the slope maps, we calculated the daily maps of potential incident global radiation [W m^{-2} d^{-1}] and potential insolation [h] from 1st January to 31rd December of the average solar year (365 d). For the calculations of these maps on the pilot area, a computation domain equal to the extension of the entire Province of Trento (Figure 3) was used as the horizon line is made up of points very far from those of the project area. The identification of the horizon allows to include the shadowing effect due to the orography and so to correctly calculate the potential global radiation and the potential insolation. We used

[7] https://siat.provincia.tn.it/geonetwork/srv/eng/catalog.search#/metadata/p_TN:28582ba0-cee1-42c8-9b19-7baca61bd2de

[8] https://opendatacommons.org/licenses/odbl/1-0/

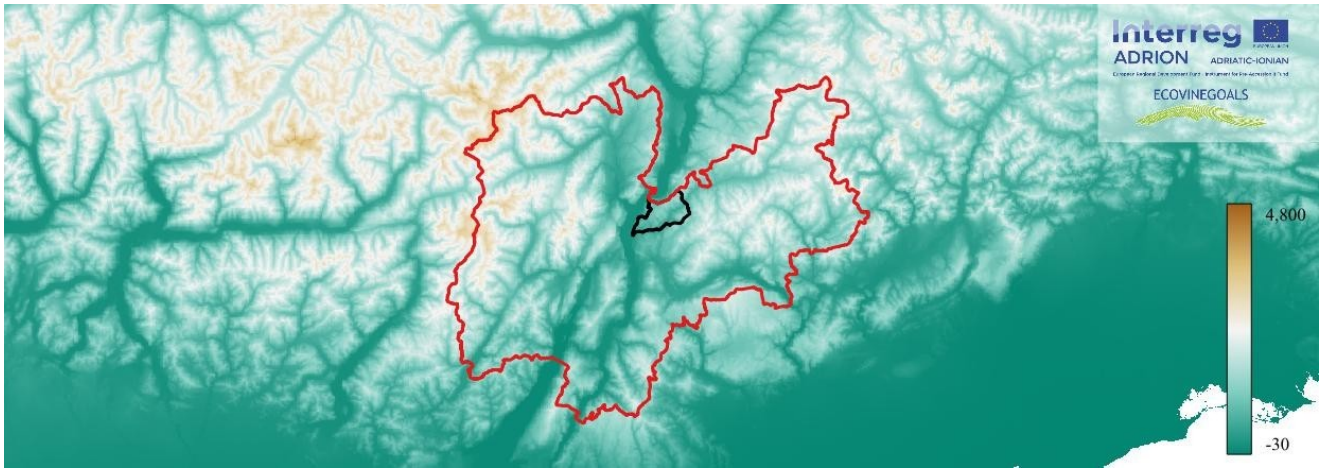

Figure 3. The European Digital Elevation Model with the district of the Provence of Trento (red line) and the pilot area (black line)

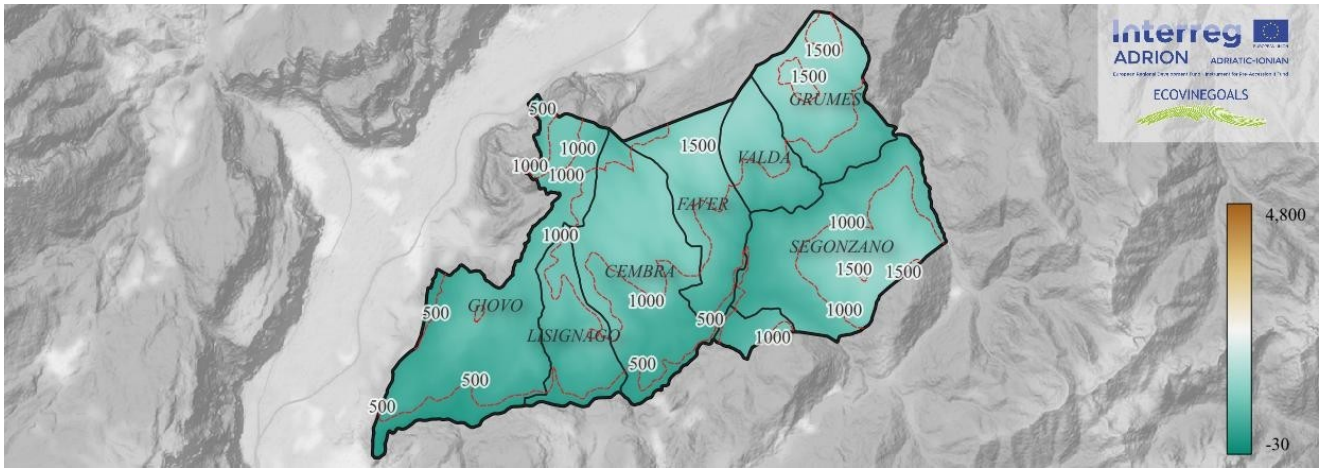

Figure 4. A more detailed view of the Digital Elevation Model in the pilot area (black thick line) and the cadastral administrative boundaries (black thin line). The contour lines are shown with red dashed lines at 500 m intervals. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

