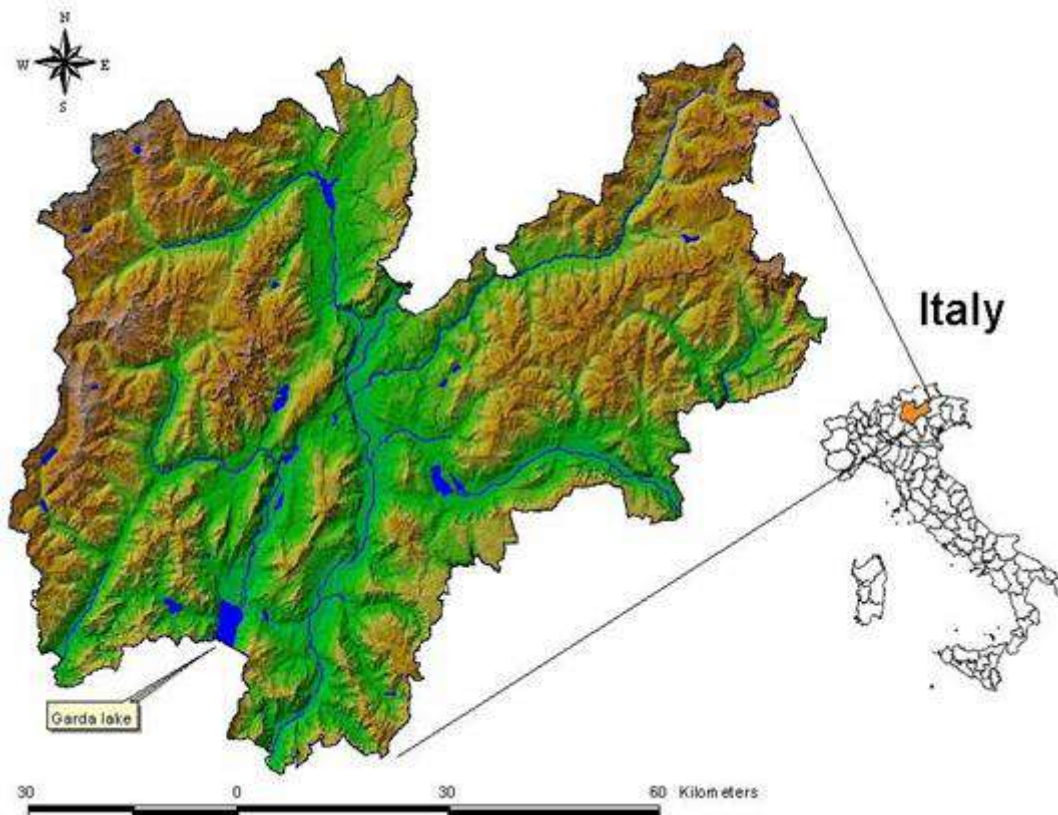


# MULTI-TEMPORAL LAND COVER MAPPING AND COMPARISON OF RIPARIAN VEGETATION BELTS OF PROTECTED SITE: THE CASE OF TRENINO, ITALY

