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Variation of the floristic inventory and vegetation cover observed, after 50 years, on the Isola Rossa of Trinità d'Agultu (Central-northern Sardinia)

Abstract

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The Authors present the results of their observations on the changes to the flora and vegetation cover which has occurred over the past 50 years on the Isola Rossa of Trinità d'Agultu (Central-northern Sardinia) The presence of 23 entities, not listed in the preceding floristic inventory, has brought about a decided alteration in the floristic stock and, in particular, in the aspect of the vegetation landscape. Among the species responsible for these changes, a major role has been played by *Lavatera arborea* L., *Parapholis incurva* (L.) C. E. Hubbard and *Arisarum vulgare* Targ.-Tozz.

Introduction

The flora of the Isola Rossa of Trinità d'Agultu was investigated by Desole in 1954; he published a study in which he provided a floristic inventory and information on the plant coenoses present on the island. Almost half a century later, on our recent visits, we observed that vegetation cover has undergone significant change as a result of the presence of new entities not mentioned by Desole.

The purpose of this study, as reported by other authors, is to highlight the alterations in vegetation cover on the island resulting from the presence of these new entities since previous descriptions of its vegetation landscape differ from our recent observations.

The small islands off the coast of Sardinia are prone to alterations in their floristic component (Bocchieri 1998a; Arrigoni & Bocchieri 1995; Bocchieri & al. 2000) as was observed in particular on the Isola Piana of Stintino (Bocchieri 1998b), the Isola di Figarolo (Bocchieri & Satta 1999) and the Isola Rossa of Teulada (Bocchieri & Iiriti 2000). On all these islands new plants can contribute significantly to the alteration of vegetation cover.

Modification in floristic composition, density and distribution may also be observed throughout the Mediterranean where botanists, during their surveys, are increasingly reporting a growth in the number of new invasive, ruderal species, particularly where there is failure to promote habitat conservation and ensuing degradation favors the disappearance of floristic entities.

Notes on the territory

The Isola Rossa of Trinità d'Agultu, situated in Central-northern Sardinia, is some 450 m off the coast, has an area of 56,392 sq m, an overall coastline of about 1,5 km and an elevation of 29 m a.s.l. (Fig. 1).

From a geological point of view, it consists of granites dating back to the late tectonic stage of the Hercynian orogenic cycle, belonging to the vast intrusive complex present in north eastern Sardinia. Its coastline is indented, rocky and without sandy bays, while its soils are poorly developed and mostly found in sheltered areas, in rocky ravines or where vegetation has taken stable root.

Climate, temperature and rainfall data have been provided by the nearby station of S. Maria Coghinas, according to which mean annual rainfall is some 530 mm whereas mean temperature is about 17 °C.

There is no historical record of human presence on this island. Human activity first occurred during the 1960s when the island was used for pasturing goat herds. At the present time, the vegetation cover is subjected to the presence of numerous colonies of gulls and cormorants.

