

## Altitudinal pattern of vegetation variation on Tenerife

Fernández-Palacios, José María & de Nicolás, Juan Pedro

Departamento de Ecología, Universidad de La Laguna, 38206 Tenerife, Islas Canarias, España;  
Tel. +34 22 603733; Fax +34 22 253344

**Abstract.** The variation in structure and floristic composition of the vegetation of Tenerife is related to different environmental factors. 200 sample plots, stratified according to altitude, exposure to wind, kind and age of parent rock, inclination and degree of disturbance were analysed throughout the island. The resulting data were analysed using univariate statistics (altitudinal distribution profiles of the more frequent species) and multivariate methods (Correspondence, Cluster and Pattern Analysis).

Altitude, exposure to wind and, to a lesser extent, disturbance were found to be the major determinants of vegetational variation, whereas parent rock and inclination were less important. Ordination results show a continuum in structural and floristic variation of the vegetation with species distributions varying continually along the altitudinal gradient. Nevertheless, altitudinally bound plant community types were recognized with Cluster Analysis. Vegetational discontinuities, which were also detected by pattern analysis, are more evident on the windward slope of the island; they have been attributed to the existence of a major underlying environmental discontinuity - the 'cloud sea' - which is associated with a climatic inversion. On the leeward slope, beyond the influence of the cloud sea, discontinuities are less evident and vegetational variation seems to be closer to a coenocline, i.e. a vegetational continuum.

**Keywords:** Canary Islands; Cloud sea; Coenocline; Environmental determinant; Vegetation belt.

**Nomenclature:** Hansen & Sunding (1985).

### Introduction

The between-island floristic variation in the Macaronesian region (Azores, Madeira, Canaries and Cape Verde) is related to three major environmental components: latitude, degree of isolation and island altitude respectively (de Nicolás et al. 1989). In this context, Tenerife is the Macaronesian island with the best conditions for studying the environmental determinants governing the variation in floristic composition and structure of the vegetation: (1) its vegetation cover is rather well conserved; (2) its altitudinal gradient is long and well-developed; (3) it has well-defined slope types; (4)

there is a large lithological and chronological variation in bedrock; and (5) it has been studied by many biologists ever since Alexander von Humboldt's stay on the island, almost 200 yr ago (Pérez de Paz 1982).

The general recognition of clearly defined altitudinal vegetation belts on Tenerife (von Humboldt & Bonpland 1814; Webb & Berthelot 1840; Ceballos & Ortuño 1951; Wildpret & Arco 1987) does not necessarily imply the discontinuous nature of altitudinal variation. The altitudinal limits of a vegetation belt do not coincide with the limits of the plant community involved, nor with the limits of the plant species defining them. Most plant species are rare, but present at the lower and upper ends of their bell-shaped distribution along the altitudinal gradient. In these marginal zones with low species performance, the landscape is not characterized by these species, hence the name of the vegetation belt has a different origin. The difference in altitudinal limits between *Pinus canariensis* and *P. canariensis* forest on Tenerife illustrates this phenomenon.

Less conspicuous species, which do not characterize the landscape, may have different distribution limits participating in two or more consecutive altitudinal vegetation belts. Conversely, different plant communities may be distinguished in the same vegetation belt, although from a physiognomic point of view there is no major change in the landscape. Thus, any boundaries between communities should be documented with analyses which give the same weight to all species constituting the vegetation and not only to the more conspicuous ones.

In this framework, the objectives of the present work are: (1) to elucidate the major environmental determinants of floristic and structural variation of the vegetation of Tenerife; (2) to recognize and characterize the plant community types along the altitudinal gradient as to their distribution and floristic composition, and (3) to interpret the environmental basis of vegetation response patterns along the altitudinal gradient, while considering whether the individualistic model of vegetational variation (Gleason 1926; Whittaker 1970) must be rejected.