**Stefano GOBBI, Paolo ZATTONI, Clara TATTONI, Giulia M. CANTIANI, ,  
Marco CIOLLI, Nicola LA PORTA**

# The forests and protected areas in Trentino



**Total area = 621'000 ha**

**Forest areas = 410'000 ha**

**Land over 1000 m = ~70 %**

**Land below 500 m = ~10 %**

**Privat/Public forest = 24/76 %**

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**Protected areas = ~35%**

**Parks = 17 %**

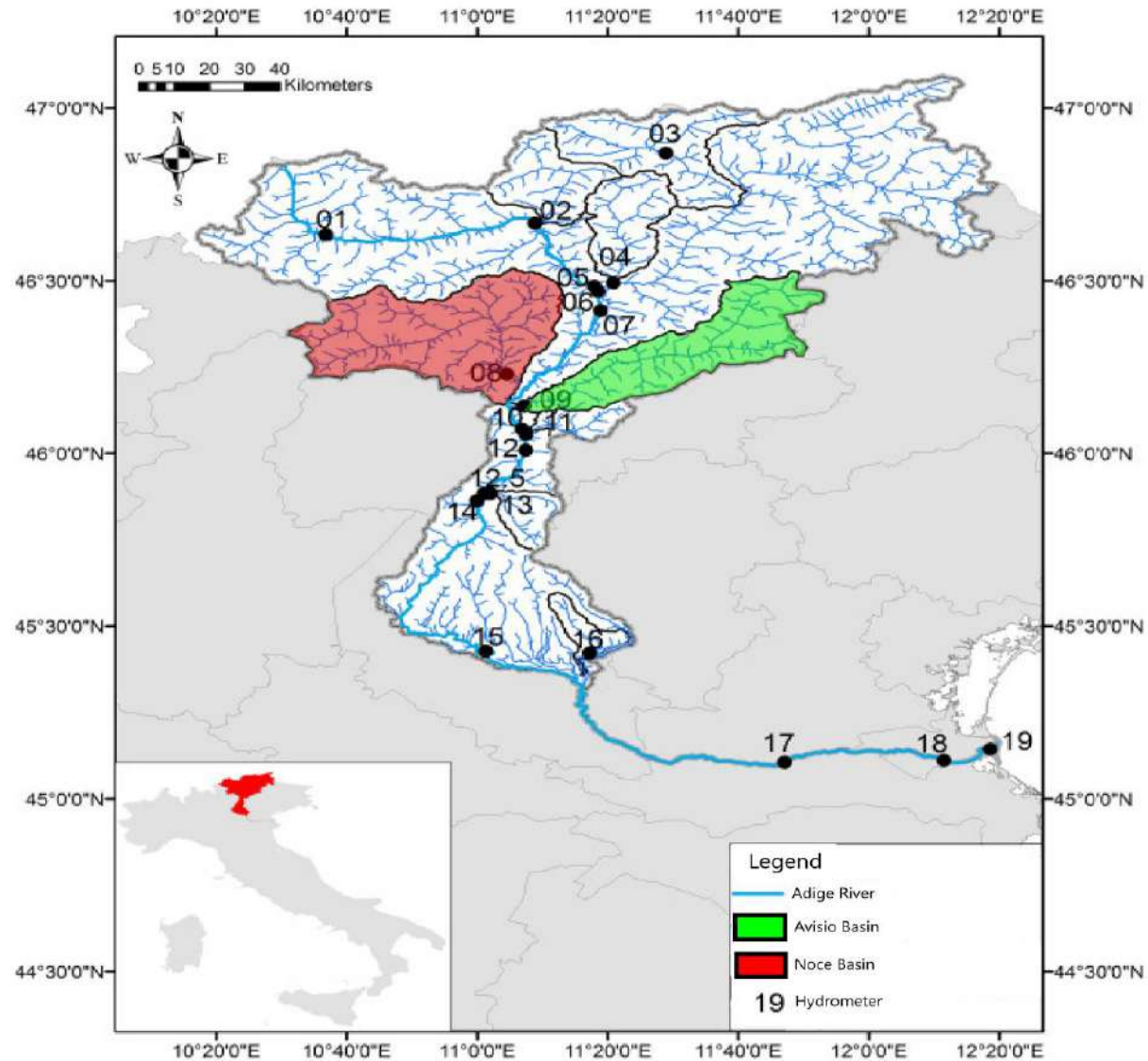
