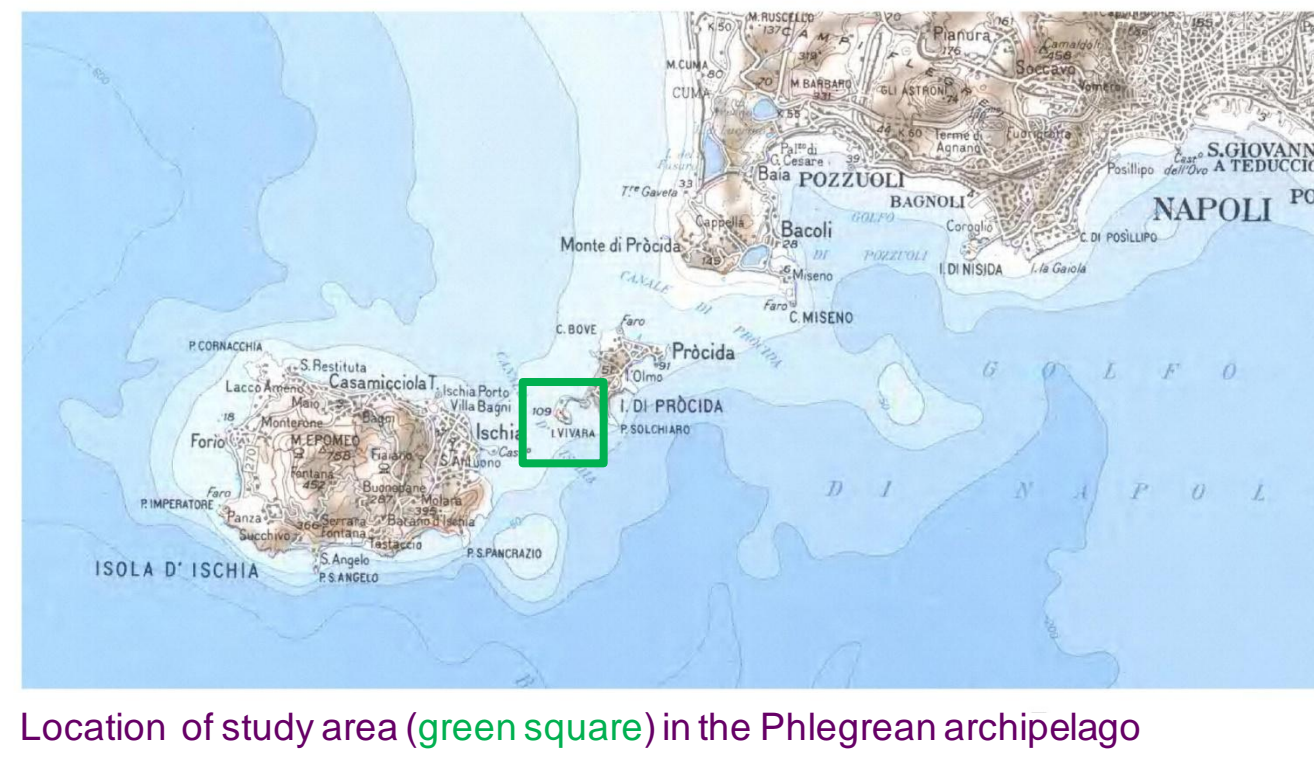


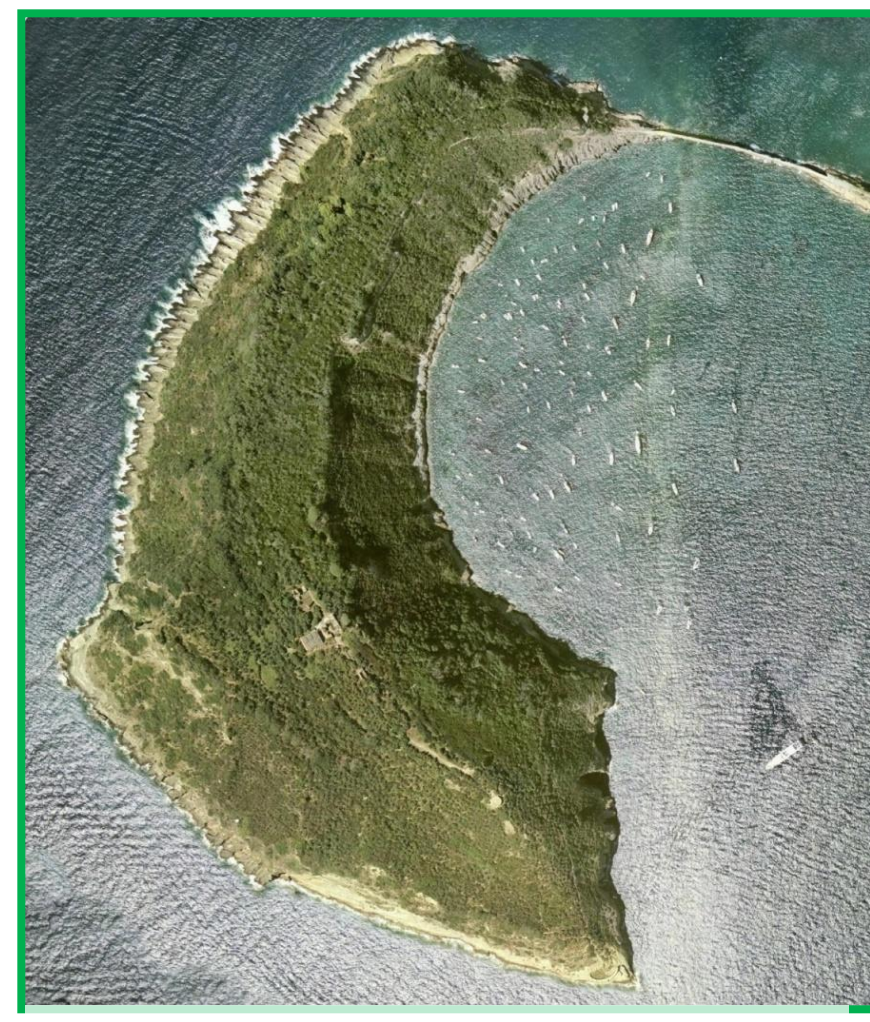
# 3.1 = Analysis of plant diversity in the Island of Vivara (NA), southern Italy

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Location of study area (green square) in the Phlegrean archipelago



Island of Vivara (aerial image 2004)

In the past Vivara was deeply exploited for agricultural purpose (mainly grapevine and olive trees), but in the middle of the XX century the island was quite completely abandoned (1). The abandonment triggered secondary dynamics processes of the vegetation which lead to the growth of sclerophyllous evergreen dominated plant communities (Mediterranean macchia and *Quercus ilex* and *Q. pubescens* woodland).



Abandoned terraced olive grove with *Erica arborea* L. and *Arbutus unedo* L.



In 1974 Vivara became a Fauna Protected Area (DPGR 609, 10/05/1974) and it was preserved from the urbanization and touristic over-exploitation. Currently the island is part of the Natura 2000 Network (IT8030012, both SPA and CSI) and starting from 2002 it is a State Nature Reserve (2) too

The island of Vivara is one of the volcanic islands of eastern Tyrrhenian Sea (Phlegrean islands, Gulf of Naples, Italy), together with Pontine archipelago. Vivara is located between Ischia and Procida and it is a small island (32 ha)

According to the Management Plan of the Reserve, the Reserve Management Committee funded several environmental requalifications, involving the University of Naples Federico II (3). Concerning flora and vegetation two actions were assessed: 1) updating of the vascular plants checklist and 2) monitoring of orchids populations.

