

**RESEARCH ON THE CHANGES IN THE FLORA
AND VEGETATION COVER ON "ISOLA ROSSA"
OF TRINITÀ D'AGULTU
(CENTRAL-NORTHERN SARDINIA)***

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Resumen. Los trabajos de campo, desarrollados durante dos años, han permitido detectar 23 taxones nuevos para la isla, mientras que no se ha podido confirmar la presencia de 13 especies que habían sido citadas con anterioridad. La flora de la isla está compuesta por 40 taxones muchos de ellos invasores y nitrófilos, ya que la acumulación de escombros y otros detritos ha modificado notablemente la composición original, lo que se observa sobre todo en la distribución actual de *Lavatera arborea* L. Se incluyen indicaciones sobre las formaciones vegetales más importantes de la isla, relacionando su extensión actual con la que ocupaban con anterioridad.

Summary. The Authors report the results of their survey carried out on the Isola Rossa of Trinità d'Agultu (Central Northern Sardinia). This survey covered a two-year period and shows that 13 species previously reported do not seem to occur in the island any longer where as 23 new records have been added. The flora, consisting of 40 entities, included numerous invasive and ruderal species which have to a large extent modified the composition, floristic distribution and vegetation cover of the island, the species which has played a major role in this modification being without doubt *Lavatera arborea* L. Details are also provided on the main plant formations on the island, in comparison with those previously reported.

INTRODUCTION

During a series of survey trips to Isola Rossa of Trinità d'Agultu (Central-Northern Sardinia) aimed at identifying any changes in the vegetation cover on this small island, the Authors found that numerous species listed by the only botanist who had carried out systematic investigations there (DESOLE, 1954) could no longer be found while some new entities had appeared in the

(*) This research was carried out in the framework on the INTERREG project.

vegetation cover. This fact was of prime importance in undertaking detailed and systematically programmed research aimed at identifying the present species, defining the way in which they have contributed to modify vegetation cover and cataloguing, in physiognomic terms, the main plant formations and groupings.

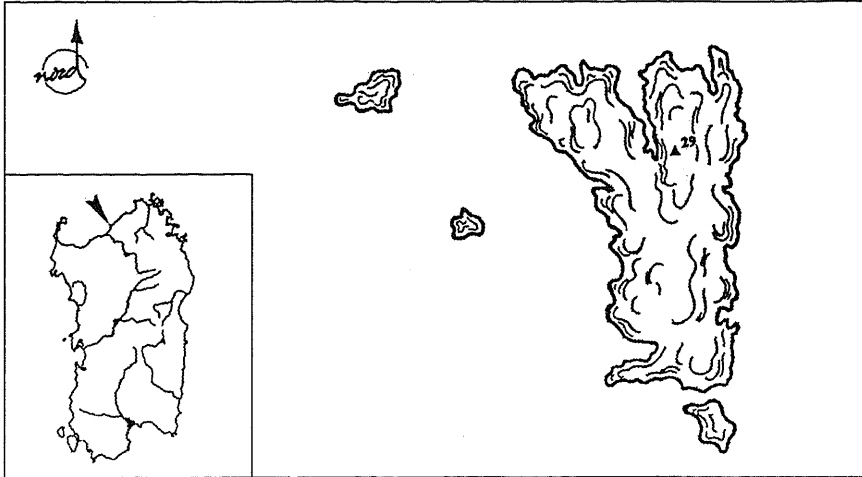


Fig. 1. Isola Rossa and its position with respect to Sardinia.

NOTES ON THE TERRITORY

The colour of the rocks which constitute a territory is a determining factor for its identification and since in Sardinia granites and porphyries are well represented, the term “rosso” (red) is fairly common. This is the case of this small island which is the subject of our researches and whose toponym is very often repeated in the names of other islands along the southern, north-eastern and eastern coasts of Sardinia.