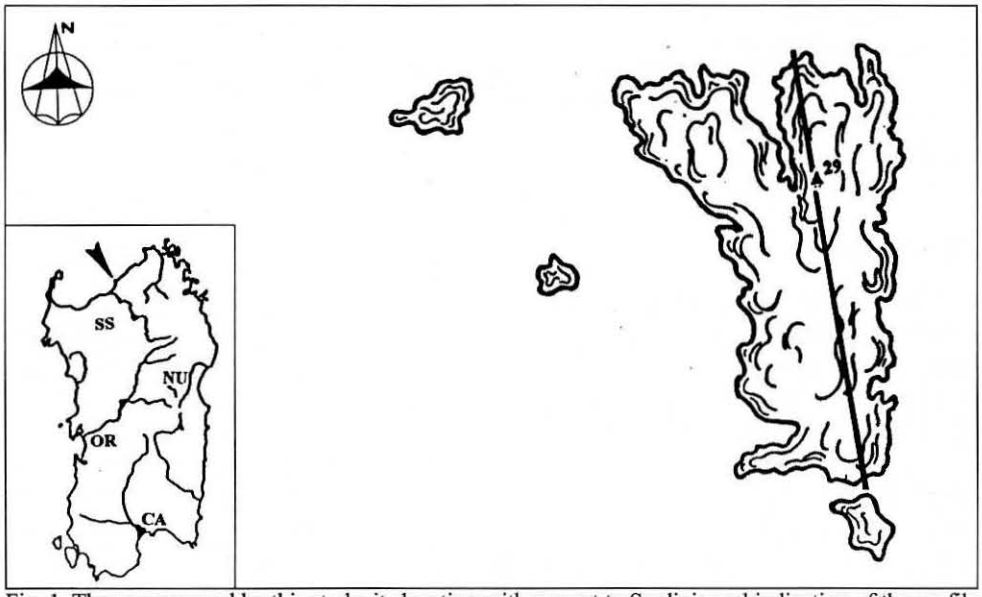

Fig. 1. The area covered by this study, its location with respect to Sardinia and indication of the profile of plant formations.

Notes on flora and vegetation cover

Desole's floristic survey of the island (1954) comprised 30 entities belonging to 13 families and 27 genera. Three main plant formations were identified: a florula of the central plain area, a florula of the landing cove and a rock-growing florula. This distinction was

based on the geomorphological characteristics of the island, which was marked by the presence of these different habitats. The main difference between these three environments is in terms of soil availability: the largest amounts are found in the central area of the island and in small side patches bordered by rocks.

The island's prevailing rocky terrain (more than 70%), together with the influence of marine aerosol and strong winds limit vegetation development which consists of low bush growths as indeed was highlighted by Desole himself. He reported a high rate of therophytes in relation to the environmental conditions which favor the establishment of annual halophilous and xerophilous species. This trend is also observed in the species listed in Table 1 which includes 23 new entities found on the island. Of these, 65% are therophytes and 43% cosmopolites and sub-cosmopolites. This finding highlights the fact that the presence of numerous colonies of birds favors the establishment of ruderal, widely distributed taxa as has been observed on other small Mediterranean islands (Tauleigne Gomes & Lebfrève, 2001). During theese 50 years, in effect, the anthropic use of island has been limitated up to Sixties, favouring and increasing the presence of bird colonies on the following periods.

Among the new entities found on the island, the following are worthy of mention as a result of their high frequency: *Lavatera arborea* L., *Avena barbata* Pott, *Arisarum vulgare* Targ.-Tozz. and *Parapholis incurva* (L.) C. E. Hubbard. Others, such as *Solanum nigrum* L., *Bromus rigidus* Roth, *Poa annua* L. and *Allium commutatum* Guss., although with low cover indices, contribute to characterize the vegetation landscape. The difficult environmental conditions present in the area under study also explain the scant presence

Table 1. List of new floristic entities found on the Isola Rossa of Trinità d'Agultu.

Entity	Family	Biological form	Chorological form
Allium commutatum Guss.	*Liliaceae*	G bulb	Steno-medit.
Arisarum vulgare Targ.-Tozz.	*Araceae*	G rhiz	Steno-medit.
Asterolinon linum-stellatum (L.) Duby	*Primulaceae*	T scap	Steno-medit.
Avena barbata Pott	*Poaceae*	T scap	Euri-medit.
Bromus rigidus Roth	*Poaceae*	T scap	Paleo-subtrop.
Cynodon dactylon (L.) Pers.	*Poaceae*	G rhiz	Cosmopol.
Digitaria sanguinalis (L.) Scop.	*Poaceae*	T scap	Cosmopol.
Echinochloa crus-galli (L.) Beauv.	*Poaceae*	T scap	Subcosmopol.
Fumaria bastardii Boreau	*Papaveraceae*	T scap	Subatl.
Fumaria capreolata L.	*Papaveraceae*	T scap	Euri-medit.
Galactites tomentosa Moench	*Asteraceae*	H bienn	Steno-medit.
Lavatera arborea L.	*Malvaceae*	H bienn	Steno-medit.
Olea europaea L. var. *sylvestris* Brot.	*Oleaceae*	P caesp	Steno-medit.
Parapholis incurva (L.) C. E. Hubbard	*Poaceae*	T scap	Medit.-atl.
Paspalum paspalodes (Michx) Scribner	*Poaceae*	G rhiz	Subcosmopol.
Poa annua L.	*Poaceae*	T caesp	Euri-medit.
Polygonum aviculare L.	*Polygonaceae*	T rept	Cosmopol.
Posidonia oceanica (L.) Delile	*Posidoniaceae*	I rad	Steno-medit.
Solanum nigrum L.	*Solanaceae*	T scap	Cosmopol.
Sonchus asper (L.) Hill	*Asteraceae*	T scap	Subcosmopol.
Sonchus oleraceus L.	*Asteraceae*	T scap	Subcosmopol.
Spergularia marina (L.) Griseb.	*Caryophyllaceae*	T scap	Subcosmopol.
Stellaria media (L.) Vill.	*Caryophyllaceae*	T rept	Cosmopol.

