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CARTOGRAPHY AND VEGETATION DYNAMICS IN THE SIERRA NEVADA, ALMERIA (S.E. SPAIN).

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Abstract

In the present paper a study is made of the ecological characteristics of the area, and the vegetation series, current vegetation and dynamics of three of the series present in Sierra Nevada, Almería. Quantitative data regarding the representation of the different vegetation units and of their conditions are obtained.

Introduction

The upper basin of the Andarax river (Fig. 1) is currently undergoing considerable erosion, as a result of which desertification is progressing, especially in the lower-lying parts. In the present study, vegetation mapping techniques previously developed by our research group are used, together with a study of the phytosociological features and dynamics of the vegetation of some of the series present in the study area.

Methodology

1, Study of the physical environment (topography, geology, edaphology and climatology.

2, Bioclimatic and biogeographical methodology, following RIVAS MARTÍNEZ (1994) and RIVAS MARTÍNEZ & al. (1995).

3, Study of the vegetation using the methodology of the Zürich-Montpellier school (BRAUN-BLANQUET, 1979).

4, Description of the plant dynamics and vegetation series, by means of studying the ecological features of each area and the vegetation (RIVAS MARTÍNEZ, 1987).

5, Mapping the current vegetation, following the method described by GÓMEZ MERCADO & VALLE (1987).

Results

The most significant results were as follows:

Geology.- The study area lies within the inland areas of the Sierra Nevada range, in which the following complexes can be identified: Nevado-Filábride complex (lower unit or Manto del Veleta, Abla or La Caldera unit, upper unit or Manto del Mulhacén), Alpujárride complex (mica schist and quartzite formation, filites and quartzite formation, carbonate rock formation), Malaguide and Neogene-Quaternary formation.