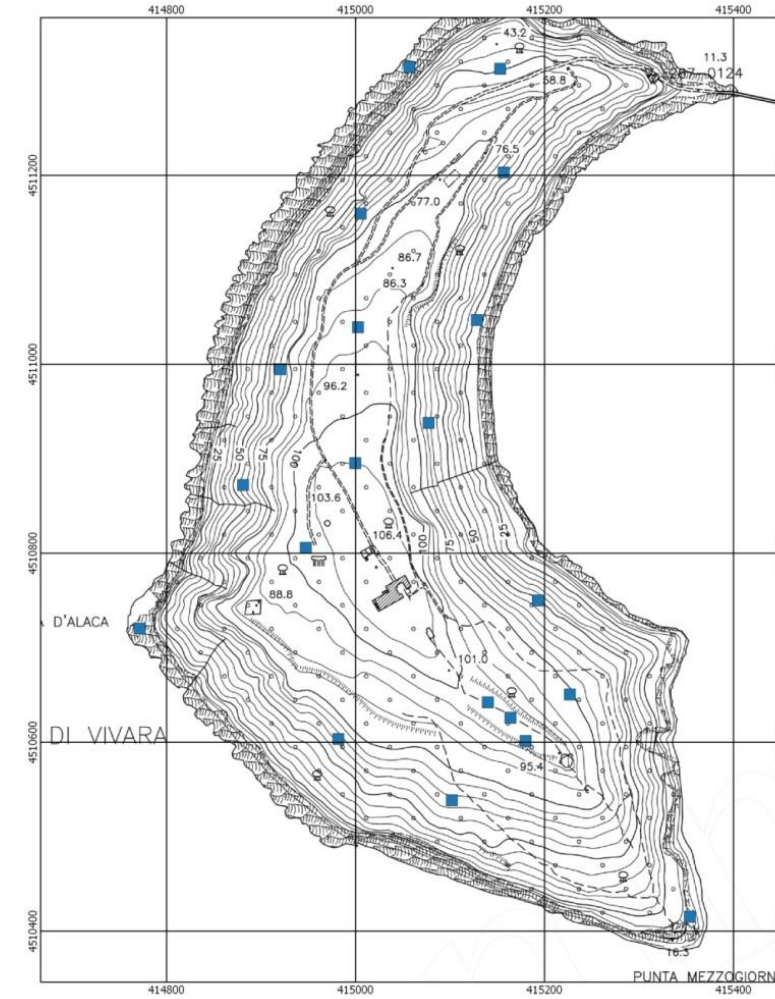
Data entry format for bibliographic data

Both bibliographic and ex-novo collected data were registered in a floristic geodatabase (10). All sampling sites were georeferenced using a GPS.

A deep analysis of both scientific and educational references was done (1, 4, 5, 6, 7, 8), pointing out the weakness of updated knowledges.

Data entry format for field data

For the updating of vascular plant checklist, floristic samplings in the whole island were carried out. For each of the main vegetation type (woodland, high and low macchia, herbaceous community and rocky shore vegetation) circular plots (10 metres of diameter) were assessed; in each of the plot floristic composition was recorded as well as cover value of each species using the cover-abundance scale according to Braun-Blanquet modified (9).



location of standard plots (10 m diameter)