Isola Rossa of Trinità d’Agultu (in the period in which DESOLE carried out his research, it was part of the municipality of Aggius), is situated in the northern-central area of Sardinia (Fig. 1), it has an area of 56392 sq m and its geographical co-ordinates calculated, according to the Gauss-Boaga grid, are: $x=1488535$, $y=4540330$. It has a coast line measuring approximately 1.5 Km, it is 450 m from the coast of Sardinia and has an elevation of 29 m ASL. In its southern and western sectors there are a few islets, of the same lithological type, without any topsoil or any type of vegetation as they are easily washed over by the waves and tides.

The island is constituted by leucogranite of regular grain size dating back to the late Tectonic phase of the Hercynian orogenic cycle and belonging to the vast intrusive complex to be found in North-Eastern Sardinia. Its coasts are indented, rocky and without sandy inlets. There are no soils in the true sense of the word since soil formation processes are strongly hindered by the salty aerosol present for the best part of the year. Wind erosion is also very evident; in fact, the small deposits of soil are to be found in sheltered areas, in rocky hollows or where vegetation has produced stable root.

Climatic data, recorded by the nearby meteorological station of S. Maria Coghinas, gives the overall values of temperature and rainfall shown in Tableau 1.

	J	F	M	A	M	J	J	A	S	O	N	D	Year
Av.T°	11.0	11.2	12.7	14.6	18.9	22.5	25.0	26.4	23.0	19.4	14.8	11.7	17.6
mm	33.4	21.6	38.9	57.9	37.0	20.2	3.1	15.2	50.8	80.8	78.4	82.9	520.2
MDS	33.05	62.56	22.18	0	25.9	59.67	93.81	69.63	0	0	0	0	-
MCS	60.36	59.63	47.27	41.41	10.18	15.80	0	0	0	0.72	28.36	56.00	-

Tableau 1. Average temperature and rainfall, in °C and mm, as registered by the meteorological station of S. Maria Coghinas from 1990 to 2000, and MDS and MCS indices according to Mitrakos.

On the basis of these data, in accordance with RIVAS-MARTINEZ's thermicity index we can classify this island in the upper thermo-Mediterranean bioclimate and dry umbrotype. This index is perfectly in line with the results obtained when drawing up the Mitrakos diagram (Fig. 2) and in particular when calculating the intensity of summer drought (SDS=223.12) and the annual incidence of drought (YDS=169.8). These values show that drought is a factor which, to varying degree, marks all months of the year. Of particular significance is also the historical analysis of rainfall values. Indeed, over the past 40 years, we find an average decrease in annual rainfall of 40 mm with respect to the preceding forty year period.

As regards the winds, it was noted that the dominant winds come from the 4th quadrant and they sweep over the island with intensity and violence for a good part of the year, making landings extremely difficult. In the past, seeking shelter to the SE of the island provided the only protection against the northern and western winds since for a good stretch of the opposite coast there are no natural inlets guaranteeing safe landing.

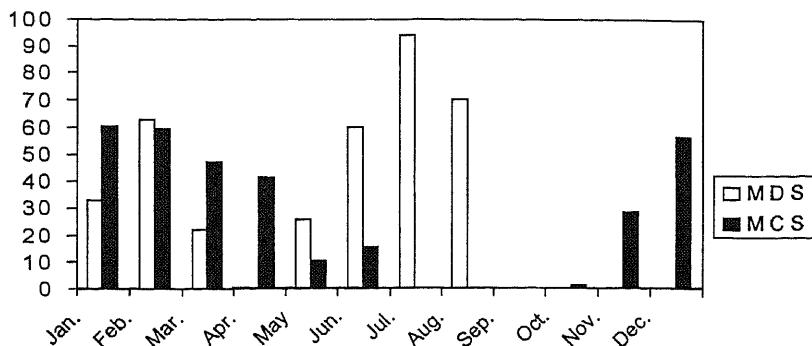


Fig. 2. Mitrakos' diagram (1990-2000) for S. Maria Coghinas.

Nothing indicates that man has ever settled on Isola Rossa. According to the information provided by the boatman who kindly ferried us across, it would appear that until the early sixties the island was intensively grazed by numerous goats, but they were removed to greener fields because of the low quality of the pastures.