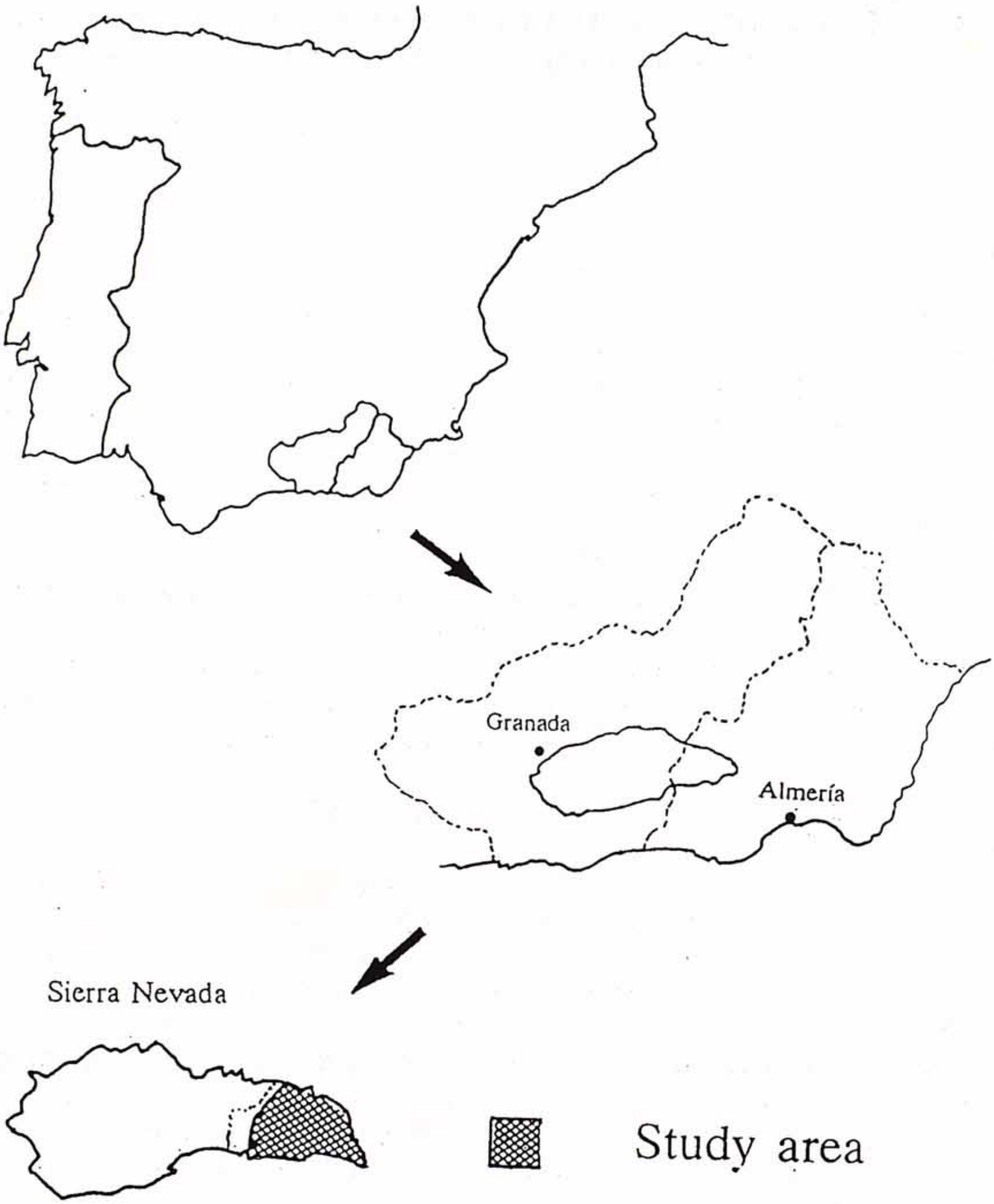


Fig. 1. Geographical location of the study area.

Edaphology.- The soils present in the area are typified as follows: Lithosols, Fluvisols, orthic Solonchaks, Luvisols (chromic and calcic Luvisols), Regosols (Calcareous Regosols, Calcic Regosols, Eutric Regosols, Distric Regosols), Rankers, Luvisols, Cambisols (Calcic Cambisols, Humic Cambisols, Chromic Cambisols, Eutric Cambisols). Lithosols and regosols are very abundant. These soils, which have evolved little, are subjected to severe erosion which causes constant renewal and prevents these soils from evolving into more highly developed structures.

Bioclimatology.- Four thermoclimates can be identified, with the following horizons: Thermo-, meso-, supra-, and oro-Mediterranean. The ombrotypes present range from lower semi-arid to humid.

Biogeography.- The following units can be delimited: Mediterranean-Ibero-Atlantic superprovince, Baetic province, Nevadense and Alpujarreño-Gadorense sectors; and Meditteranean-Ibero-Levantine superprovince, Murciano-Almeriense province, Almeriense sector.

Vegetation series.- The following were identified in the study area:

1, Thermo-Mediterranean eastern Murciano-Almeriense semiarid-arid jujube (*Ziziphus lotus*) series: *Zizipheto loti* S.

2, Thermo-meso-Mediterranean Alpujarreño-Gadorense, Guadiciano Bacense, Filábrico-Nevadense and Almeriense, semiarid-dry lentisc (*Pistacia lentiscus*) series: *Bupleuro gibraltarici-Pistacieto lentisci* S. Faciation with *Salsola Webbii.*

3, Meso-Meditterranean Aragonesa, Murciano-Manchega, Murciano-Almeriense and Setabense semiarid holly-oak (*Quercus coccifera*) series: *Rhamno lycoidis-Querceto cocciferae* S. Faciation with *Ephedra fragilis.*