## Study area

Tenerife, measuring 2058 km<sup>2</sup>, is the largest Macaronesian island. It has a triangle-based pyramid shape with a truncated apex at an altitude of 2000 m in Las Cañadas, from which the volcano Teide, the highest peak of this region rises to 3718 m. This peculiar form, together with the predominating NE trade winds, has given rise to the establishment of two entirely different slope types: the windward N slope and the leeward SE-SW slope. At higher altitudes, the summit can be distinguished as a third zone beyond the influence of the trade winds.

Tenerife, like the other Macaronesian islands, is of volcanic origin; its oldest rocks (the Anaga and Teno massives in the NE and NW corners, respectively) are estimated to be more than 6.5 million yr old (Ancochea et al. 1990). Vulcanism is still active with several eruptions during the last 500 yr, the most recent - Volcán de Chinyero - in 1909.

The main environmental feature of Tenerife arises from the existence of a thermic inversion separating a lower layer of humid, cool air from a higher layer of dry, warm air at ca. 1200 m a.s.l. Due to this inversion the orographic ascension of moist air masses carried by the trade winds is prevented. Above the inversion the air is warmer and thus more stable, leading to a lower dew point temperature which implies the accumulation of clouds below the inversion level. This phenomenon, which is quite frequent on the windward slope of the island, is locally known as 'mar de nubes' (cloud sea). The altitudinal limits of this cloud sea change throughout the year, reaching the highest elevation in winter (Huetz de Lemps 1969).

## Methods

200 sample plots of 10 m × 10 m were located throughout the island according to a stratified sampling strategy, based on combinations of several environmental classes defined according to (1) altitude: belts of 100 m, (2) exposure to wind: windward slope, leeward slope and summit, (3) parent rock type: basalts and phonolites - and age: younger and older than 10 000 yr, (4) floor inclination: 0-15°, 15-30° and 30-45°, and (5) degree of disturbance of the stand: little disturbed and dominated by climax species, moderately disturbed and dominated by non-climax species but with climax species present, and highly disturbed without climax species.

Each combination of environmental classes present on Tenerife was represented by at least one plot, but more plots were selected for combinations covering large areas. For each plot the performance of the vascu-

lar plant species was measured as density, cover and biovolume (cover × mean height). Full information provided in Fernández-Palacios (1987) is available upon request.

The altitudinal distribution of the more frequent species was analysed by univariate statistics. The analysis was performed independently for both the windward and the leeward slopes of the island. Frequency values of each species - calculated as number of plots with the species present relative to all the plots within each altitudinal interval - were plotted against altitude.

In order to differentiate between the existing vegetation belts multivariate methods were used. As a general approach to relating the floristic and structural variation of the vegetation with environmental variation, Canonical Correspondence Analysis (CCA) as included in the CANOCO package (ter Braak 1987), was applied using plant cover as the primary variable. The hierarchical polythetic divisive classification method TWINSpan (Hill 1979) was considered to be an effective way to confirm or reject the validity of the plant communities traditionally described for the island. It was applied on a presence-absence matrix. For the entire data set the division process was stopped at the sixth division level, and for each group when it included fewer than 20 plots.

Finally, in order to determine if the clusters created by TWINSpan were artefacts or real groups, a pattern analysis, based on the similarity variation between equidistant plots (de Nicolás et al. 1980), was carried out. The plots were divided into windward and leeward groups and subdivided in 100-m altitudinal classes. Southern slope localities with an exceptional incidence of the cloud sea - as in Ladera de Güímar - were left out of consideration. Mean floristic similarity (Jaccard coefficient) between ten randomly selected pairs of plots located 100 m below and above each altitudinal level was calculated and plotted against altitude. Continuity in floristic variation is expected to appear in the graph as a horizontal line, whereas discontinuities should appear as either peaks - indicating floristically homogeneous zones - or valleys, floristic heterogeneities.