FLORA

The only reliable information on the plant life on Isola Rossa is provided by DESOLE (1954) who, in his second report dedicated to the study of the small islands of North-Western Sardinia, during his floristic and phytogeographic study, gathered 30 species distributed among 13 families and 27 genera. Less reliable is the information provided by COLOMO & TICCA (1987) and subsequently reported by the R.A.S. (Autonomous Region of Sardinia, 1989) who stated that on this "charming islet" we can see the remains of a juniper grove and other interesting botanical species such as sea lavender cotton, sea bindweed, *Armeria pungens* and "above all a significant presence" of *Brassica insularis*. These species are not even mentioned in floristic report since they cannot be considered as extinct species, as the above mentioned authors probably never set foot on Isola Rossa of Trinità d'Agultu.

The survey trips carried out in 2000 and which continued until June 2001 made possible to draw up the following floristic list, in which + indicates a taxon mentioned by DESOLE but not observed by the authors and * a new taxon for the island flora. The species are arranged according *Flora Europaea* (TUTIN & al., 1964-1980; 1993). For each taxon listed, the biological form found, its chorological element, the month and year it was discovered for the first time and information on its abundance and siting are indicated.

Species belonging to the same family are shown in alphabetical order.

PTERIDOPHYTAE

ASPLENIACEAE

+ **Asplenium obovatum** Viv.

Not observed. DESOLE (1954, sub *Asplenium fontanum* Bern. var. *obovatum* Viv.) found a single specimen on rock crevices.

MAGNOLIOPHYTA-MAGNOLIOPSIDA

MORACEAE

+ **Ficus carica** L.

DESOLE (1954) reported it among the flora of the rock crevices and cracks but at present there is no trace of the two examples he mentioned.

POLYGONACEAE

* **Polygonum aviculare** L. T rept. Cosmop.

June 2001, 29 m; very rare species.

CHENOPODIACEAE

Atriplex hastata L. T scap. Circumbor.

July 2000, spread over the whole island and probably as abundant as at the time of DESOLE's investigation (1954), who reported this species as characteristic and dominant of the central plain area and the small mooring inlet, sheltered from the prevailing winds.

Chenopodium album L. T scap. Subcosmop.

July 2000, small grass areas and ravines rich in guano; widespread. DESOLE (1954) mentioned it exclusively among the rupicolous species.

Halimione portulacoides (L.) Aellen Ch frut. Circumbor.

July 2000, some groupings present along the south east coast. DESOLE (1954, sub *Atriplex portulacoides* L.) reported it on the central plain area and the small inlet where he used to land.

PORTULACACEAE

Portulaca oleracea L. T scap. Subcosmop.

July 2000, frequent in the small grass stands set between the rocks and at the borders of the most widespread plant formations on the island. Already indicated by DESOLE (1954).

CARYOPHYLLACEAE

Silene gallica L. T scap. Subcosmop.

May 2001, rupicolous plant formations; widespread. DESOLE (1954) reported it as being fairly widespread on the central plain area.

Silene nocturna L. T scap. S-Medit-Macarones.

DESOLE (1954) reported it as rare specimens on the central plain area, whereas at the present time, as we observed during trips made in May 2001, this species is rare and only occurs in the highest sector of the island.

* **Spergularia marina** (L.) Griseb. T scap. Subcosmop.

May 2001, found in the central plain area of the island where it forms thick grass stands.

+ **Spergularia rubra** (L.) Presl.

Not observed. DESOLE (1954) reported it among the floristic entities present in the central plain area of the island.

* **Stellaria media** (L.) Vill. T rept. Cosmop.

May 2001, very rare among the groupings of *Lavatera* and *Anthemis*.

PAPAVERACEAE

* **Fumaria bastardii** Boreau T scap. Subatl.

May 2001, ravines and meadows extremely rare.

* **Fumaria capreolata** L. T scap. Euri-Medit.

October 2000, among *Lavatera* at the central area; rare.

CRASSULACEAE

+ **Sedum andegavense** (DC.) Desv.

Not observed. DESOLE (1954) reported it among the flora of the central plain.

+ *Sedum rubens* L.