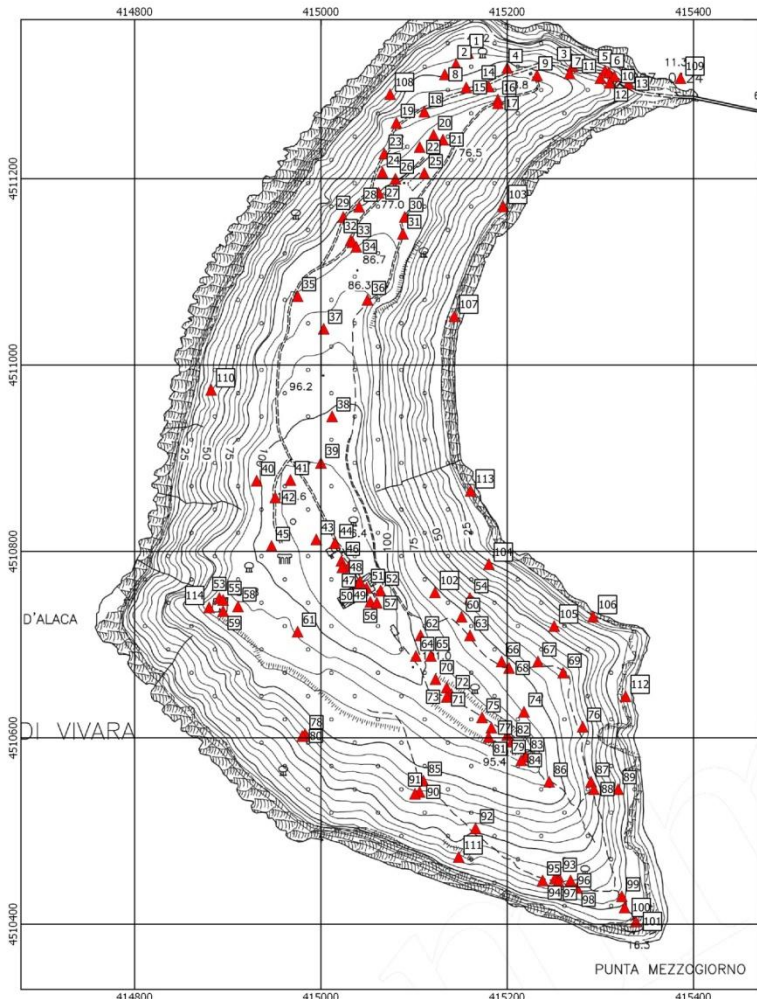
The same methodology was used for the monitoring of *Orchidaceae* species, but in this case sampling plots were variable in dimension and the number of individuals was recorded.

To achieve a more complete floristic list additional sampling plots are also provided

Authors	year of publication	n° of taxa
Geremicca M., Rippa G.	1897	97
Béguinot A.	1905	74
Caputo G.	1967	278
Scotto Di Cesare M.	1999	140
Scotto Di Cesare M.	2009	174

number of taxa reported in the available bibliographic references.

Bibliographic and actual data produced the floristic Checklist of Vivara with 381 taxa (species and subspecies) belonging to 76 families. Only 5 endemic or subendemic species were recorded (*Centaurea cineraria* L. subsp. *cineraria*, *Centaurea deusta* Ten., *Helichrysum litoreum* Guss., *Jacoba maritima* (L.) Pelsel & Meijden subsp. *bicolor* (Willd.) B. Nord. & Greuter, *Teucrium siculum* (Raf.) Guss.). The Checklist includes only 1 policy species (*Ruscus aculeatus* L.), two species included in the CITES Directive (*Euphorbia dendroides* L., *Cyclamen repandum* Sm.) and 8 species of *Orchidaceae*. These latter are protected due to the regional law (42/90 Campania region)



Sampling localities (both standard and variable plots)



*Tuberaria guttata* (L.) Fourr., reported as frequent in the past, is among the species no longer recorded

The more exhaustive bibliographic data (1, 8) were compared with the results of field work showing clear variations in the flora. Currently the flora comprises 176 taxa belonging to 63 families. The *Linaceae*, *Alliaceae*, *Asphodelaceae* families (including several herbaceous plants of mediterranean grassland) resulted no longer existing. Some recorded in the past families richer in species and including taxa reported to be important components of the diet of wild lagomorphs (11, 12, 13) (*Fabaceae*, *Poaceae*, *Asteraceae*, *Caryophyllaceae* and *Brassicaceae*) are still present, but they became very poor in number of species. Moreover vegetational data (not shown) evidenced also a very low cover value (average) of herbaceous layer in both woody and herbaceous plant communities.