**Natura 2000 = 18%**

# The basins of the three rivers interested by the study

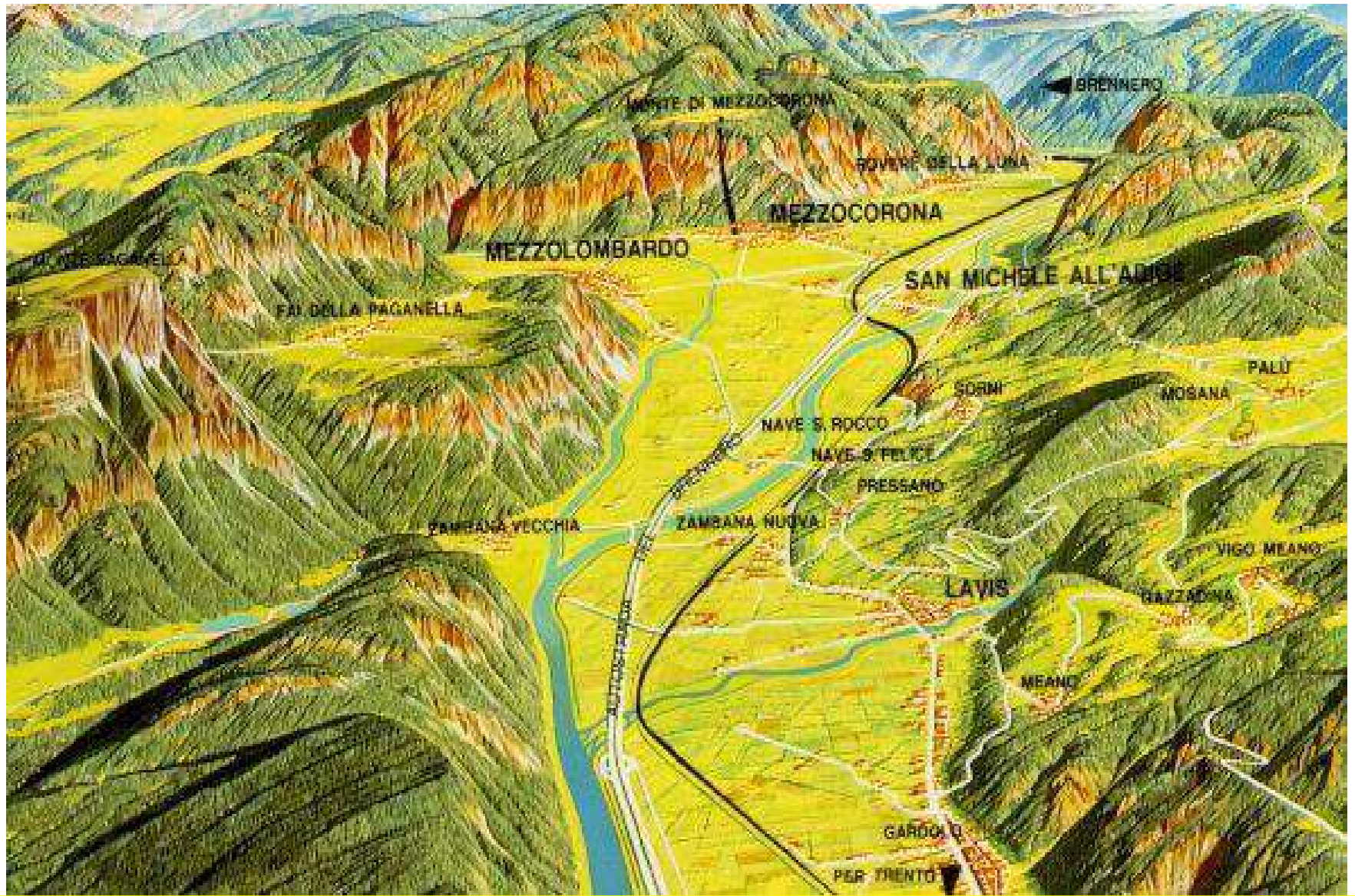
Adige

Noce

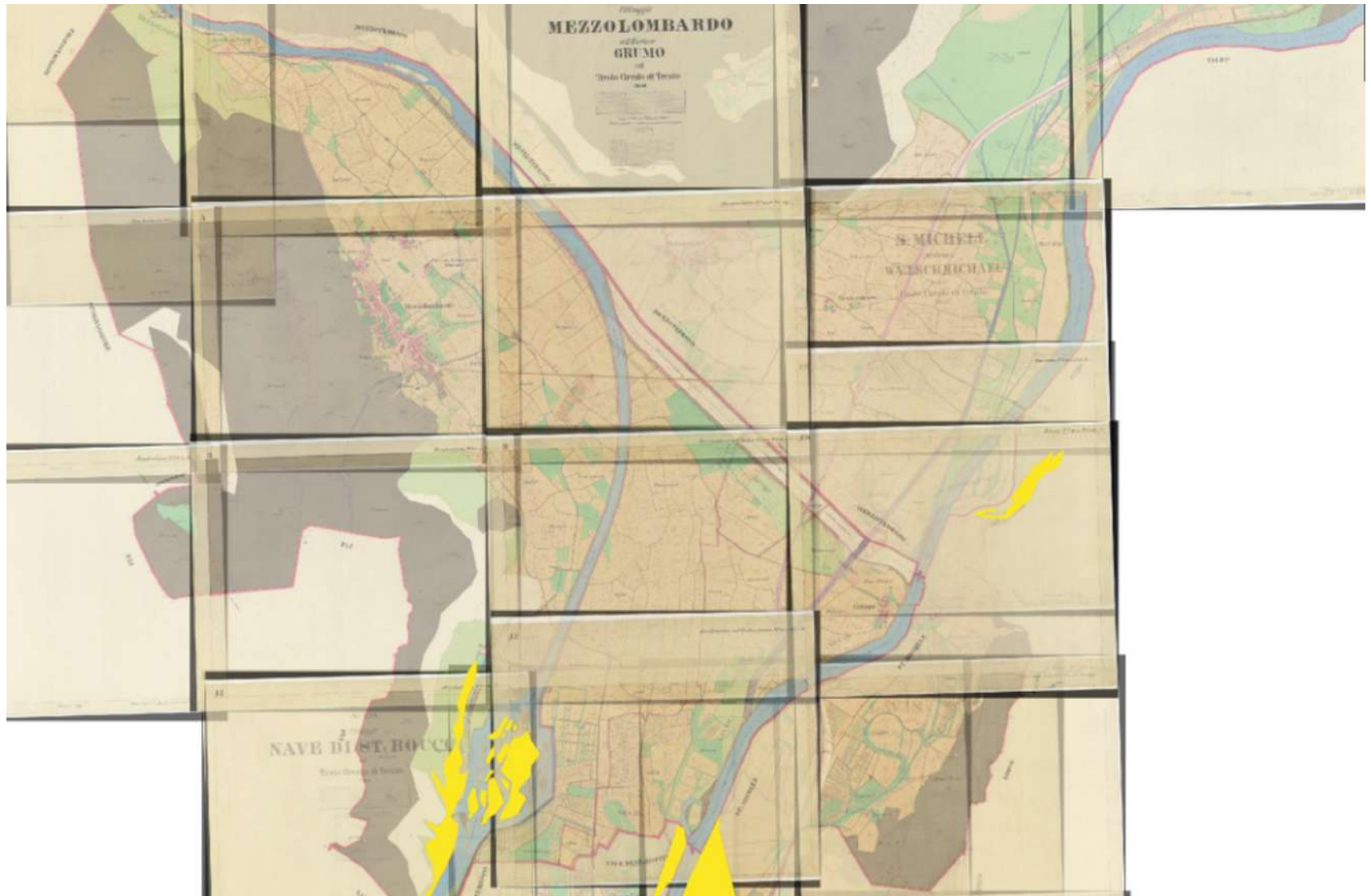
Avisio



# Piana Rotaliana with the three rivers



# Rectification of the river Noce - 1850-1853



# Traits of the three rivers and Natura2000

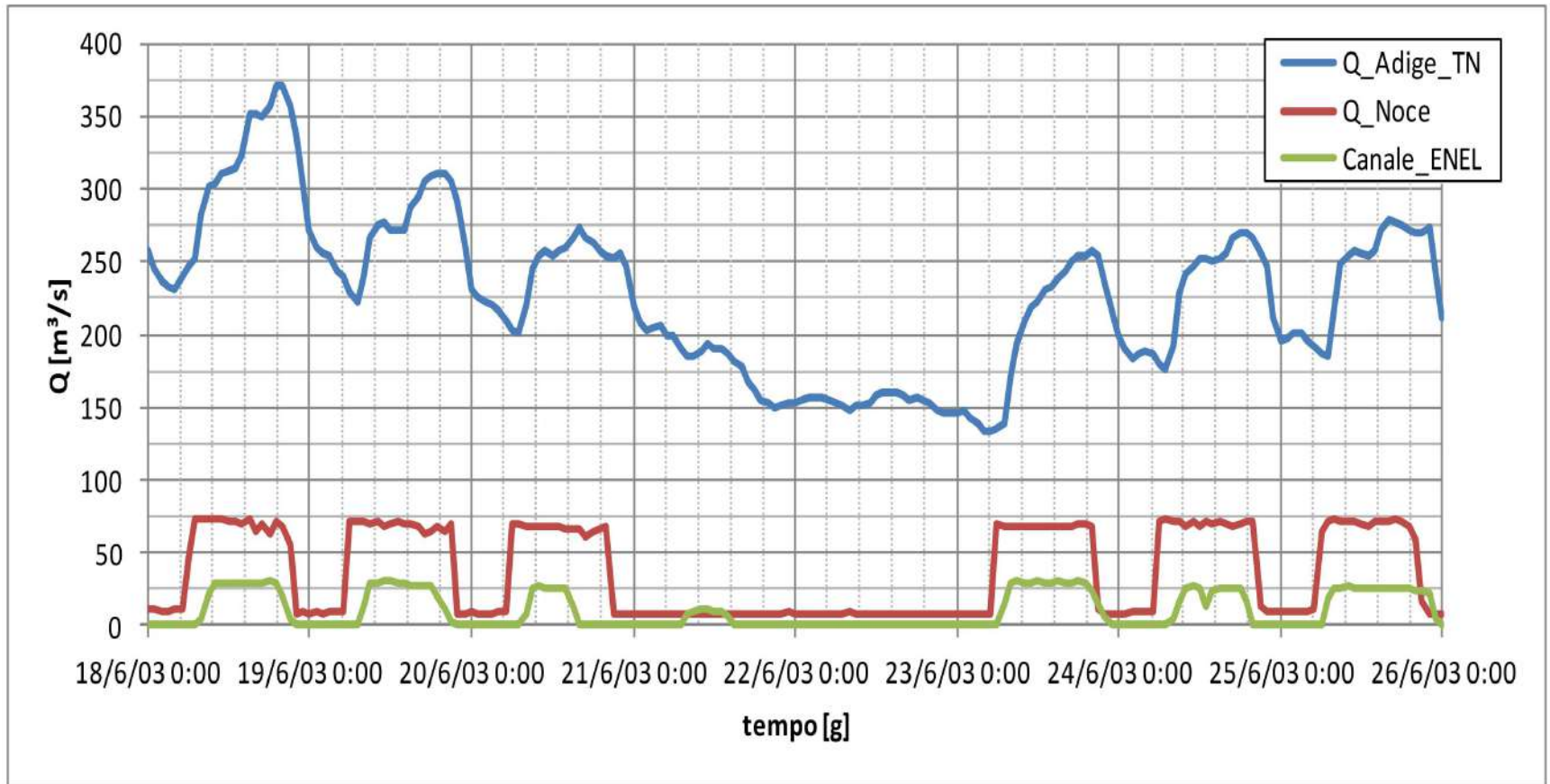
River	Mean discharge [ $m^3/s$ ]	Length [km]	Basin area [ $km^2$ ]	Avg. slope [%]	Avg. elev[m.a.m.s.l.]
Adige	235	410	12 100	49	1 500
Avisio	24	88	910	52	1 663
Noce	34	105	1 367	50	1 624