Not observed. DESOLE (1954) reported it among the flora of the central plain.

***Umbilicus rupestris* (Salisb.) Dandy G bulb. Medit-Atl.**

May 2001, some specimens among the rocky crevices. DESOLE (1954, sub *Cotyledon umbilicus-veneris* L.) reported its presence in the crevices and cracks in the rock some specimens among the rock.

FABACEAE

***Lotus cytisoides* L. Ch suffr. Steno-Medit.**

July 2000, present almost everywhere on the island. DESOLE (1954, sub *Lotus creticus* L.) reported it in all the sites surveyed on and indeed in the mooring inlet he stated that it was abundant.

MALVACEAE

*** *Lavatera arborea* L. H bienn. Steno-Medit.**

October 2000; it grows in dense clumps above all in the central part of the island where the soil is particularly rich in nitrates.

FRANKENIACEAE

***Frankenia laevis* L. Ch suffr. Stenomedit.-Centroasiat. and Sudafr.**

July 2000, coastal grass areas with low sand content in the western sector; not much widespread. DESOLE (1954), reported it for all plant formations.

APIACEAE

***Crithmum maritimum* L. Ch suffr. Euri-Medit.**

DESOLE (1954), reported this species among the flora of the small hollows, crevices and cracks in the rocks while at the present time, as observed during the course of all our visits to the island, there are only a few specimens exclusively in the eastern sector.

PRIMULACEAE

*** *Asterolinon linum-stellatum* (L.) Duby T Scap. Steno-Medit.**

July 2000, extremely rare among *Lavatera*.

OLEACEAE

*** *Olea europaea* L. var. *sylvestris* Brot. P caesp. Steno-Medit.**

June 2001, some seedlings found in cracks in the rock at about 29 m. Throughout the island there are abundant deposits of oleaster seeds transported by the numerous gulls which nest on the island; this makes it likely that, as observed on other small islands, this phanerophyte will in future have the possibility of rooting permanently on the island.

CONVOLVULACEAE

+ *Cuscuta epithymum* (L.) L.

Not observed. DESOLE (1954) reported it among the flora of the small hollows.

SOLANACEAE

*** *Solanum nigrum* L. T scap. Cosmop.**

October 2000, rocky crevices and grass areas rich in nitrates; examples to be found all over the island.

PLANTAGINACEAE

***Plantago coronopus* L. subsp. *commutata* (Guss.) Pilger T scap. Steno-Medit.**

May 2001, rare examples in the central plain area. DESOLE (1954) reported this therophyte in all the plant formations.

COMPOSITAE

+ *Andryala integrifolia* L.

Not observed. DESOLE (1954) reported it as occasional in small hollows.

***Anthemis maritima* L. H scap. W-Medit.**

July 2000, found in several points on the island, including some crevices, associated with *Lotus* and particularly with *Lavatera*. DESOLE (1954) reported its presence exclusively, but frequent and associated with *Lotus*, amongst the flora of the mooring inlet.

+ *Chrysanthemum coronarium* L.

Not observed. DESOLE (1954), reported this species, as frequent and among the flora of the central plain.

+ ***Conyza canadensis*** (L.) Cronq.

Not observed. DESOLE (1954, sub *Erigeron canadensis* L.) reported this entity as being sporadic and occasional among the rupicolous flora and in particular in the small hollows.

+ ***Dittrichia graveolens*** (L.) W. Greuter

Not observed. DESOLE (1954, sub *Inula graveolens* Desf.) reported a few specimens among the flora of the central plain.

+ ***Dittrichia viscosa*** (L.) W. Greuter.

Not observed. DESOLE (1954, sub *Inula viscosa* All.) reported a few specimens among the flora of the central plain and the small hollows.

* ***Galactites tomentosa*** Moench H bienn. Steno-Medit.

June 2001 only one specimen and in poor conditions, observed at about 29 m.

+ ***Hypochoeris achyrophorus*** L.

Not observed. DESOLE (1954, sub *Hypochoeris aetnensis* Ball.) reported its presence everywhere.

Reichardia picroides (L.) Roth H scap. Steno-Medit.