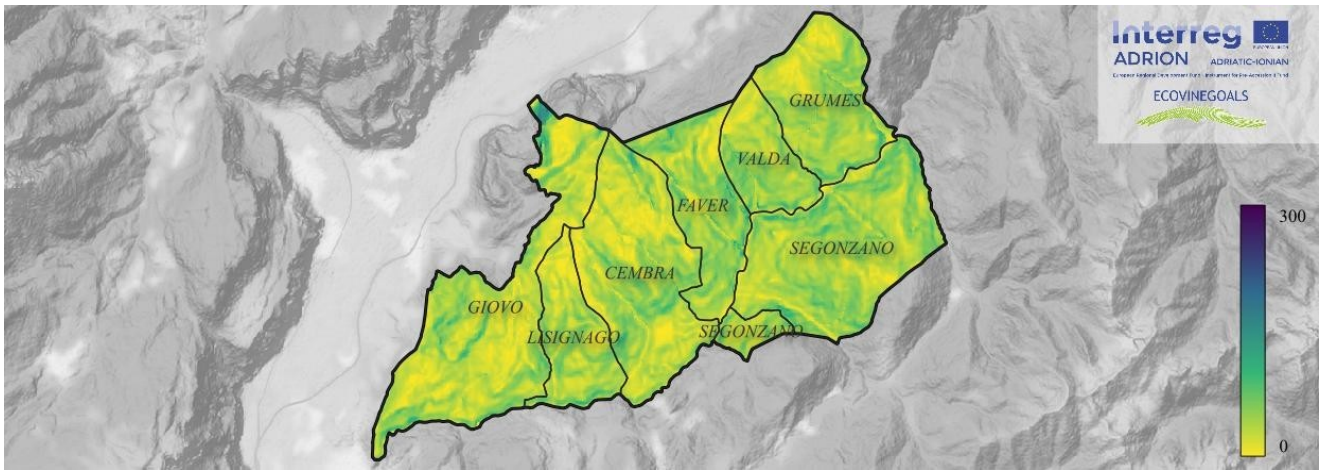

Figure 5. Slope map computed from the Digital Elevation Model [%]. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

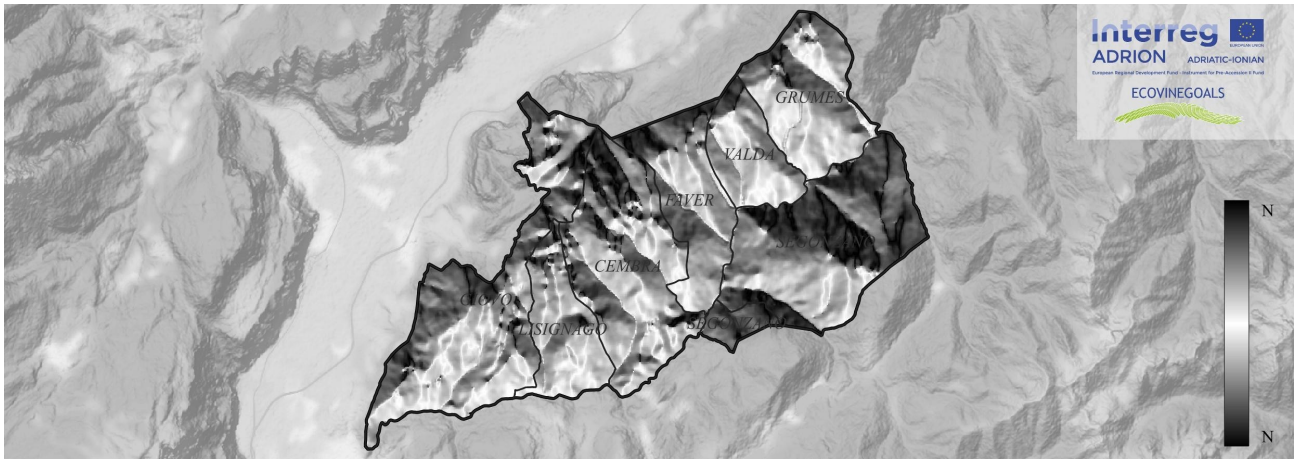

Figure 6. Aspect map computed from the Digital Elevation Model: black pixels face the North and white pixels the South direction. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