4, Meso-Mediterranean Baetic, Marianense and Araceno-Pacense basophilous holm-oak (*Quercus rotundifolia*) series: *Paeonio coriaceae-Querceto rotundifoliae* S.

5, Supra-meso.Mediterranean Filabrica and Nevadense silicicolous holm-oak (*Quercus rotundifolia*) series: *Adenocarpo decorticantis-Querceto rotundifoliae* S. Meso-Mediterranean faciation with *Retama sphaerocarpa* and supra-Mediterranean faciation with *Adenocarpus decorticans.*

6, Supra-Mediterranean Baetic basophilous holm-oak (*Quercus rotundifolia*) series: *Berberido-Querceto rotundifoliae* S.

7, Oro-Mediterranean Filábrico-Nevadense silicicolous creeping juniper *(Juniperus nana*) series: *Genisto versicoloris-Junipereto nanae* S.

8, Meso-Mediterranean Baetic basophilous riparian geoseries.

9, Meso-supra-Mediterranean Nevadense geoseries on siliceous soils.

10, Lower meso- and thermo-Mediterranean Ibero-Levantine riparian geoseries.

For these series we have slightly modified the limits given by previous authors (VALLE, 1985; RIVAS MARTÍNEZ, 1987, PÉREZ RAYA & al., 1990), as the scale used for the present study (1:50000) requires delimitation to be more precise.

Fig. 2, shows the relative representation of each of the climatophilous series present in the study area.

Map of current vegetation.- The usefulness of this map lies in the possibility of combining in each unit the dynamic state of the vegetation with the potentiality existing in the unit. As a result of devising this map we have been able to synthesize the various units, reducing them to a maximum of six. The sectors may be expressed in the form of a diagram with the percent representation of each (Fig. 3).