October 2000, some specimen spread over the whole island. DESOLE (1954) reported its presence in all the plant formations.

Senecio leucanthemifolius Poiret T scap. Steno-Medit.

July 2000, common and abundant all over the island. DESOLE (1954), reported this species as pre-eminent among the flora of rock crevices and cracks.

* ***Sonchus asper*** (L.) Hill T scap. Subcosmop.

June 2001, only one specimen observed on the central plain.

* ***Sonchus oleraceus*** L. T scap. Subcosmop.

May 2001, scattered but very few specimens.

+ ***Silybum marianum*** (L.) Gaertner

Not observed. DESOLE (1954) reported this species as, sporadic and occasional, among the rupicolous flora.

MAGNOLIOPHYTA-LILIOPSIDA

POSIDONIACEAE

- * **Posidonia oceanica** (L.) Delile I rad. Steno-Medit.

At the time of DESOLE's report (1954), this hydrophyte was surely abundant along the under water coasts of the island. No sea-grass formations or deposits of this phanerophyte were observed. Not included in GRIME's triangular model.

LILIACEAE

- * **Allium commutatum** Guss. G bulb. E-Steno-Medit.

July 2000, cracks in the rock in the central eastern sector of the island; very few specimens.

GRAMINEAE

- * **Avena barbata** Pott T scap. Euri-Medit.-Turan.

July 2000, deposits of soil in the cracks where it is often associated with *Portulaca*.

- * **Bromus rigidus** Roth T scap. Paleo-Subtrop.

May 2001, scattered specimens all over the island, in particular in the areas bordering on clumps of *Lavatera*.

- * **Cynodon dactylon** (L.) Pers. G rhiz. Termo-Cosmop.

May 2001, around 29 m, very rare.

- * **Desmazeria marina** (L.) Druce T scap. Medit-Atl.

May 2001, only found in the cracks in the rocks; not very widespread. DESOLE (1954, sub *Catapodium loliaceum* L.) reported it among the flora of the central plain area and in the small hollows.

- * **Digitaria sanguinalis** (L.) Scop. T scap. Cosmop.

October 2000, in the eastern central inlet which leads to the central plain area; extremely rare.

- * **Echinochloa crus-galli** (L.) Beauv. T scap. Subcosm.

October 2000, only one specimen found in a crevice in the central eastern sector.

Hordeum murinum subsp. **leporinum** (Link) Arcangeli T scap. Circumbor.

May 2001, widespread but not abundant, all over the island. DESOLE (1954) reported it on the central plain area and in rock crevices.

* **Parapholis incurva** (L.) C. E. Hubbard T scap. Medit-Atl.

May 2001, grass areas with sandy, or humic soil with *Spergularia*; widespread in the central sector.

* **Paspalum paspalodes** (Michx) Scribner G rhiz. Subcosmop.

October 2000, in the inlet of the central eastern sector; extremely rare.

* **Poa annua** L. T caesp. Euri-Medit.

May 2001, grass areas with small soil deposits associated with *Portulaca*, *Spergularia* and *Atriplex*.

Polypogon maritimus Willd. T scap. Steno-Medit.-Macaron.

June 2001, meadow areas and crevices; not very widespread. DESOLE (1954) reported it in small groupings on the central plain area and reasonably widespread in the mooring inlet.

ARACEAE

* **Arisarum vulgare** Targ.-Tozz. G rhiz. Steno-Medit.

October 2000, spread all over the island.

REMARKS ON THE FLORA AND VEGETATION COVER

During our surveys, we identified 40 taxa which belong to 19 families and 37 genera. Compared with DESOLE' observations (1954), our list shows 23 new taxa, while 13 he reported were no longer found. As shown in Fig. 3, 3 families were not reconfirmed whereas 9 are completely new. The most numerous families, as already observed on several other islands round the coast of Sardinia, are *Gramineae* (10 species plus 1 subspecies), *Compositae* (6 species) and *Caryophyllaceae* (4 species). A comparison of the data reported by DESOLE with those found in this study shows that *Compositae* has lost the greatest number of species (6) whereas *Gramineae* family has a great increase (8). Of particular significance is the failure to find pteridophytes and the presence, as indicated in the floristic list, of several species represented by only one plant, as it was already reported by DESOLE (1954) for *Asplenium obovatum* (one specimen) and *Ficus carica* (two specimens).