**Table 1.** Average features for Adige, Avisio and Noce, the three rivers in the present case study.

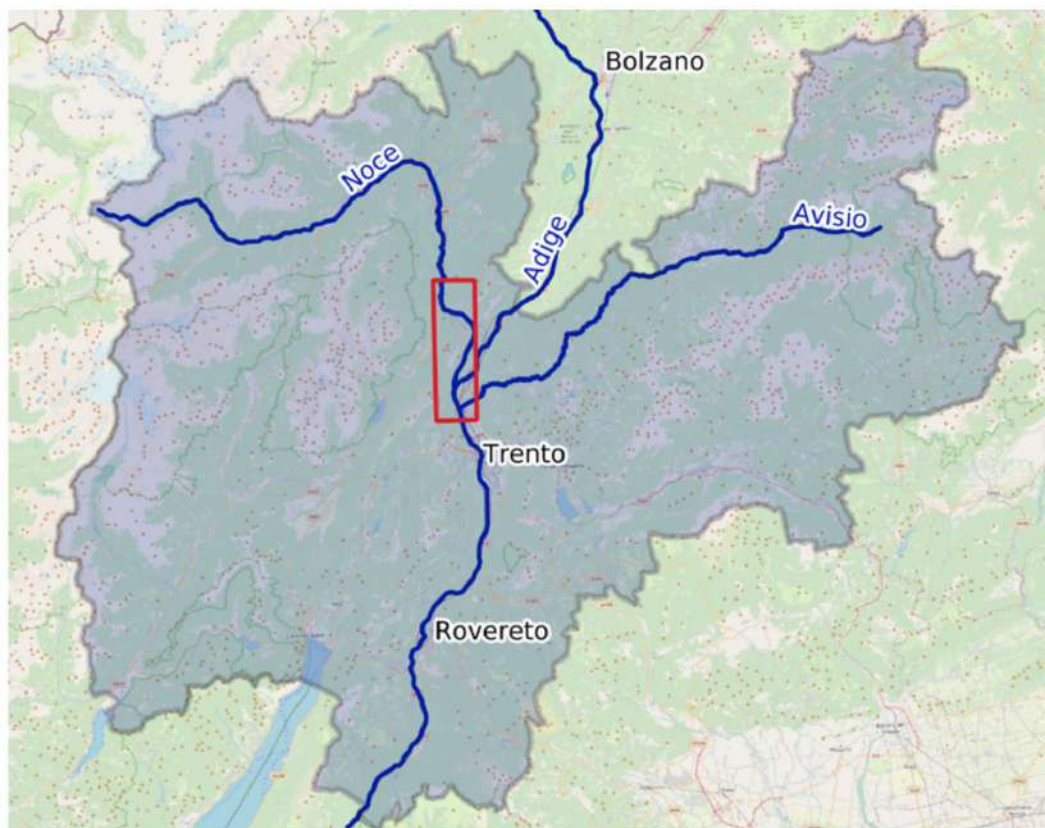
Natura 2000 site	La Rocchetta	La Rupe	Foci dell'Avisio
Extent [ha]	88	45	144
Perimeter [km]	8	4	10
Centroid N [m]	661799	661799	661065
Centroid E [m]	5123746	5116832	5110712
Protected River	Noce	Noce	Avisio, Adige, Noce

**Table 2.** Extent and coordinates (WGS84, UTM32N) of the centroids of the three Natura2000 sites of the current case study.

# River flow of Adige and Noce along the week



# Position of the rivers in the study area



## Legend

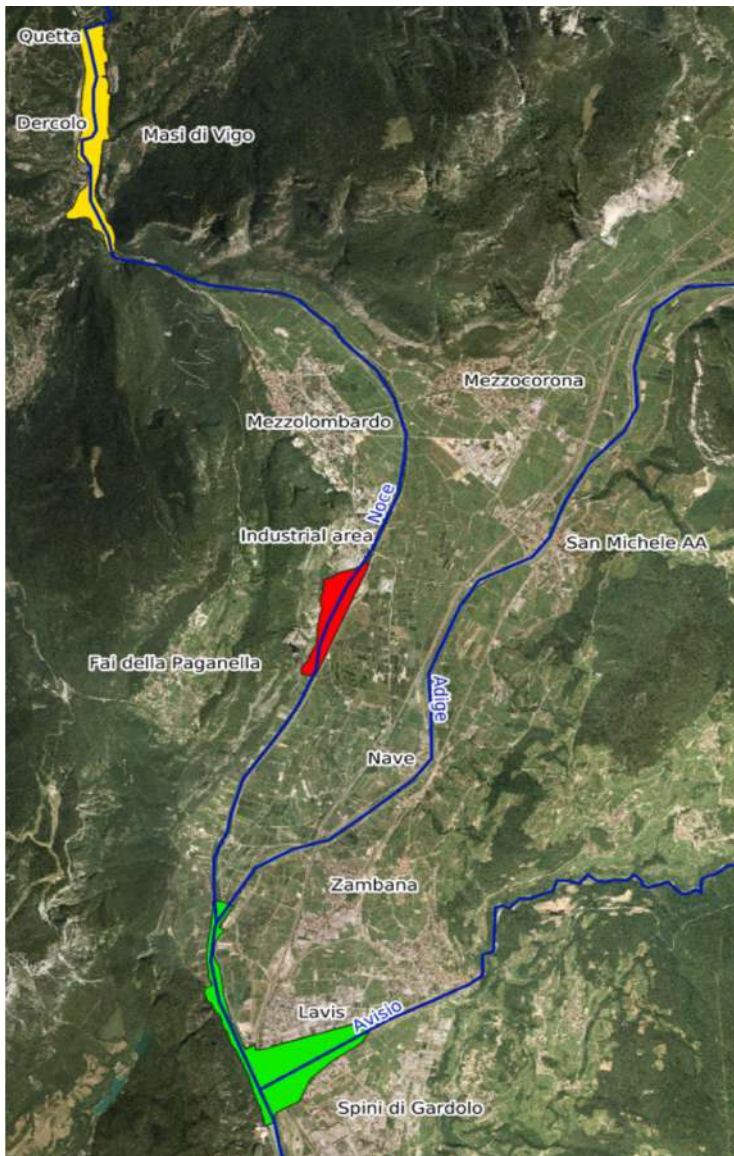
- Location of the Natura2000 sites
- Provincia Autonoma di Trento territory



0 10 20 30 km







Legend

- La Rocchetta
- La Rupe
- Foci dell'Avisio





Figure 4. Detailed view of La Rocchetta protected area.