With the vegetation study carried out in parallel to the cartography, the dynamic charts corresponding to two vegetation series have been identified (see Figures 4 y 5): *Adenocarpo decorticantis-Querceto rotundifoliae* S. Meso-Mediterranean faciation with *Retama sphaerocarpa* and supra-Mediterranean faciation with *Adenocarpus decorticans;* and *Genisto versicoloris-Junipereto nanae* S.

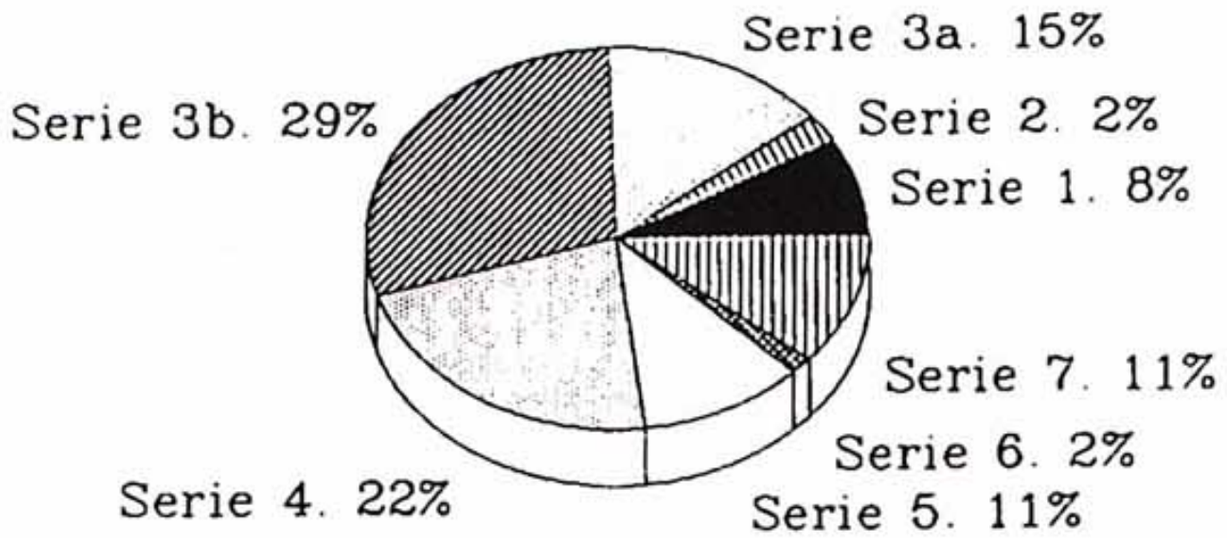
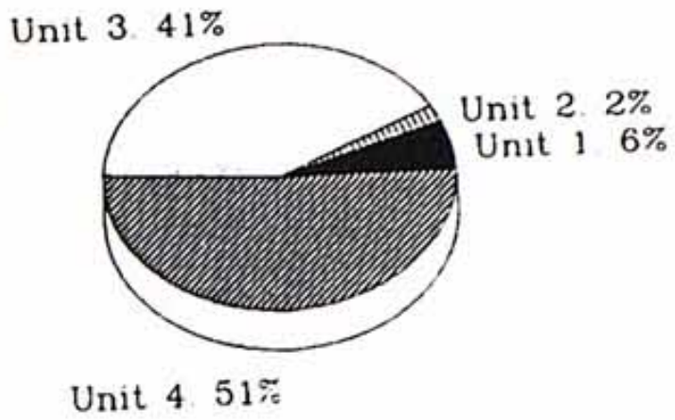


Fig. 2. Percent representation of each of the series present in the study area. 1, *Genisto versicoloris-Junipereto nanae* S. 2, *Berberido-Querceto rotundifoliae* S. 3a, *Adenocarpo decorticantis-Quercus rotundifoliae* S. supra-Mediterranean faciation with *Adenocarpus decorticans*. 3b, *Adenocarpo decorticantis-Querceto rotundifoliae* S. Meso-Mediterranean faciation with *Retama sphaerocarpa*. 4, *Paeonio coriaceae-Querceto rotundifoliae* S. 5, *Rhamno lycoidis-Querceto cocciferae* S. 6, *Bupleuro gibraltarici-Pistacieto lentisci* S. 7. *Zizipheto loti* S.