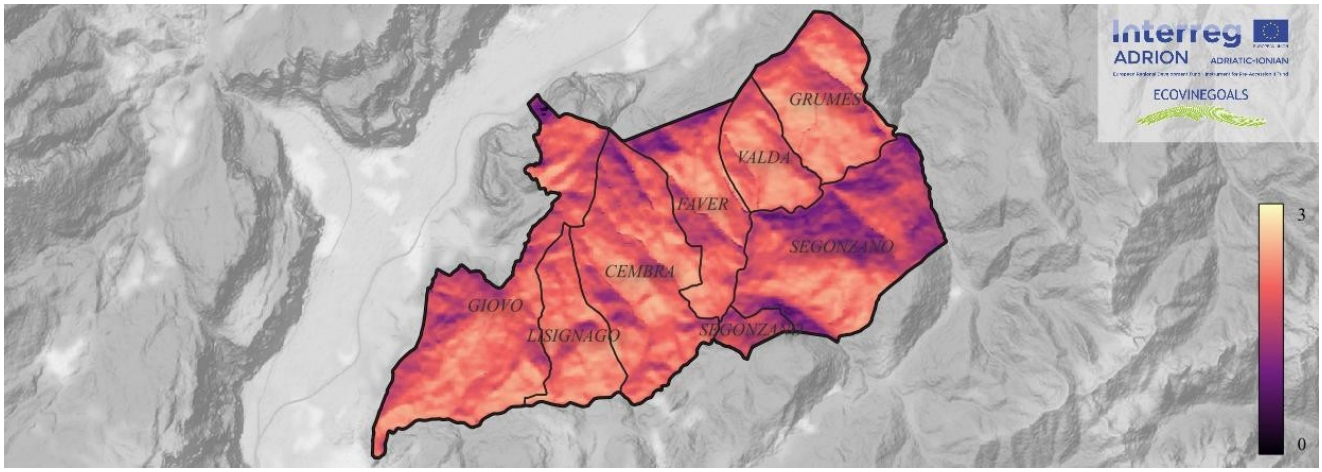

Figure 7. Global radiation map calculated for the average year, on the piolot area [MW m^{-2} yr^{-1}]. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

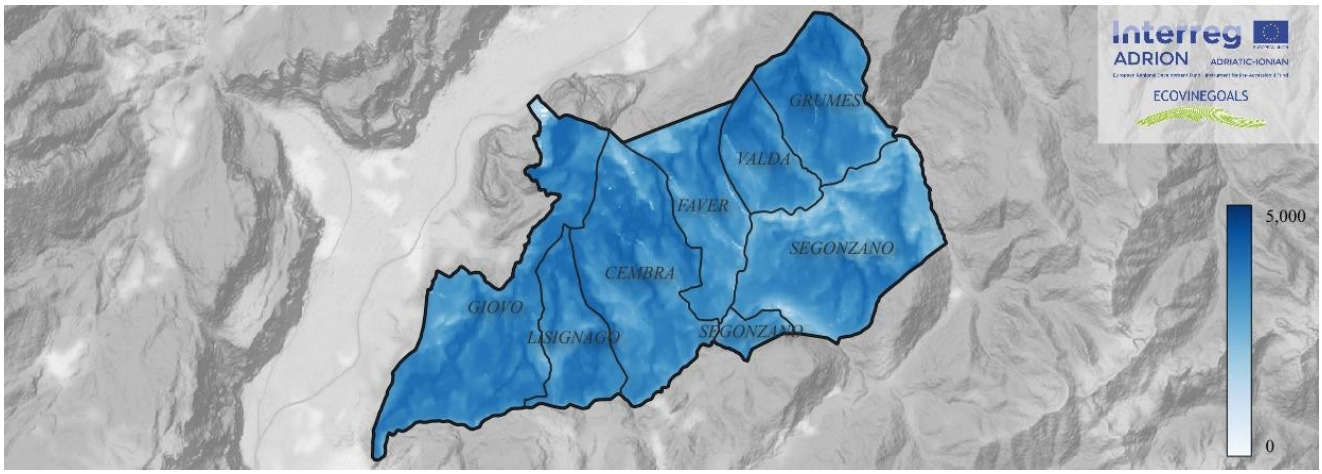

Figure 8. Total insolation time calculated for the average year on the pilot area [h yr^{-1}]. Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

the GRASS Geographic Information System (GRASS Development Team, 2021) to compute the maps, considering the condition of a cloudless sky, setting an average turbidity factor of the atmosphere $T_L = 3$ (Kasten, 1996; Ackerman, 2015). The daily maps have been calculated by integrating the solar energy arriving on a surface perpendicular to the incident ray in the period between sunrise and sunset using a time step of 1 h, which corresponds to approximately 15° on to the ephemerid of the sun (Laiti et al., 2014). Finally, the daily maps have been summed and the resulting map has been cropped on the pilot area of the project (Figure 7 and 8).