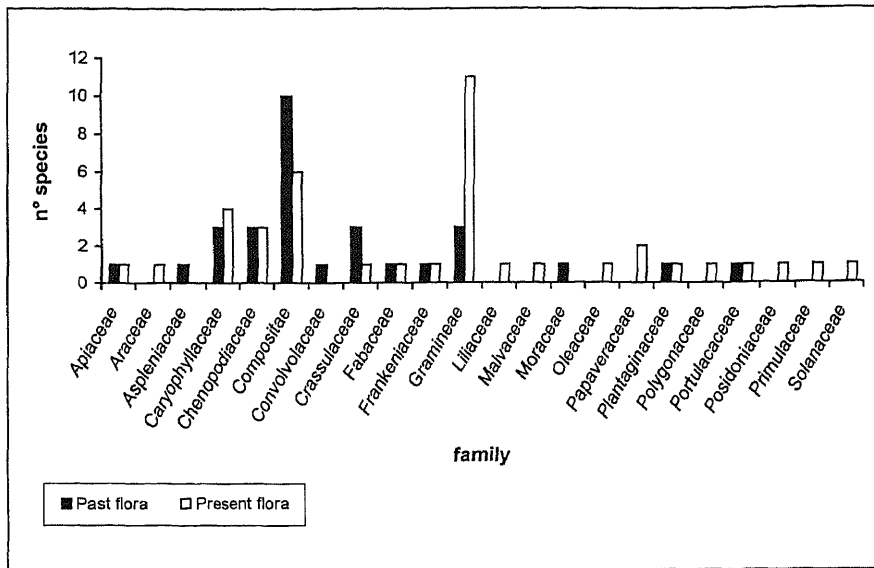


Fig. 3. Comparison between the composition of the flora in the past (according to DESOLE, 1954) and in present times.

The flora of the island, as shown in Fig. 4, is typically Mediterranean since it consists mainly of therophytes and about a 60% of Mediterranean species. As regards the adaptation strategies identified by GRIME (1985) and GRIME & al. (1988) for the interpretation of the triangular model, R-strategy plants are the 46% of the total while the remaining 54% is distributed between C- and S-strategy plants. In overall, with respect to the preceding floristic composition, we find a 6% increase of ruderal species, in detriment of S-strategy plants. This agrees with surveys made on other islands, where there has been a notable variation in floristic composition, density and distribution, and especially on Mediterranean islands, where numerous researchers have observed a marked presence of new invasive and ruderal species. Indeed from a chorological point of view, we have confirmed an increase of species with widespread distribution whereas communities of Mediterranean and endemic species have always a smaller number of plants and are often found exclusively in the more protected positions.

No species of marked phyto geographic significance as for instance *Limonium* species have been found a genus rich in endemics species in the coast facing the island. *Echinochloa crus-galli*, a *Gramineae* in the islands round the coast of Sardinia, was reported only on La Maddalena (BIONDI & BRUGIAPAGLIA, 1995) has been found.

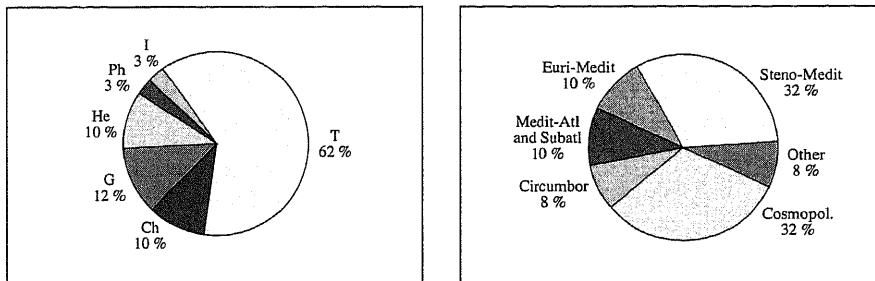


Fig. 4. Biological and chorological spectrum.