of phanerophytes which have difficulty in taking stable root on the island. Desole reported the presence of two bushes of *Ficus carica* L., which we were unable to find, whereas we did observe among the rocks some plantules of *Olea europaea* L. var. *sylvestris* Brot. whose presence is assuredly linked to seed dispersal by birds and we found small heaps of the seeds of this oleacea among the rocks. It is likely that in the future, accentuation of the already difficult ecological conditions on the island might lead to the disappearance of this entity, as has already occurred with *Ficus carica* L.

On the other hand, species which have not undergone any significant variations are *Atriplex hastata* L., *Halimione portulacoides* (L.) Aellen, *Portulaca oleracea* L., *Lotus cytisoides* L. and *Senecio leucanthemifolius* Poiret which in some cases have even increased in number. Indeed, some of them, established in the coastal strip, occupy an ecological niche where salinity is a selective element for the settlement of other entities.

As regards vegetation cover, the greatest difference we observed was that regarding vegetation of the central plain area in which *Lavatera arborea* L., not present some fifty years ago, has significantly altered vegetation physiognomy and structure (Fig. 2). In this plain area, the plant community originally described mainly included the species *Atriplex hastata* L., *Spergularia rubra* (L.) Presl., *Plantago coronopus* L. subsp. *commutata* (Guss.) Pilger, *Frankenia laevis* L., *Hordeum murinum* L. subsp. *leporinum* (Link) Arcangeli and *Polypogon maritimus* Willd. This formation has now been replaced by a plant population dominated by *Lavatera arborea* L., associated with *Senecio leucanthemifolius* Poiret and *Lotus cytisoides* L., whereas only rarely did we find other species such as *Anthemis maritima* L., *Fumaria capreolata* L. and *Sonchus oleraceus* L. The structure of this plant community consists of a low bush cover with an average height of 1,5 m and a cover of about 70%, while the grassland layer, average height 30 cm, covers about 50%. This formation is the most widespread not only in the central area but throughout the island and it would appear to have established itself to the detriment of presently less widespread species such as *Anthemis maritima* L., *Senecio leucanthemifolius* Poiret and *Lotus cytisoides* L. The development of this formation is probably linked to the use of the island for pasturing during the 1960s and to the presence of numerous bird colonies which have aided the introduction of new entities.

Again concentrating on the central area of the island, Desole reported the presence of extensive meadows of *Hordeum murinum* L. subsp. *leporinum* (Link) Arcangeli which today have become somewhat sparse and are located almost exclusively in small hollows in the driest areas of the island. This formation is dominated by *Hordeum murinum* L. subsp. *leporinum* (Link) Arcangeli which with some difficulty permits the establishment of *Atriplex hastata* L., *Lotus cytisoides* L. and plantules of *Lavatera arborea* L. Its structure is marked by an average height of 15 cm and 60% cover. The presence in this plant community of *Lavatera arborea* L. plantules seems consistent with the assumption that the process of colonization by this plant is still in progress.

The formations dominated by *Frankenia laevis* L. have also largely disappeared from the central area of the island, whereas they have remained unaltered in the small meadows among the rocks near the sea, together with other entities such as *Reichardia picroides* (L.) Roth, *Spergularia marina* (L.) Griseb. and *Plantago coronopus* L. subsp. *commutata* (Guss.) Pilger.