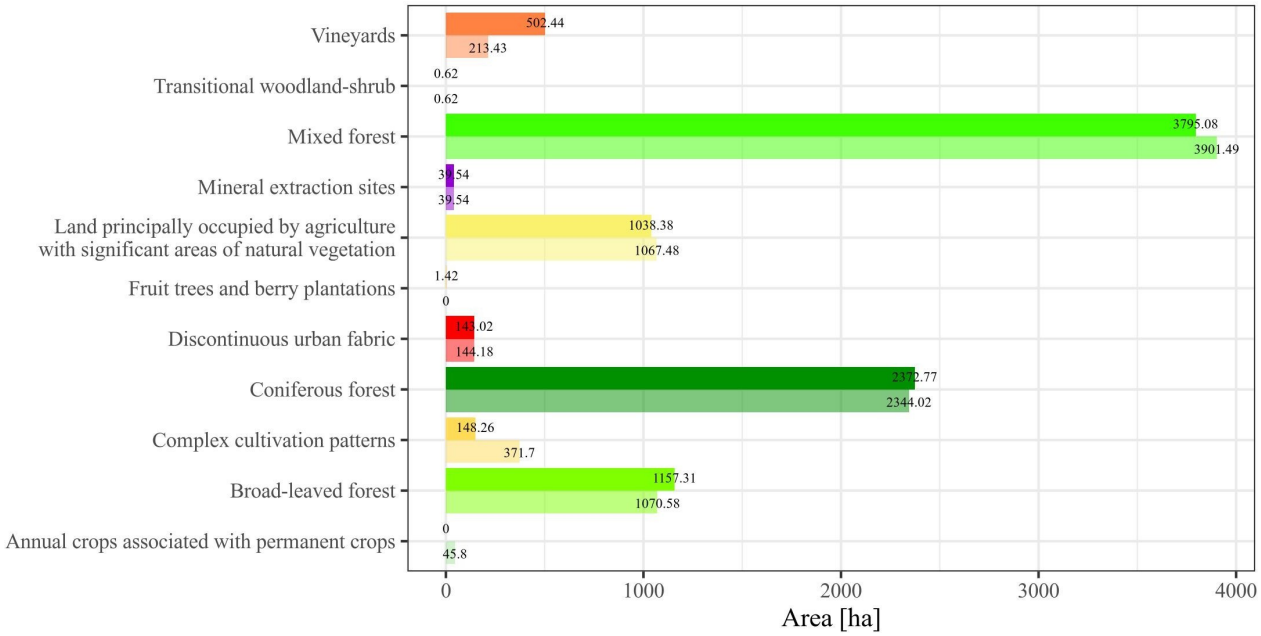

Figure 9. Land cover dynamics on the pilot area between year 2018 (darker color) and 1998 (lighter color) and based on the CORINE Land Cover datasets.

2.2 Land cover

2.2.1 CORINE Land Cover

We cut the map (ver. 2018) on the pilot area obtaining 65 polygons associated with 10 of the 44 classes available in the original dataset. The same theme, redacted in year 1998 consists of 82 polygons for a total of 11 coverage classes. The area of all the obtained polygans has been recalculated. From the aggregation of the surfaces (Figure 9) it appears that the three land cover classes linked to the primary sector (*Vineyards*, *Land principally occupied by agriculture with significant areas of naural vegetation*, and *Complex cultivation*) cover approximately 30 % of the entire surface of the pilot area. This result is not likely and consequently a we used a quick, visual analysis to assess the consistency of CORINE Land Cover soil classification (update 2018) with remotely sensed images (Airbus D&S, Center National d'Etudes Spatiales (CNES)-SPOT 6 and Pleiades imagery). The surfaces classified as "discontinuous urban fabric" roughly cover the inhabited centers of Cembra and Faver, while the urbanized part of Lisignago is classified as "mainly agricultural area, with significant areas of natural vegetation" and is incorporated into a single polygon for the entire town up to the CRM located between Cembra and Lisignago. From a visual analysis of the orthorectified imagery, we verified that inside this poorly defined polygon coexist a dense urban coverage (the nucleus of the historic center of Lisignago with the most recent urban expansion areas), widespread urban coverage (for example the building of the retirement home and the artisan area), agricultural coverage (mainly vineyard and orchards) and mixed forest cover (Figure 11a). On the other hand, the mining site upstream of the town of Cembra is identified in very detail. The "vineyards" and "complex agricultural textures" classes cover both vineyard areas and forest cover, without distinction (Figure 11b). As agreed

(Dallaporta, Corradini, and Bigaran, 2021), we computed the transition matrix (or landscape dynamics matrix) of the two CORINE Land Cover datasets. The results are shown in Figure 10.