Reference	N. of taxa	P	Ch	G	H	T
Caputo, 1967	278	14.4	5.4	11.9	23.0	45.3
Scotto di Cesare, 2009	174	19.0	9.8	12.6	22.4	36.2
dati 2014	176	21.0	8.0	10.8	15.9	44.3

Comparison among biological spectrum of the more exhaustive bibliographic data and the new ones of present research

Comparison of past and current life forms spectra have shown a clear increase of phanerophytes and a decrease of hemicryptophyte

Reference	N. of taxa	Endemic	Stenomediterranean	Eurimediterranean	Mediterranean-mount.	Eurasian	Atlantic	Circumboreal	Wide distribution
Caputo, 1967	278	1.4	30.2	24.1	1.1	12.6	5.0	2.2	23.4
Scotto di Cesare, 2009	174	1.7	35.1	21.3	0.6	8.6	2.9	1.1	28.7
dati 2014	176	1.7	39.2	18.2	1.1	8.0	2.8	0.6	28.4

Comparison among biological spectrum of the more exhaustive bibliographic data and the new ones of present research

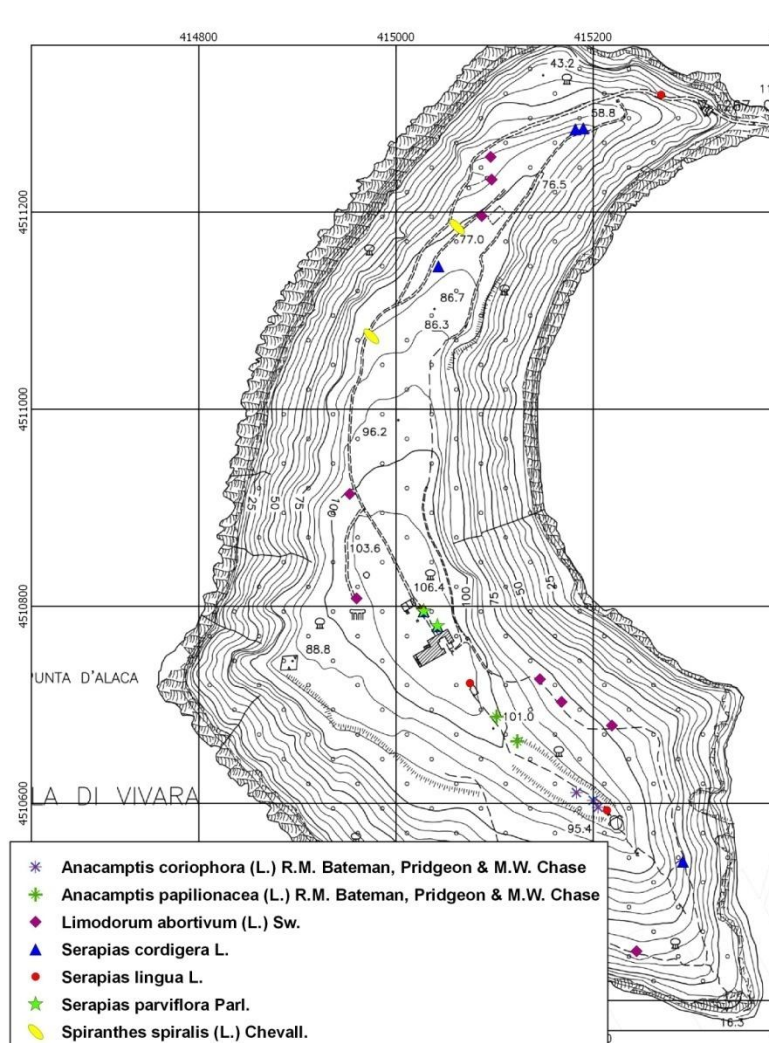
Comparison of chorological data evidenced an increase of both Stenomediterranean and Wide distribution elements.