The marked reduction of some species or failure to find any specimens at all is a phenomenon which is often highlighted by numerous researchers, such as BANCHIERI & ANZALONE (1999), BOCCHIERI (1998), DE NATALE & LA VALVA (2000), PARADIS & LORENZONI (1999), PARADIS & PIAZZA (2000), PAVESI & LEPORATI (1998), POZZO DI BORGO & PARADIS (2000), TAMMARO & al. (1995), TRAVAGLINI & al. (1999). All these authors indicate that the alteration of the habitat and the modification of environmental conditions are the main cause of the increasing infrequency or extinction of species which were previously reported at the sites which they investigated.

Vegetation cover is to be found mainly in the sub-plains areas, in small hollows, and cracks and rock crevices where small soil deposits of limited fertility occur. Overall, as a result of the prevalently rocky nature of the island, soil covers only a 25% of the whole surface and plants form small patches with a dominance of one or two species.

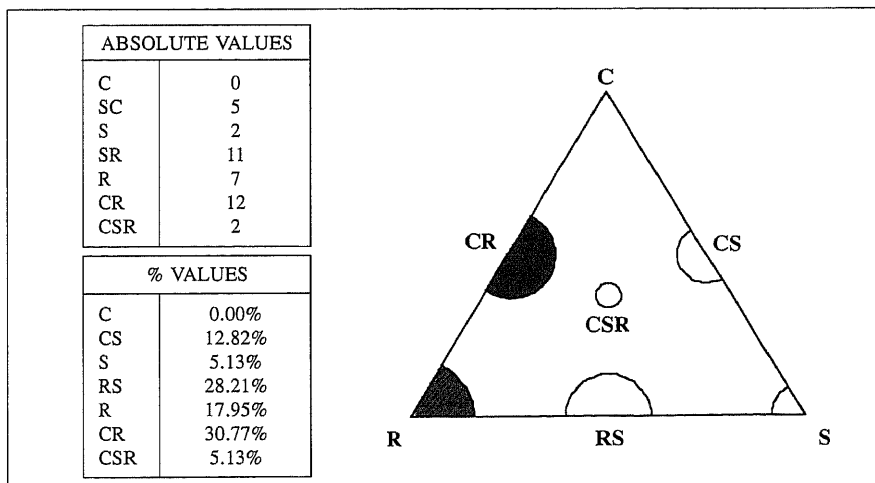


Fig. 5. Grime's strategy.

Amongst the first we find those where *Lavatera arborea* dominates: in spite of the fact that this species was not present at the time of DESOLE (1954), it certainly now represents the most widespread plant formation in the island. It is found on the central plain area with slight slopes and where the soil is reasonably deep.

Lotus cytisoides and *Senecio leucanthemifolius* also form patches which are at times almost pure or in combinations where these two dominant species are associated mainly with *Hordeum marinum* subsp. *leporinum*, *Frankenia laevis*, *Solanum nigrum* and of *Lavatera arborea*.

In comparison with DESOLE (1954) data, authors have observed a marked reduction, of *Halimione portulacoides* formations, which was accompanied by rare specimens of *Senecio leucanthemifolius*, *Lotus cytisoides* and *Atriplex hastata*. This plant formations, which moreover is very fragmentary, is to be found at present only in the south-eastern sector of the island while it is completely absent in the central area, where it was recorded by DESOLE (1954).

The communities of *Anthemis maritima* are also much reduced. This formation, occurs only in two populations, one denser compact and localised in the southern portion of the island and the other more scattered at about 29 m of altitud, where the population has been reduced, probably because of the growth of new stands of *Lavatera arborea*.

Among the plant formations with two dominant species we should mention those formed by *Spergularia marina* and *Parapholis incurva* to which *Atriplex hastata*, *Plantago coronopus* subsp. *commutata* and *Reichardia picroides* associate.