1998 \ 2018	Discontinuous Urban fabric	Mineral extraction sites	Vineyards	Annual crops associated with permanent crops	Complex cultivation patterns	Land principally occupied by agriculture, with significant areas of natural vegetation	Broad-leaved forest	Coniferous forest	Mixed forest	Transitional woodland-shrub	Fruit trees and berry plantations	Tot 1998
Discontinuous Urban fabric	**139.87**		4.30		0.00	0.00	0.00	0.00	0.00			144.17
Mineral extraction sites		**39.54**				0.00	0.00		0.00			39.54
Vineyards	0.00		**213.43**		0.00	0.00	0.00	0.00	0.00			213.43
Annual crops associated with Permanent crops	0.00		0.00			45.8	0.00		0.00			45.80
Complex cultivation patterns	1.11		198.91		**148.26**	0.00	0.00	0.00	22.00		1.42	371.70
Land principally occupied by agriculture, with significant areas of natural vegetation	2.03	0.00	64.69		0.00	**915.61**	66.54	0.00	18.62			1067.49
Broad-leaved forest	0.00	0.00	15.36		0.00	4.68	**1042.41**	0.00	8.12	0.00		1070.57
Coniferous forest	0.00		0.00		0.00	1.77	0.00	**2338.22**	4.03			2344.02
Mixed forest	0.00	0.00	5.76		0.00	70.52	48.36	34.55	**3742.3**		0.00	3901.49
Transitional woodland-shrub							0.00			**0.62**		0.62
Fruit trees and berry plantations												0.00
Tot 2018	143.01	39.54	502.45	0.00	148.26	1038.38	1157.31	2372.77	3795.07	0.62	1.42	**9198.83**
2018 (%)	1.55%	0.43%	5.46%	0.00%	1.61%	11.29%	12.58%	25.79%	41.26%	0.01%	0.02%	100.00%
1998 (%)	1.57%	0.43%	2.32%	0.50%	4.04%	11.60%	11.64%	25.48%	42.41%	0.01%	0.00%	100.00%
Variazione (%)	-0.01%	0.00%	3.14%	-0.50%	-2.43%	-0.32%	0.94%	0.31%	-1.16%	0.00%	0.02%	

Figure 10. Landscape Transition Matrix computed by using the CORINE Land Cover on the pilot area.

Inconsistences emerge even in the landscape dynamics of the pilot area: from 1998 to 2018 a slight reduction of the urban fabric (2%) in is reported favour of the primary sector: this could arise from the approximations of the classifications for the two datasets. Therefore, the CORINE Land Cover does not allow us to realistically describe neither the current soil cover of the pilot area nor the dynamics of landscape transformation over time.

2.2.2 APPAG Land Cover

To perform the data analysis we firstly projected the original dataset using a 7 parameters transformation from the *Rome40* geodetic datum to *WGS84* (Grafarend, Krumm, and Okeke, 1996). Subsequently, the data have been corpped on the pilot area. Similarly to what was done with the CORINE Land Cover data, the correctness of the polygon classification has been visually verified by matching the most updated dataset (2020) with the same, recent orthophotos. The accuracy in the delineations and the precision of the classification of the APPAG data are clearly superior to those of the CORINE Land Cover (Figure 12). We computed the total surface and the increase rate (from 2012 to 2020) of the 44 different coverages associated to

(a) (b)

Figure 11. Land cover classification according to CORINE Land Cover (update 2018). On the left is shown a detail of the Lisignago town where 3 different land cover classes (urban areas, vineyards/orchards and forests) are incorporated into just one coverage (Land principllay oppied by agriculture). On the right: a detail of the urban center of Cembra that has been correctly delineated (red area). Instead, the vineyards and orchards are not distinguished from the forest cover. Basemap: ©CNES (2021) Distribution Airbus DS, ©2021 TomTom.

(a) (b)

Figure 12. APPAG land cover classification (update 2020). Both for the inhabited area of Lisignago (on the left) and for the inhabited area of Cembra (on the right) the wine-growing area is delineated with a higher accuracy than CORINE Land Cover. Base map: ©CNES (2021) Distribution Airbus DS, ©2021 TomTom.