Extension of the *Anthemis maritima* L. coenosis has decreased significantly with

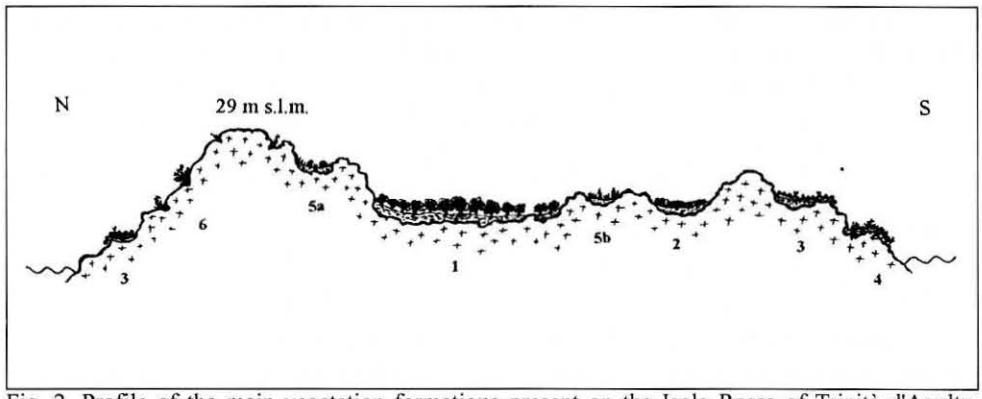

Fig. 2. Profile of the main vegetation formations present on the Isola Rossa of Trinità d'Agultu. Formation of: 1 - *Lavatera arborea* L. with *Senecio leucanthemifolius* Poiret and *Lotus cytisoides* L.; 2 - *Anthemis maritima* L. with *Atriplex hastata* L.; 3 - *Lotus cytisoides* L. and *Senecio leucanthemifolius* Poiret; 4 - *Halimione portulacoides* (L.) Aellen with *Frankenia laevis* L.; 5 - Meadows of : a) *Parapholis incurva* (L.) C. E. Hubbard, *Spergularia marina* (L.) Griseb., *Hordeum murinum* L. subsp. *leporinum* (Link) Arcangeli and *Frankenia laevis* L.; b) *Atriplex hastata* L., *Portulaca oleracea* L. with *Arisarum vulgare* Targ.-Tozz.; 6 - rupiculous coenoses of *Silene gallica* L., *Fumaria bastardii* Boreau, *Umbilicus rupestris* (Salisb.) Dandy, *Reichardia picroides* (L.) Roth, *Allium commutatum* Guss. and *Crithmum maritimum* L.

respect to Desole's findings that it was dominant in the small landing cove. At the present time this coenosis is present in a small dense population in the southern part of the island and another to the west at 29 m asl, which also includes some other species such as *Atriplex hastata* L., *Lotus cytisoides* L. and *Senecio leucantemifolius* Poiret. These formations have an average height of 30 cm and a cover very close to 100%.

Another type of plant formation that has developed significantly is characterized by *Parapholis incurva* (L.) C. E. Hubbard and *Spergularia marina* (L.) Griseb. It is mainly located in patches among the rocks where it can reach a cover of 90% and an average height of 15 cm.

At the present time, there are widespread meadows of *Arisarum vulgare* Targ.-Tozz. - a species not reported by Desole - which are particularly flourishing when located in the shelter of other plants or of rocks. Their cover ranges between 60 and 80% and their average height varies in relation to the ecological conditions in which they grow. When exposed to direct sunlight they do not exceed 5-8 cm in height and their life cycle is completed more rapidly, whereas when sheltered by other plants or rocks they grow to a height of 20-25 cm and their life cycle extends until the late spring.

As regards rupiculous florulas, we did not remark any particular differences as to the aspect and structure of the vegetation since there is a lack of population coenoses, but there are rather isolated plants which exploit the small amount of soil trapped in the rocky fissures. Amongst the new species which have taken root on the island, we observed *Fumaria bastardii* Boreau, *Allium commutatum* Guss., *Cynodon dactylon* (L.) Pers. and *Echinochloa crus-galli* (L.) Beauv.

From the floristic contingent, structural analysis and aspect of the plant formations present at this time, the following observations may be made:

a) after some 50 years, the island's flora has been altered by the spread of numerous new floristic entities which have deeply modified some aspects of vegetation cover;

b) amongst the numerous new entities those which have brought about the greatest changes in vegetation cover are *Lavatera arborea* L., *Parapholis incurva* (L.) C. E. Hubbard and *Arisarum vulgare* Targ.-Tozz., which have also altered the composition and balance of plant communities existing before their spread;

c) the process of colonization by *Lavatera arborea* L. is still in progress at the present time;

d) the presence of a consistent bird colony plays a vital role in the introduction of new entities;

e) the environmental conditions present on the island favor the establishment and/or spread of therophyte, halophyte and xerophyte flora, whereas a multitude of factors hamper the establishment of higher vegetation.

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