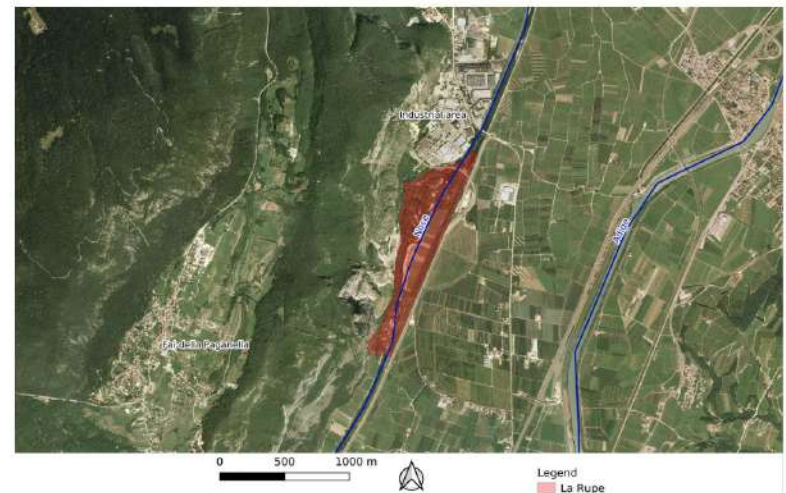
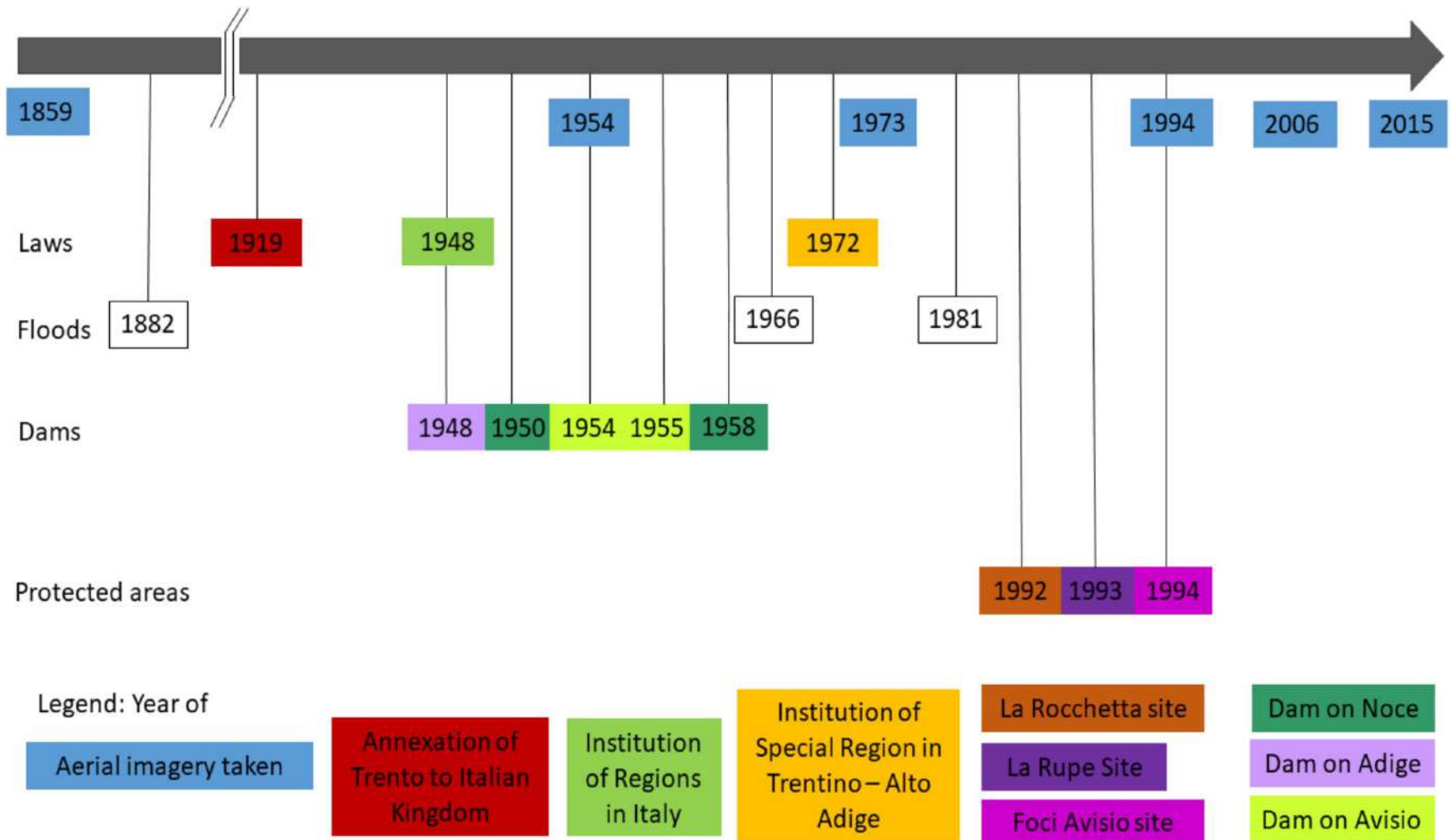


Figure 5. Detailed view of La Rupe protected area.



Figure 6. Detailed view of Foci dell'Avisio protected area.