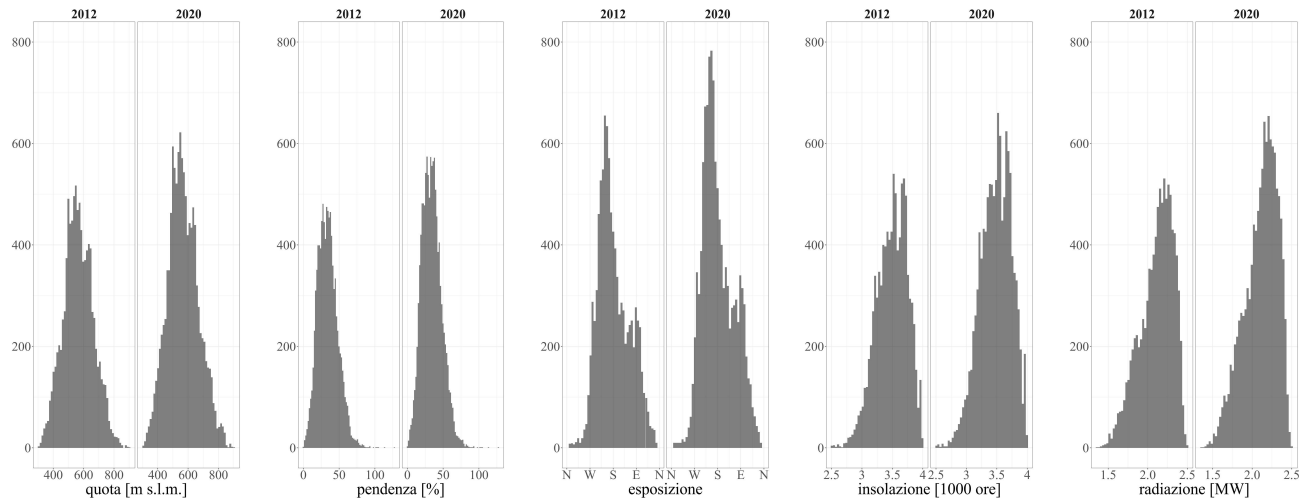

Figure 13. Histogram of the indexes derived from the Digital Elevation Model on the vineyards of the pilot area for year 2012 and 2020.

the 89 620 polygons in the pilot area. Subsequently, the 9795 polygons classified as ”grapevine” and ”grapevine for quality wine grapes” have been analysed aggregating the type of irrigation (irrigated, non-irrigated) , the different forms of cultivation and the type of vine (according to the color of the grape: white, gray, blue and pink berry). The results of the analysis are reported in Table 1. In particular, up to 2020, the 35 % of the vineyards in the pilot area are classified as ”non-irrigated”. This data is unlikely and should be further checked, if relevant for the project.

2.2.3 Morphometric analysis of the vineyards

The 20 408 polygons classified as ”grapevine” and ”grape vine for quality wine” have been super-imposed on the themes derived from the Digital Terrain Model (sections 2.1 and 2.1.1). In Table 2 we reported the descriptive statistics of the indices. Figure 13 shows the corresponding distribution of the values for the two reference years.

2.2.4 Organic farming

We firstly georeferenced the database of the agricultural parcels with organic productions, then we subsetted them for the pilot area identifying 38 different types of organic productions. The organic productive surface may not correspond to the geometric surface of the cadastral parcel as on the same parcel there can be multiple organic productions or only a part of the parcel could be mangaed with the organic method. For the surface aggregations, therefore, reference is made to the SUP field present in the dataset. So, the organic method of farming has grown from 4.63 ha in 2012 to 139 ha in 2020. The polygons defined as SPECIALIZED TREE CULTIVATIONS - WINE GRAPES grew from 0.18 ha in 2012 to 62.77 ha in 2020 (the 5.95 % of the area classified as ”vineyards” as from the APPAG source (paragraph 2.2.2). The result of these analysis is shown in figure 14.

Table 1. Resulting aggregations on the pilot area by using the classifications of the APPAG dataset for both year 2012 and 2020.

Description	Year		Δ
	2012	2020	
	[ha]		[%]
Water bodies	80.12	77.55	−3.21
Building artifact	419.27	379.33	−9.53
Courtyard area and pertinence	0.010	0.005	−48.06
Non-grazing area	34.76	25.23	−27.44
Forests	7493.45	6835.11	−8.79
Non productive pastures	28.83	30.57	6.06
Mixed pastures-meadows	0.67	0.58	−13.10
Pastures (productive up to 80%)	0.27	0.01	−95.02
Permanent pastures	95.46	158.92	66.49
Permanent pastures (productive up to 80%)	66.91	55.46	−17.10
Permanent pastures (productive up to 50%)	49.51	58.99	19.16
Chestnut	0.68	2.67	293.60
Cherry tree	0.06	0.01	−91.57
Specialized orchards	237.77	174.89	−26.45
Apple orchards (not specified)	0.83	0.67	−18.49
Fixed greenhouses	0.88	3.33	277.93
Arable	192.98	145.75	−24.48
Vineyards	807.05	1054.78	30.70
Irrigation system:			
not irrigated	291.07	370.19	27.18
irrigated	453.67	660.59	45.61
Training system:			
guyot or linear trellis	147.14	252.64	71.69
pergola vine training	481.63	454.98	−5.53
pergola trentina (double)	79.95	113.49	41.96
pergola trentina	15.88	209.28	1218.04
Grape type:			
white berry	570.56	771.43	35.20
grey berry	16.22	21.98	35.45
blue berry	135.37	192.64	42.31
pink berry	22.60	44.74	97.97