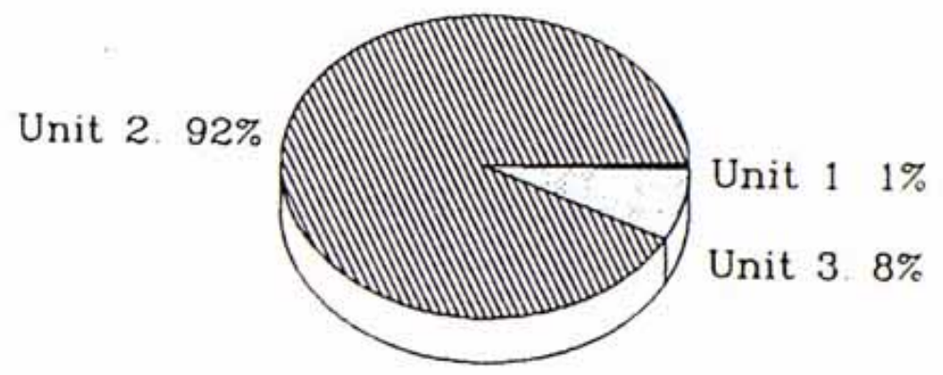
CONCLUSIONS

1, The representation of the thermoclimates is: thermo-Mediterranean 13%, meso-Mediterranean 62%, supra-Mediterranean 17%, oro-Mediterranean 8%. The ombroclimate representation is: humid 8%, subhumid-dry 69%, semiarid 23%.

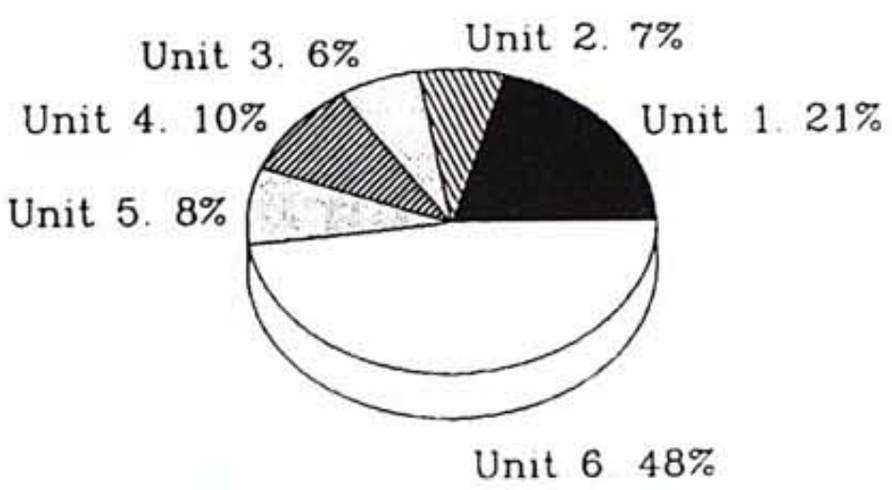
Fig. 3. Percent representation of the units of the different vegetation series represented in the study area. **1. *Genisto-Junipereto nanae:*** 1, Thorny shrub with pulvinular chamaephytes. 2, Pulnivular chamaephyte scrub. 3, Pulvinular chamaephyte scrub and perennial pasture. 4, Pulvinular chamaephyte scrub and reforested conifers. **2. *Berberido-Querceto rotundifoliae:*** 1, Holm-oak community with matorral shrubs and low scrub. 2, Shrubs and scrub with reforested conifers and remains of holm-oak communities. 3, Reforested conifers and scrub. **3. *Adenocarpo-Querceto rotundifoliae,* variation with *Adenocarpus decorticans***: 1, Holm-oak community with matorral shrubs and low scrub. 2, Matorral shrubs and low scrub with reforested conifers and remains of holm-oak communities. 4, Matorral scrub and nitrophilous scrub with remains of holm-oak communities. 5, Abandoned crops and matorral scrub and nitrophilous scrub with remains of holm-oak communities. 6, Reforested conifers with matorral scrub. **4. *Adenocarpo-Querceto rotundifoliae,* variation with *Retama sphaerocarpa:*** 1, Holm-oak communities with matorral shrubs and low scrub. 2, Reforested conifers with holm-oak communities, and matorral shrubs and scrub. 3, Reforested conifers with matorral scrub. 4, Abandoned crops and matorral scrub and nitrophilous scrub. 5, Tended or semi-abandoned crops with nitrophilous scrub. **5. *Paeonio-Queceto rotundifoliae:*** 1, Holm-oak community with matorral shrubs and low scrub. 2, Matorral scrub. 3,3 Matorral shrubs and scrub with reforested conifers. 4, Reforested conifers and matorral scrub. 5, Semi-abandoned crops with nitrophilous scrub. 6, Tended crops. **6. *Rhammo-Querceto cocciferae:*** 1, Matorral scrub. 2, Abandoned crops with matorral scrub and nitrophilous scrub. 3, Reforested conifers and matorral scrub. 4, Tended or semi-abandoned crops with nitrophilous scrub. **7. *Bupleuro-Pistacieto lentisci:*.** 1, Matorral scrub. 2, Reforested conifers with matorral scrub. 3, Tended and semi-abandoned crops with nitrophilous scrub. **8. *Zizipheto loti:*** 1, Subdesert thyme scrub. 2, Mixed crops with subdesert thyme scrub and halonitrophilous formations. 3, Tended crops.