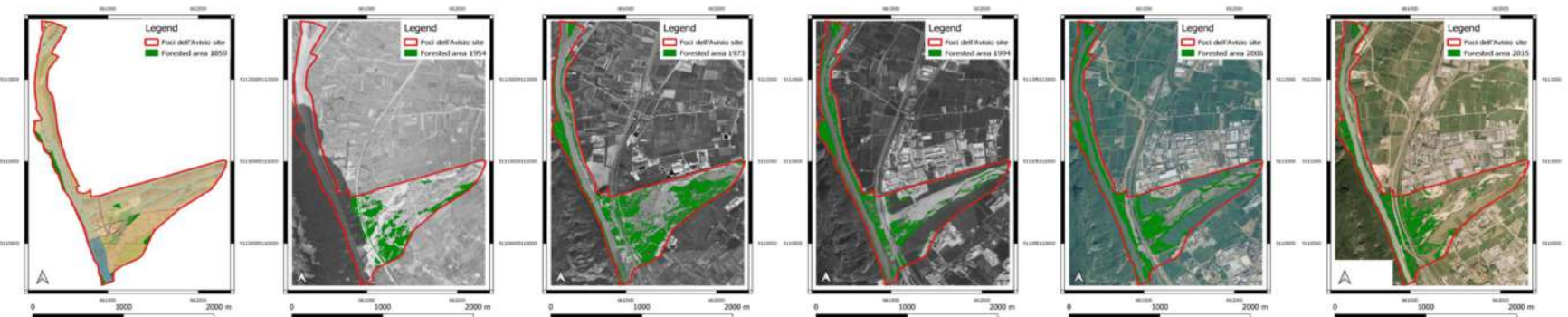
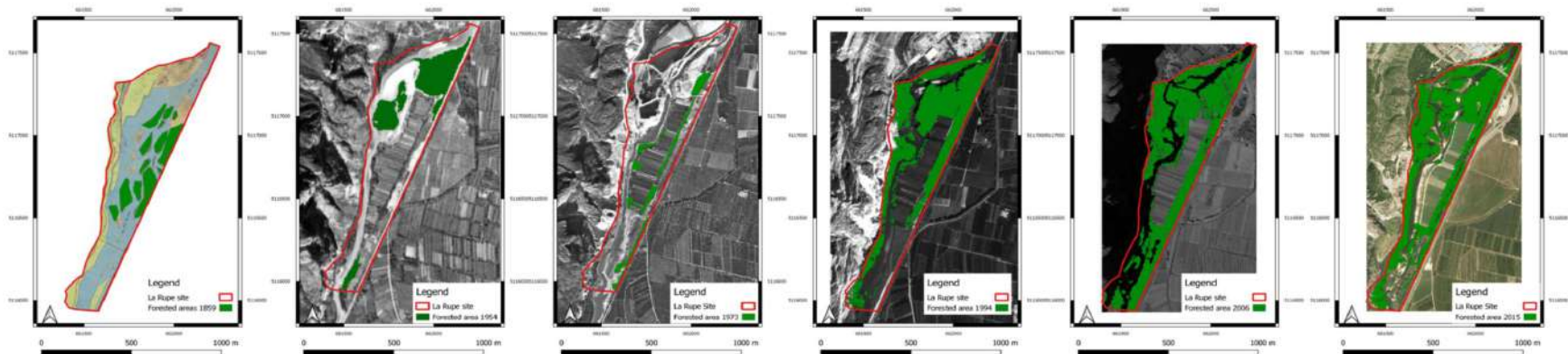
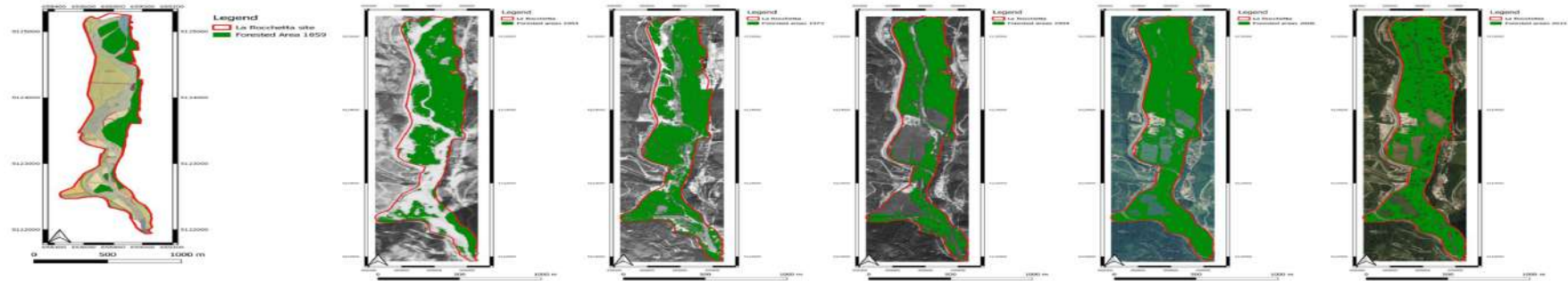
# Timeline of the principal events occurred on the three Natura2000 sites





# The forests and protected areas in Trentino

<b>Imagery set</b>	<b>Resolution [m per pixel]</b>	<b>RGB/Grey</b>	<b>Original ref . system</b>	<b>Reprojected ref. system</b>
1859	0.3x0.3	<u>grey</u>	WGS84 UTM32N	WGS84 UTM32N
1954	2x2	<u>grey</u>	WGS84 UTM32N	WGS84 UTM32N
1973	1x1	<u>grey</u>	RM40 GB	WGS84 UTM32N
1994	1x1	<u>grey</u>	RM40 GB	WGS84 UTM32N
2006	0.5x0.5	RGB	WGS84 UTM32N	WGS84 UTM32N
2015	0.2x0.2	RGB	WGS84 UTM32N	WGS84 UTM32N



1859

1954

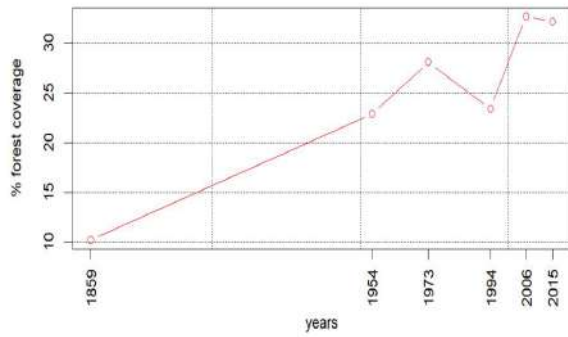
1973

1994

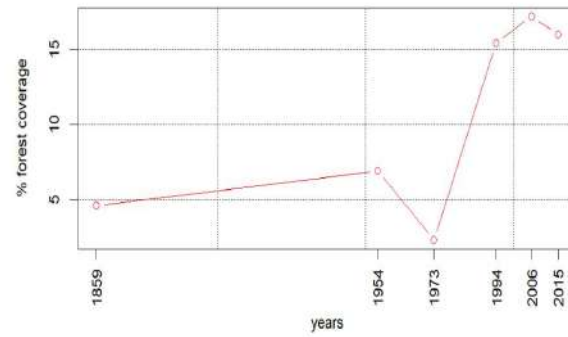
2006

2015

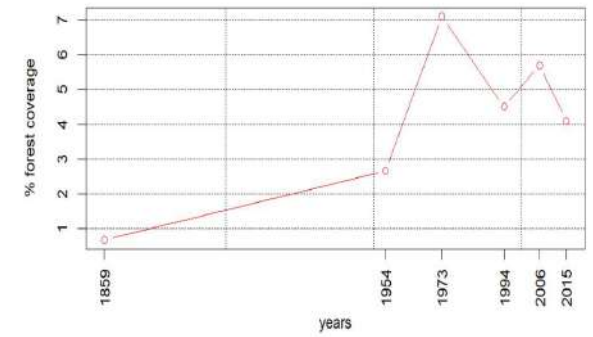
Forest coverage for Rocchetta during the years