Table 2. Decriptive statistics of the mophological indexes derived from the Digital Terrain Model fon the vineyards of the pilot area for year 2012 and 2020.

	elevation [m]		slope [%]		aspect [°]	
	2012	2020	2012	2021	2012	2020
Min.	306.0	301.6	0.5	0.5	-179.6	-178.6
1st Qu.	500.1	498.8	23.8	23.9	- 42.4	- 42.8
Median	561.2	560.2	33.1	33.2	- 10.7	- 11.6
Mean	565.1	567.2	34.0	34.0	2.2	2.0
3rd Qu.	632.2	634.4	42.7	42.7	45.8	45.2
Max.	898.5	898.5	126.7	126.7	179.6	178.7

	insolation [h yr^{-1}]		global radiation [MW m^{-2} yr^{-1}]	
	2012	2020	2012	2021
Min.	2499	2499	1.357	1.357
1st Qu.	3315	3304	1.979	1.978
Median	3513	3502	2.147	2.145
Mean	3489	3481	2.111	2.110
3rd Qu.	3684	3676	2.273	2.270
Max.	3985	3989	2.503	2.491

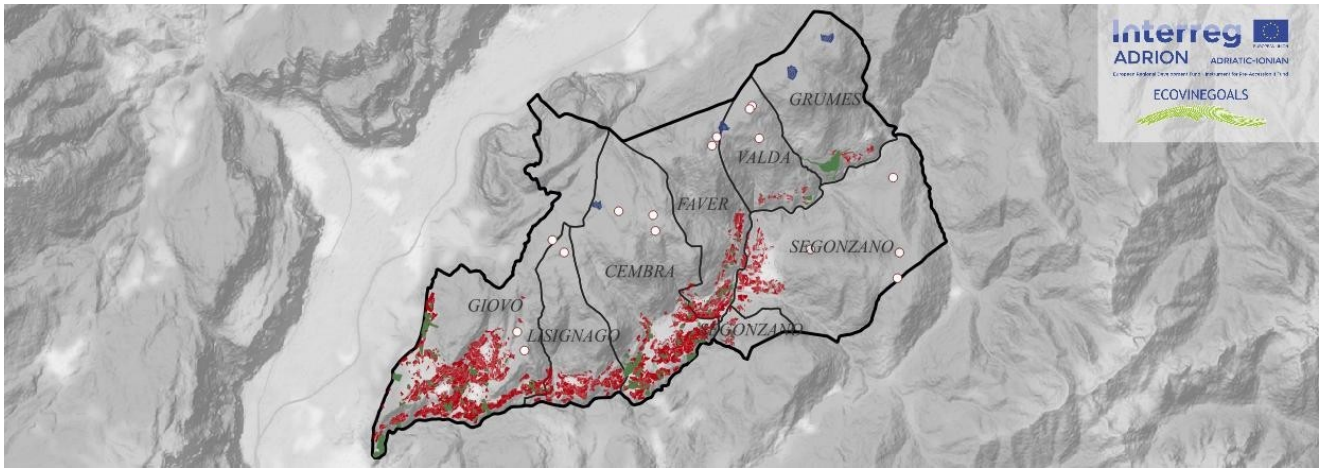

Figure 14. Distribution of the organic viticulture (in green) and the protected sites in the pilot area. In the same cadastral parcel. more than one production could be managed organically, or organic viticulture could be managed only in a portion of the cadastral parcel. The darkred polygons represent all vineyards in the pilota area updated to 2020 (APPAG datasource). The blue polygons show the Nature 2000 sites (see 1.6.7). Basemp: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

2.3 Protected Area

Apart from the ”Ambito Territoriale Ottimale” (ATO) which covers the entire surface of the pilot area and the absence of park areas and sites of community importance (SCI), the protected areas correspond to points or polygons of limited surface and often overlapping localization. In the pilot area there are 2 non-established biotopes (*Paluda La Lot* and *Laghetto di Vedes* for a total area of 14.87 ha), and 2 provincial nature reserves (*Labrun* and *Prati di Monte* for a total area of 10.48 ha). These 4 sites correspond to the ”Special Conservation Area”. There are 112 Natura 2000 sites covering a total area of 25.56 ha) and 16 local reserves. In summary, no protected area falls within the vine-growing area (Figure 14)