Unit 3. 41%
Unit 2. 2%
Unit 1. 6%
Unit 4. 51%

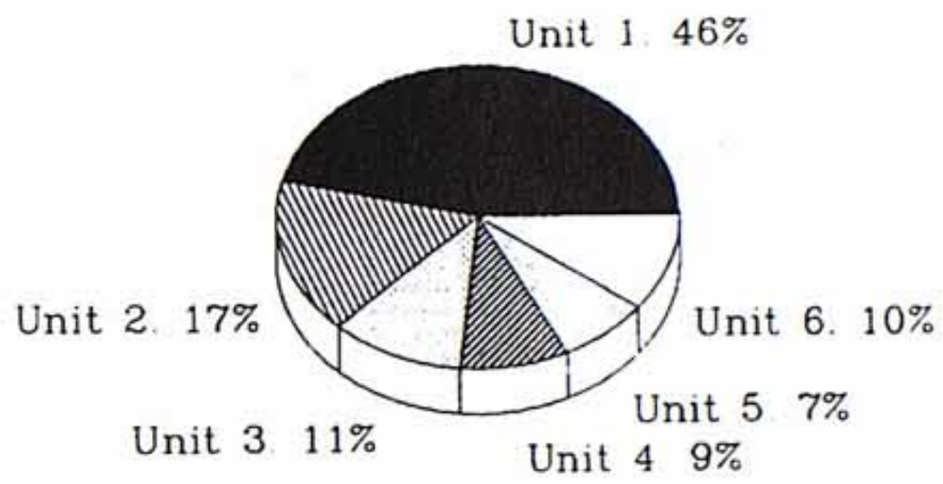
1


Unit 2. 92%
Unit 1. 1%
Unit 3. 8%

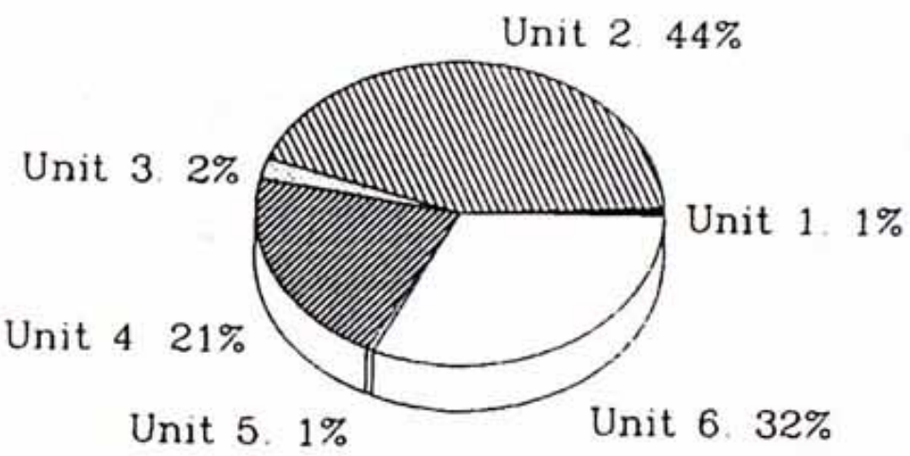
2


Unit 3. 6%
Unit 2. 7%
Unit 4. 10%
Unit 1. 21%
Unit 5. 8%
Unit 6. 48%

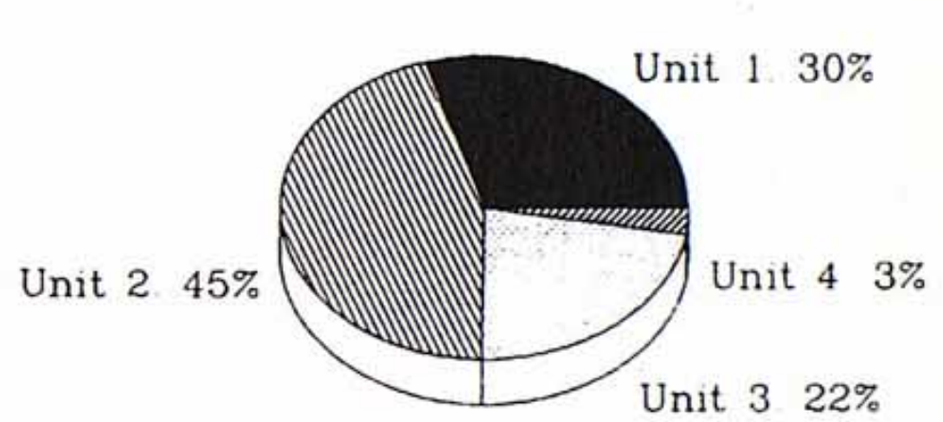
3


Unit 1. 46%
Unit 2. 17%
Unit 6. 10%
Unit 5. 7%
Unit 3. 11%
Unit 4. 9%

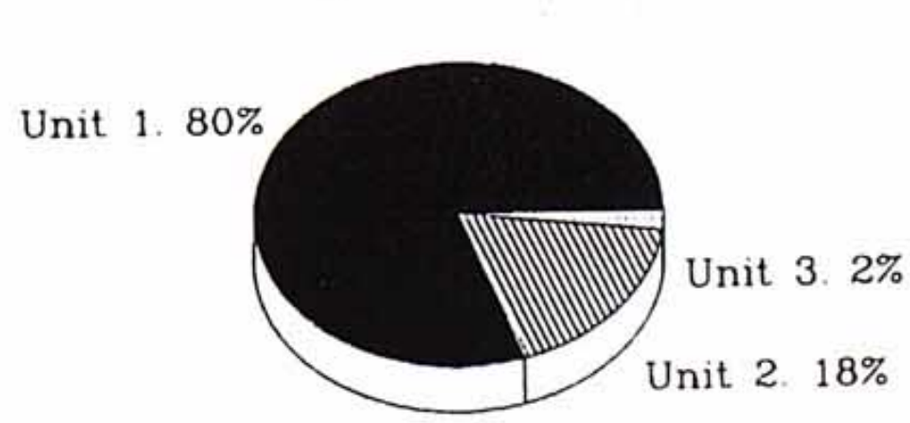
4


Unit 2. 44%
Unit 3. 2%
Unit 1. 1%
Unit 4. 21%
Unit 5. 1%
Unit 6. 32%

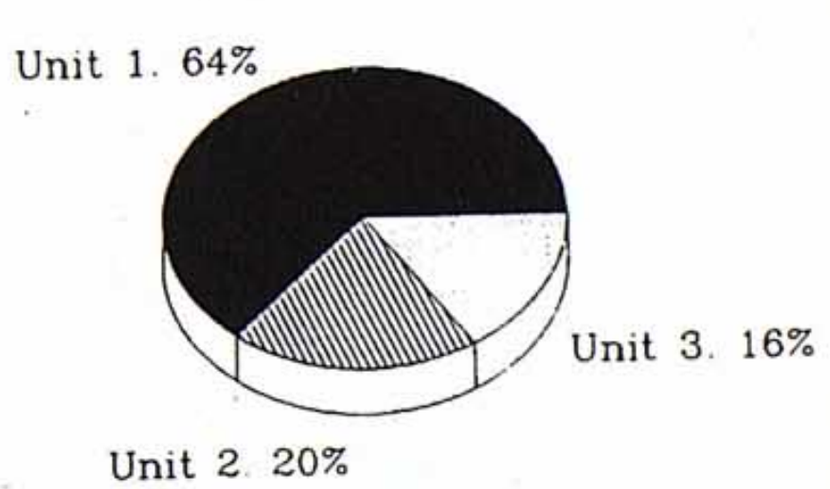
5


Unit 1. 30%
Unit 2. 45%
Unit 4. 3%
Unit 3. 22%

6


Unit 1. 80%
Unit 3. 2%
Unit 2. 18%

7


Unit 1. 64%
Unit 3. 16%
Unit 2. 20%

8

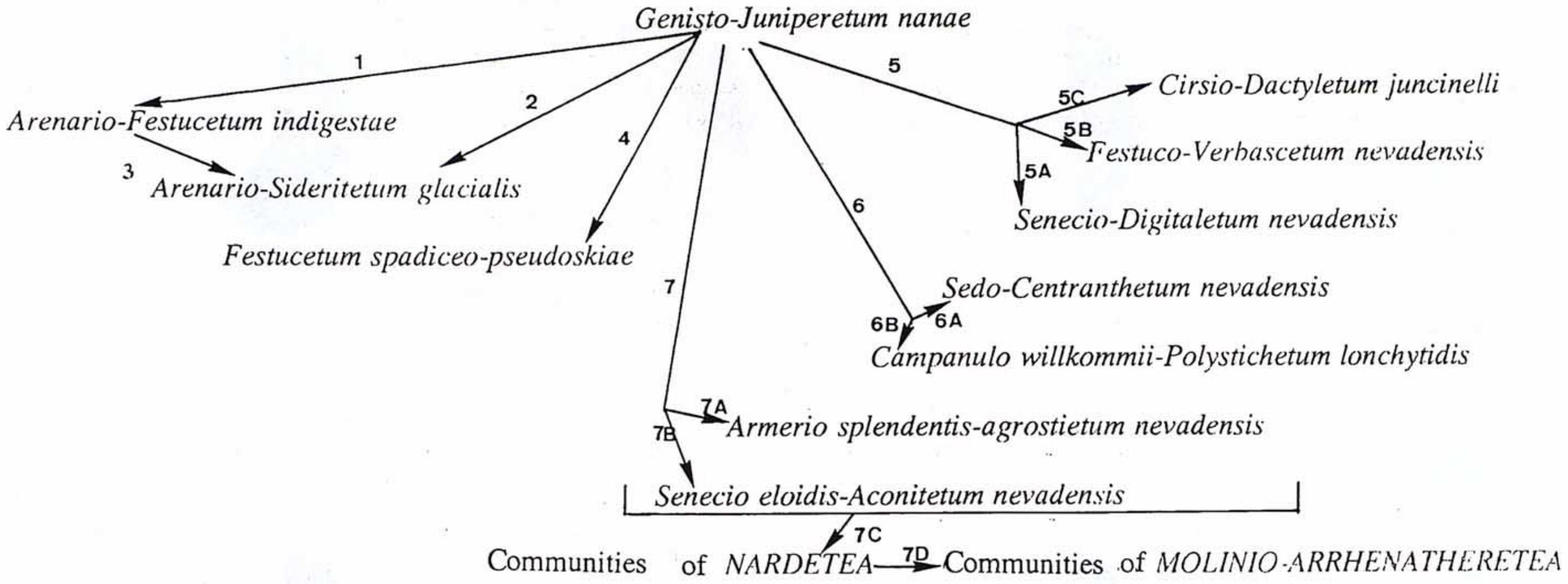


Fig. 4. Dynamic sheme of *Genisto versicoloris-Junipereto nanae:* 1, Alteration of the pulvinular chamaephytes communities, erosion slightly accented and deep soils. 2, Alteration and high erosion (permanent vegetation in cold places and on mountain peaks). 3, Alteration and soil losses. 4, Steep slopes and sunny exposures. Special situations: 5, Sal ammoniac increasing (grazing, soil movement, etc.). 5a, Steep scree slopes. 5b, Slightly sloping broken soils. 5c, Very steep banks normally not slopy; Ammonia salt enrichment. 6, Vertical rock cliffs. 6a, The lower levels of the oro-Mediterranean bioclimatic zone in sunny exposures. 6b, Upper levels of oro-Mediterranean bioclimatic zone in shady exposures. 7, Damp increasing. 7a, Inconstant damp. 7b, Inconstant damp and low nitriphication. 7c, Nitriphication increase (grazing). 7d, Constant damp. 7e, Wet ground.