Authors wish to remark that even isolated sites, relatively distant from the coast, are subjected to variations in their floristic composition and vegetation cover, as it has been recently observed on the Portuguese island of Berlenga (TAULEIGNE GOMES & LEFÈBVRE, 2001) where the numerous colonies of sea gulls, as in Isola Rossa, have favoured the rooting of ruderal and widespread species.

REFERENCES

- BANCHIERI, C. & B. ANZALONE (1999) La flora vascolare del Monte Cairo (Lazio meridionale). *Webbia* **55**: 337-380.
- BIONDI, E. & E. BRUGIAPAGLIA (1995) Contributo alla conoscenza floristica dell'Arcipelago di La Maddalena. *Boll. Soc. Sarda Sci. Nat.* **30**: 159-170.
- BOCCHIERI, E. (1998) On the failure to find plants on some minor islands of Sardinia. *Fl. Medit.* **8**: 197-212.
- COLOMO, S. & F. TICCA (1987) *Sardegna da salvare: un sistema di parchi e riserve naturali per le grandi distese selvagge della nostra isola*, **1**: 184-185. Ed. Arch. Fotogr. Sardo, Nuoro.

- DE NATALE, A. & V. LA VALVA (2000) La flora di Napoli: i quartieri della città. *Webbia* **54**: 271-375.
- DESOLE, L. (1954) Studio floristico e fitogeografico delle piccole isole della Sardegna nord-occidentale. Seconda nota: isola Rossa (Aggius); isola dei Porri (Stintino); isola Foradada (Alghero). *Nuovo Giorn. Bot. Ital.*, n.s. **61**: 290-326.
- GRIME, J. P. (1985) The C-R-S model of primary plant strategies, origins, implications and tests. In: *Plant evolutionary biology*, 371-393. Chapman and Hall, London.
- , J. G. HODGSON & R. HUNT (1988) *Comparative plant ecology*. Unwin Hyman, London.
- PARADIS, G. & C. LORENZONI (1999) Description dans un but de gestion conservatoire des stations corses de l'espèce rare *Cressa cretica* L. (Convolvulaceae). *J. Bot. Soc. bot. France* **9**: 5-34.
- & C. PIAZZA (2000) Effectifs de l'endémisme rarissime et très menacée, *Anchusa crispa* Viv. (*Boraginaceae*), dans ses stations corses, après la tempête de décembre 1999. *Bull. Soc. Bot. Centre-Ouest*, n.s. **31**: 47-80.
- PAVESI, A. & M. L. LEPORATI (1998) La flora vascolare del Monte Testaccio in Roma. *Inform. Bot. Ital.* **30**: 25-36.
- POZZO DI BORGO, M.L. & G. PARADIS (2000) Inventaire des stations naturelles et comptage du nombre d'individus de l'espèce rare et protégée *Rouya polygama* (*Apiaceae*) en Corse. *Bull. Soc. Bot. Centre-Ouest*, n.s. **31**: 3-20.
- REGIONE AUTONOMA DELLA SARDEGNA, ASSESSORATO DELLA DIFESA DELL'AMBIENTE (1989) Proposta delle delimitazioni cartografiche delle superfici territoriali da proteggere, pag. 115. *Centro Stampa Regione Sarda*.
- TAMMARO, F., L. PACE & C. CATATONICA (1995) Variazioni floristiche e relitti mediterranei nel bacino dell'ex lago Fucino (Marsica, Abruzzo). *Boll. Soc. Sarda Sci. Nat.* **30**: 321-335.
- TAULEIGNE GOMES, C. & C. LEBFRÈVE (2001) Évolution de la végétation del l'île Berlenga (Archipel des Berlengas, Estremadura, Portugal) sur une période de douze ans. Influence des oiseaux maritimes et possible répercussion sur les taxa endémique. *X OPTIMA Meeting, Abstracts*: 189. Palermo.
- TRAVAGLINI, A., M. GRILLI CAIOLA & G. D'ANDREA (1999) Contributo alla conoscenza floristica dei Monti Simbruini. *Webbia* **54**: 85-117.
- TUTIN, T. G. & al. (eds.) (1964-1993) *Flora Europaea*. **1-5**. University Press, Cambridge.