2.4 Protection Buffer Area

As agreeded (Dallaporta and Bigaran, 2021), we computed how much viticultural surface could be considered as ”buffer zones” on the ecotone between the vineyards and the settled area (comprehensive of the roads and the waterways), for promoting on them the agro-ecological practices. The map of the road infrastructure – classified as MAIN, 68 linear elements – has been cropped on the pilot area so excluding the local road network and tunnels. Similarly, only the 2365 sections of hydrographic network in the pilot area have been included. The map of the urban infrastructure has been cropped on the pilot area and we considered only the elements classified as settled contexts. We obtained 1283 geometries for a total area – calculated as a planar projection – of 191.35 ha: the 18.14 % of the surface of the pilot area (Figure 15). Establishing a buffer zone of 20 m, the protection buffer sums to 228.30 ha, or 21.65 % of the entire vineyards (APPAG source updated to 2020). With a buffer zone of 30 m the buffer area would grows up to 374.46 ha, the 35.52 % of the entire vine-growing surface.

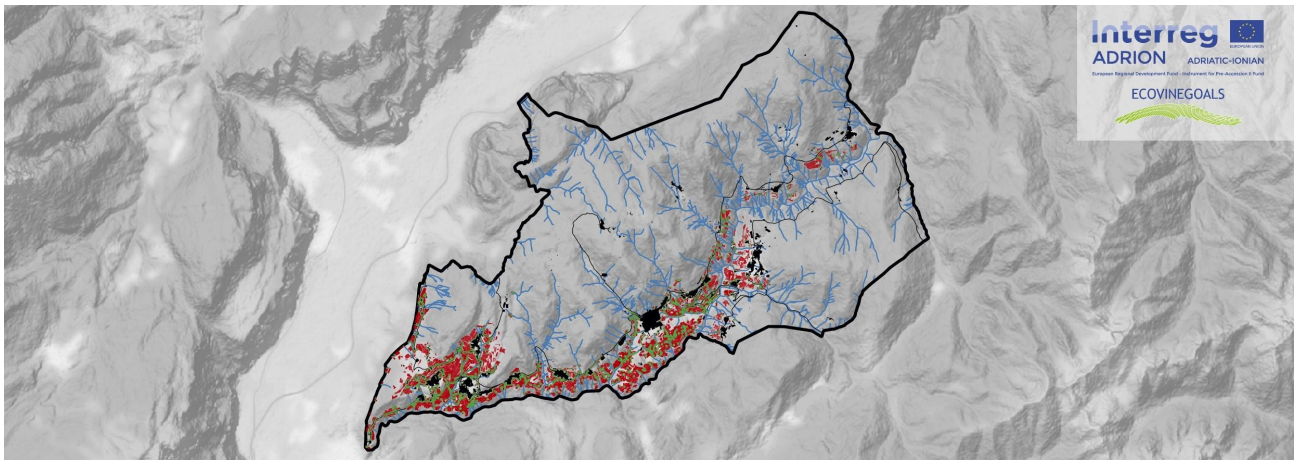

Figure 15. The map shows the candidates for the ”Protection Buffer Zone” (green polygons calculated with a buffer distance of 30 m). The black polygons represent both the urban texture and the road infrastructure. Blue lines represt the streams network. Eventually, the vineyards are drawn in red (APPG datasource, updated tp 2020). Basemap: Map tiles by CC BY 3.0 — Map data ©OpenStreetMap contributors.

3 Conclusions

We presented here the analysis and elaborations made in the framework activities planned within the ECOVINEGOALS project (Interreg VB Adrion 2014-2020 program), on the basis of the agreement stipulated on 17 May 2021 (protocol FEM 0003560) between the Autonomous Province of Trento (PAT) and the Edmund Mach Foundation of San Michele all'Adige (FEM) and the subsequent communications. The results refer to the first part of the project activities, carried out until November 15, 2021. As agreeded we focused on the ”objective analysis of the landscape of the pilot area with reference to land cover”. In particular, the analyses show that the CORINE Lad Cover tool, the database provided by the project to evaluate the soil cover in the pilot area, does not allow to correctly describe neither the characteristics of the pilot area, nor the evolution of the land cover over time (from 1998 to 2020). As for subsequent agreements we added the computation of the ”protection buffer zones”. Further analyses, to be agreed with the client, will be the object of the future work.

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