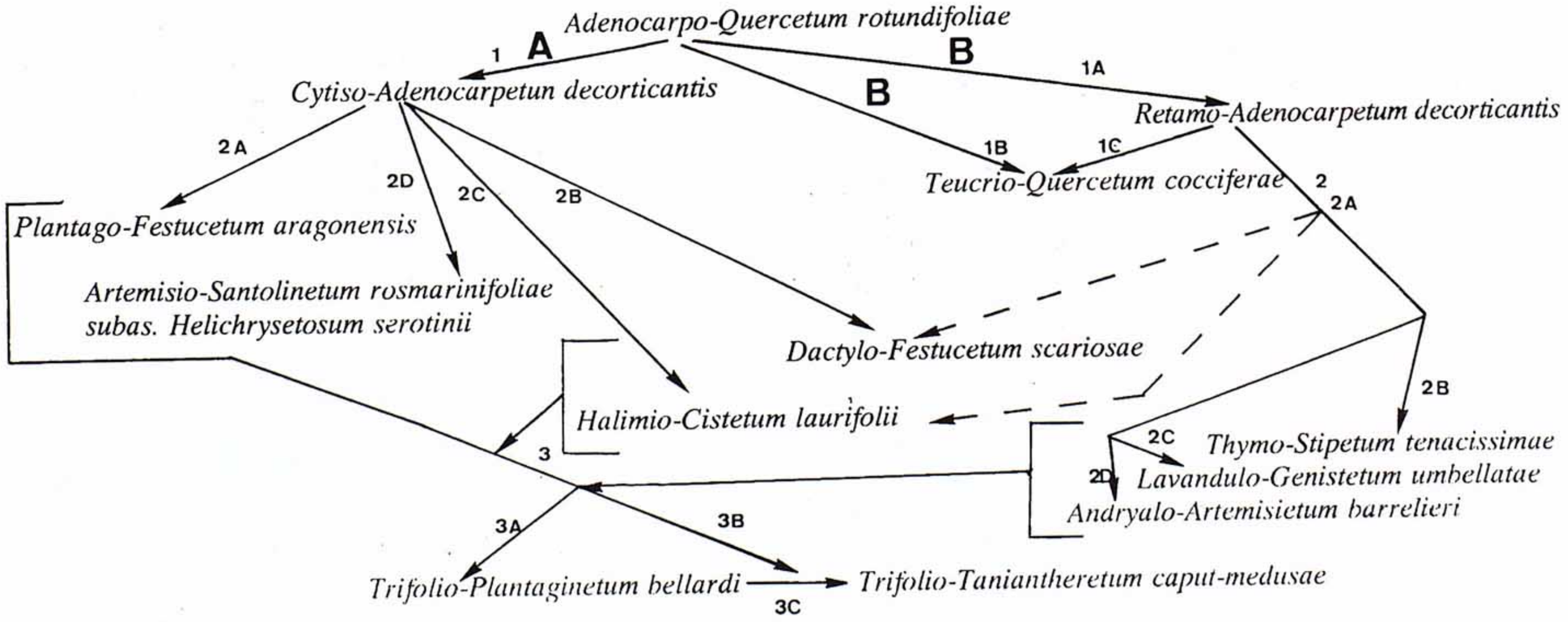


Fig. 5: *Dynamic scheme of Adenocarpo decorticantis-Querceto rotundifoliae*. A, Supra-mediterranean faciation with *Adenocarpus decorticans*: 1, Holm-oak wood degradation. 2, Subserial Shrub degradation. 2a, On skeletal soils. 2b, Ammonia salt enrichment. 2c, Soft soils. 2d, Medium-depth soils. 3, Serial scrub degradation. 3a, Therophytic pasture. 3b, Subnitrophilous pasture. 3c, Ammonia salt enrichment. B, Meso-mediterranean faciation with *Retama sphaerocarpa:* 1, Holm-oak wood degradation. 1a, ETP normal conditions. 1b, Partial degradation and ETP increase, in nearly semiarid ombroclimatic conditions. 2, Subserial Shrub degradation. 2a, Upper horizon of meso-Mediterranean bioclimatic belt and nearly subhumid conditions. 2b, Soft soils. 2c, Medium-depth soils. 2d, Ammonia salt enrichment. 3, Serial scrub degradation 3a, Therophytic pasture. 3b, Subnitrophilous pasture. 3c, Ammonia salt enrichment.

2, The most represented series in the study area (see Diagram 1) is *Adenocarpo-Querceto rotundifoliae*, with 44% (two faciations); the least represented is *Bupleuro-Pistacieto lentisci*, with 2%.

3, From the current-vegetation map and the various diagrams the following conclusions may be drawn:

a, The potential vegetation has been quite significantly disturbed in most of the series, with no climax representations in many of them.

b, The most extensive communities are the holm-oak communities mixed with shrubby and scrub communities belonging to the series *Adenocarpo-Querceto rotundifoliae* (21% in the faciation with *Adenocarpus decorticans* and 46% for the faciation with *Retama sphaerocarpa*). At the opposite extreme we find the scant representation of holm-oak communities in the *Berberido-Querceto rotundifoliae series* (1%) and *Paeonio-Querceto rotundifoliae* (1%). In the lower-lying areas this may be attributed to the disturbance suffered because of intensive cultivation, and in the other areas because of poor soils, which would probably never be able to support dense tree cover.

c, The reforested pine with scrub communities are quite abundant, representing almost 50% of the extension in some of the series.

d, Abandoned crops accounted for 22% of the total in the *Rhamno-Querceto coccíferae* series. If this result is combined with observations about the dynamics involved, it suggests that the abandonment of crops and the erosion processes that occur when the soil is bare of vegetation are the main causes of the advance of desertification.

f, There are significant representations of very interesting formations such as the oro-Mediterranean pulvinular chamaephytes scrub and pastures and subdesert thyme scrub.

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