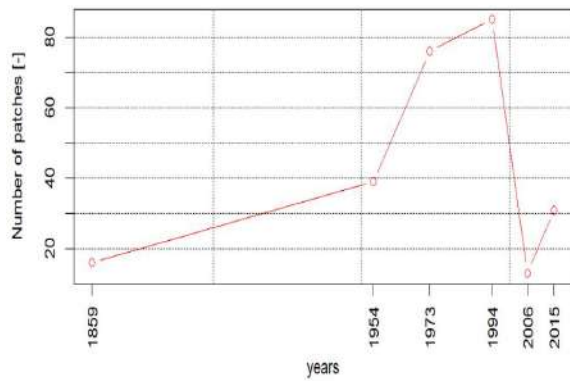
Forest coverage for La Rupe during the years



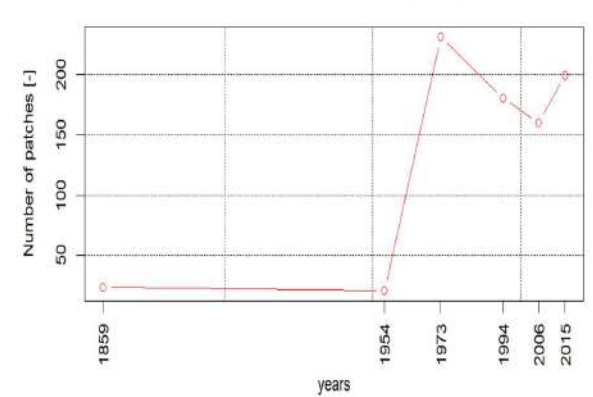
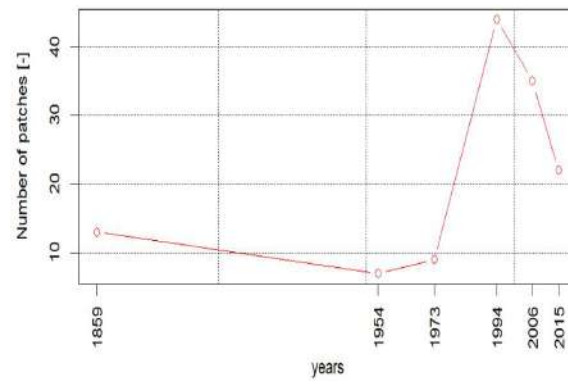
Forest coverage for foci dell'Aviso during the years



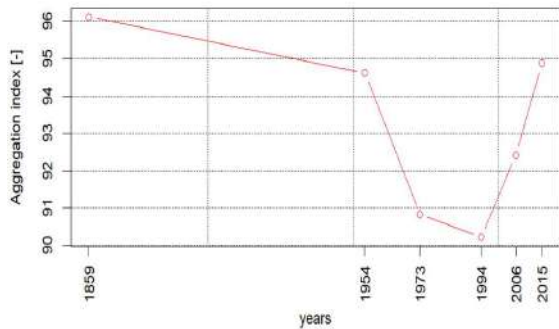
NP for Rocchetta during the years



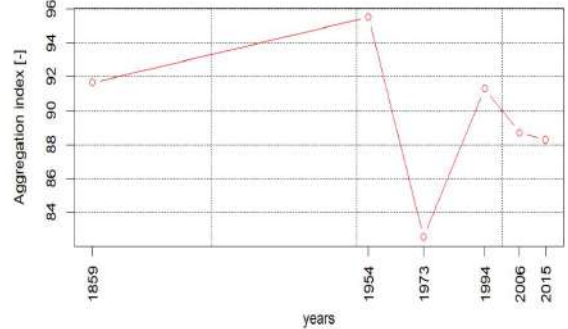
NP for La Rupe during the years



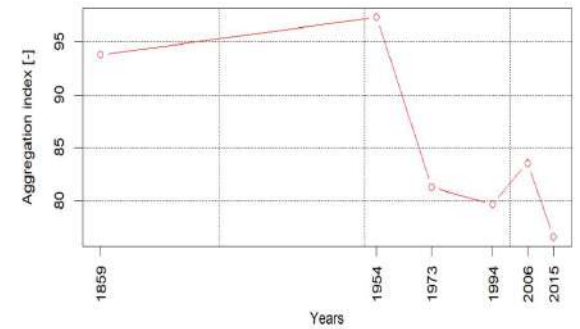
AI for Rocchetta during the years



AI for La Rupe during the years



AI for foci dell'Aviso during the years

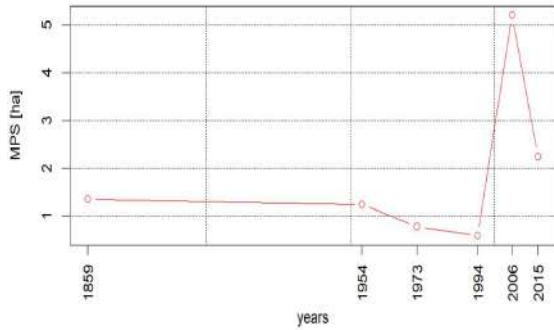


## Other statistics

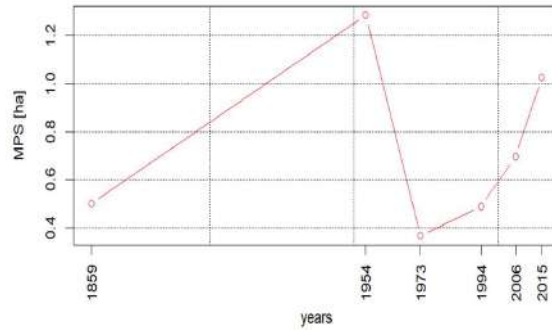
1. **Mean patch size (MPS)** is the average area of all the patches of a given type measured in m<sup>2</sup>. When used in combination with NP, MPS gives information about how the patches of a given land use class are growing or merging over time.
2. **Edge Density (ED)** is the sum of the lengths of all edge segments involving the corresponding patch type, divided by the total landscape area, usually measured in m/ha. This index is useful in ecological studies dealing with ecotonal species.
3. **Landscape Shape Index (LSI)** measures the perimeter-to-area ratio for the landscape as a whole, as a measure of the overall geometric complexity of the landscape. LSI is major than 1, and **adimensional**