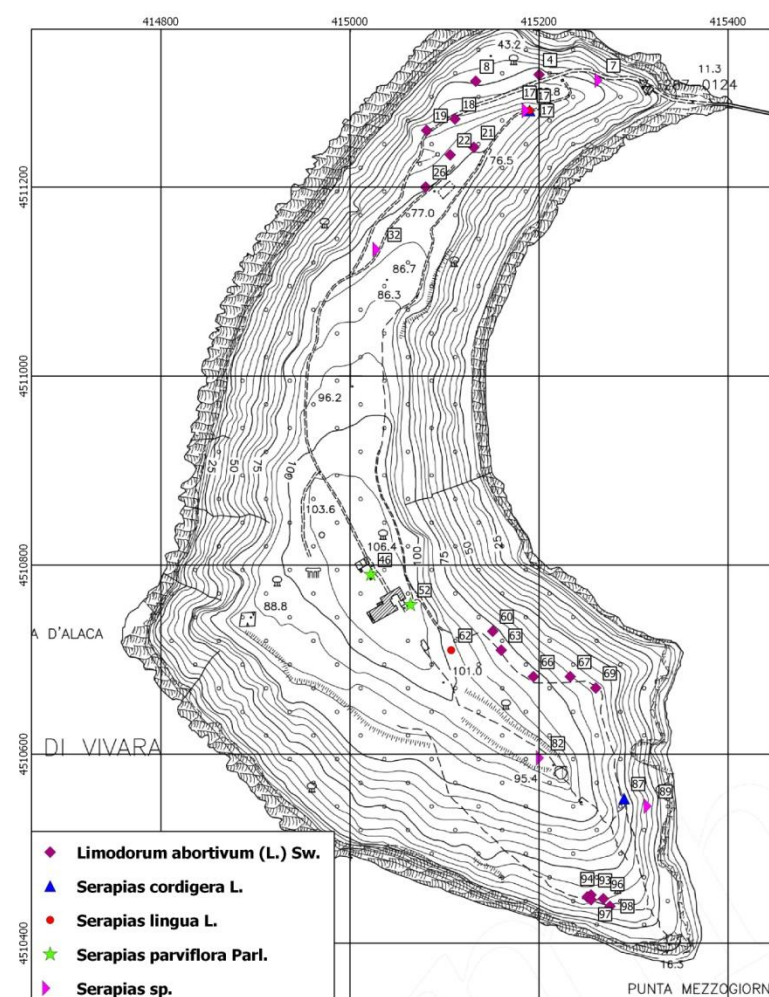
Among the 55 taxa not recorded in 1967 (1), but currently present in the island, many are synanthropic Stenomediterranean or Wide distributed. Some of them are invasive non-native species

Non-native invasive species
<i>Agave americana</i> L.
<i>Ailanthus altissima</i> (Mill.) Swingle
<i>Arundo donax</i> L.
<i>Carpobrotus edulis</i> (L.) N.E. Br.
<i>Chamaesyce maculata</i> (L.) Small
<i>Oxalis pes-caprae</i> L.
<i>Phytolacca americana</i> L.
<i>Robinia pseudacacia</i> L.

Among new record also some species which actual distribution in Campania region is still not well defined (*Asplenium obovatum* subsp. *obovatum*, *Sagina maritima*, *Vinca difformis* subsp. *difformis*)



Distribution of Orchidaceae species based on the observation of LIPU members in the year 1978-2011



Distribution of Orchidaceae species resulting from the present research

The Orchid flora of Vivara comprises 8 species very frequent in Campania (14), but currently only 4 species has been confirmed; they are mainly located near the main tracks and the ancient buildings. The results of diachronic monitoring of orchids plants did not evidence a clear negative impact of rabbit grazing on the orchids as reported in the Management Plan.

The research evidenced a depletion of Vivara flora in terms of both quantitative (number of taxa, mainly herbaceous species) and qualitative (increasing of ruderal and alien) characteristics. Concerning the reasons of the observed depletion, two hypotheses arose:

•the secondary dynamics processes caused an increase of cover surface of woody dominated (and poor in herbaceous) communities, entailing the extinction of gaps available for herbaceous communities, very rich in species.

•the reduction in surface of the gaps may have magnified the negative effects of the presence of the rabbit in Vivara; in fact it is reported that the damages due to the rabbit grazing were present also in the past (1), but not in the current dramatic form. Perhaps this process caused an overgrazing effect entailing to the observed depletion of the Vivara flora.

Further researches are needed to test these hypotheses in order to plan the right actions to improve the quality of existing plant communities.

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