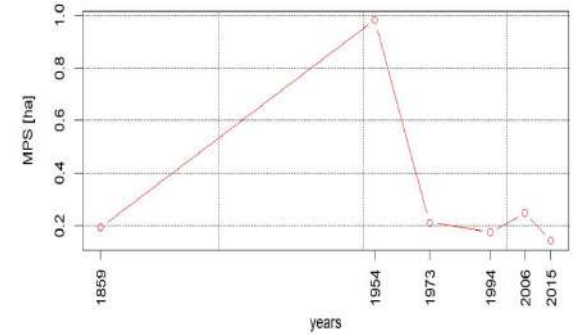
MPS for Rocchetta during the years



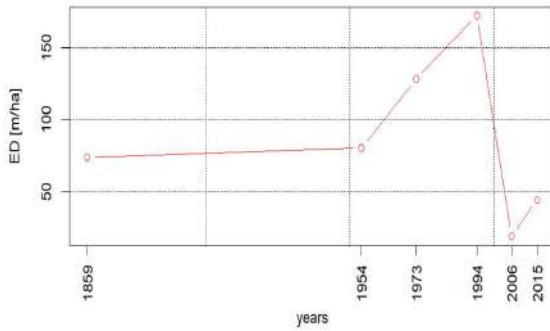
MPS for La Rupe during the years



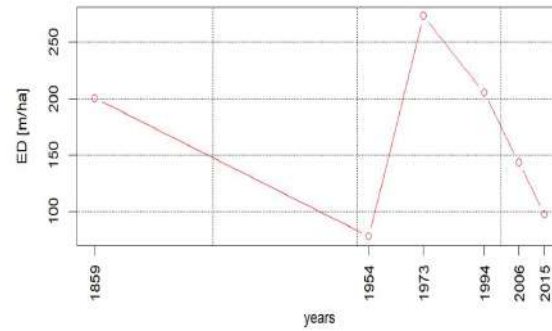
MPS for foci dell'Aviso during the years



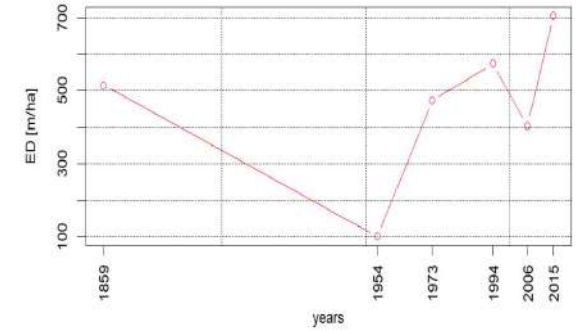
ED for Rocchetta during the years



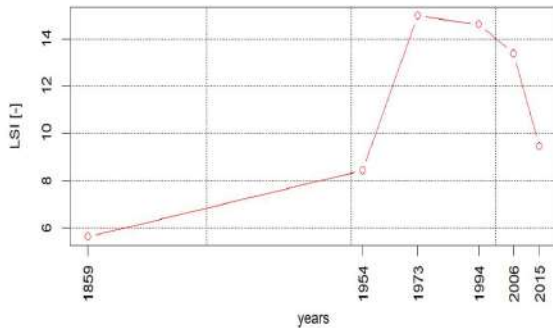
ED for La Rupe during the years



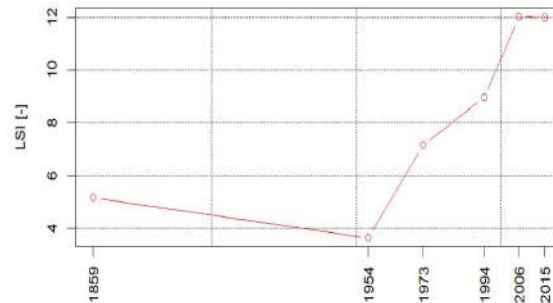
ED for foci dell'Aviso during the years



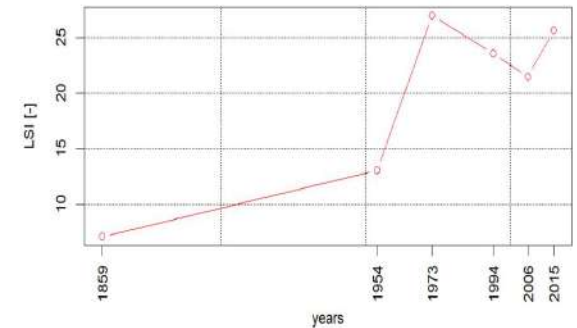
LSI for Rocchetta during the years



LSI for La Rupe during the years



LSI for foci dell'Aviso during the years



# Conclusions

1. All the three sites showed an initial situation in 1859 very different to the one of the present day as the riparian forests started to grow and gain importance inside the three sites they **started to gain other functions for the human activities**, such as a buffer area of the river from the infrastructures, and a recreational function.
1. The institution in the early '90 of Natura2000 helped to improve the existent situation on the three riparian forests of the study. In fact, **in all cases landscape metrics shows a trend toward a compaction** of the riparian vegetation, which is going to improve the ecosystem services.
2. Still, we have a long history of these three sites before the institution of the protection, and just 21 years of history after, **we will have to wait to see the effect of the protection** in the long term.
3. To highlight all these changes with **such precision the use of aerial imagery instead of satellite imagery was crucial**. The resolution of the LANDSAT or the Copernicus imagery would have not been sufficient to highlight all the changes, especially for the narrow Avisio and Noce rivers.
4. The drawback presented by these images is the **lack in information about biodiversity** of the trees, as the grey-scale and the three band composite colours does not allow the remote recognition of tree species.
5. A possible outcome for this study is an **on-field survey** to check the presence and frequency of different arboreal species.
6. Overall, as the three sites underwent a series of landscape changes, from barren land to vegetated, the **Natura2000 network gave good quality in the habitat of the riparian forests** for La Rocchetta, La Rupe and Foci dell'Avisio.

**THANKS FOR THE ATTENTION**

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