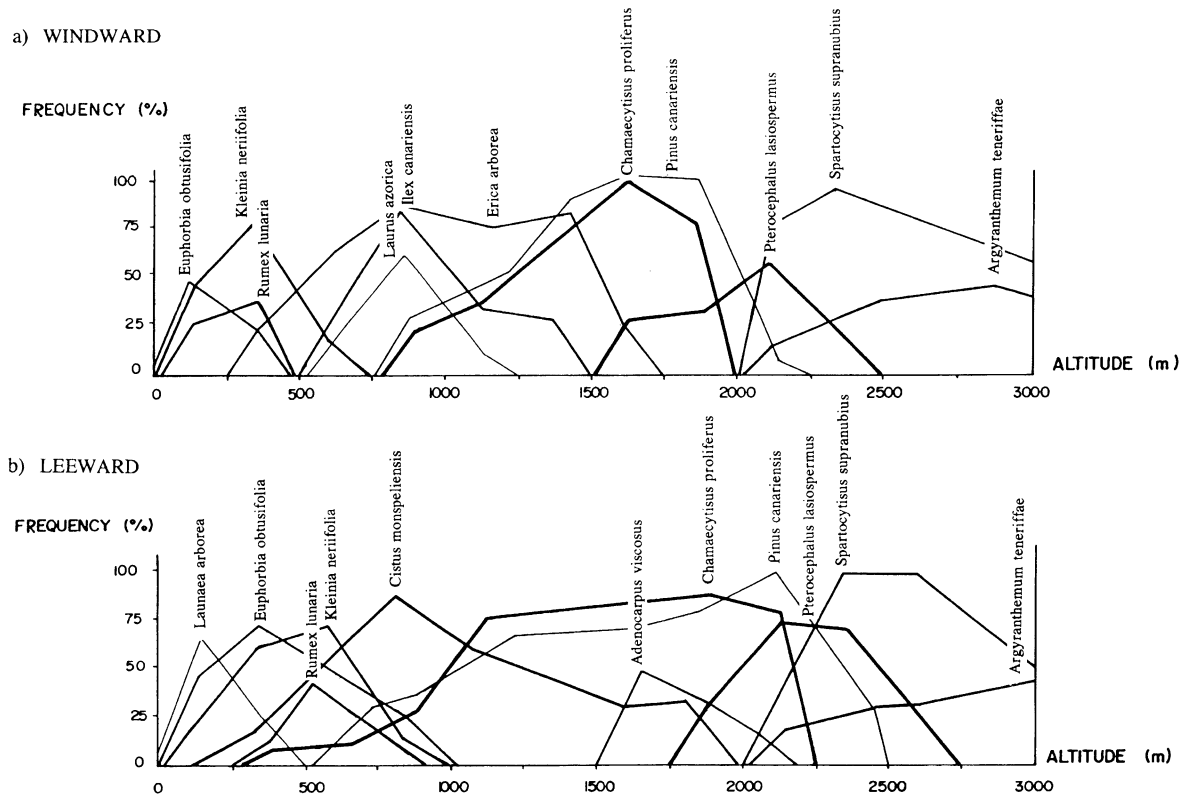


Fig. 1. Altitudinal distribution of some frequent plant species on (a) the windward slope and (b) the leeward slope of the island.

## Results

Fig. 1 represents the altitudinal profiles of some selected species with a high frequency. Both on the windward (a) and the leeward (b) slopes, the general picture is that of overlapping bell-shaped curves along the altitudinal gradient. Fig. 2 represents the biplot scores of the environmental variables introduced in the analysis. Altitude is positively correlated with the first ordination axis, and exposure to wind is negatively correlated with the second ordination axis. The disturbance degree occupies an intermediate position, whereas neither parent rock nor floor inclination appear to be significant factors of vegetation variation.

Fig. 3 shows the projection of the frequent species in the diagram of the first two CCA axes, which together account for more than 50 % of the total variance. The hierarchical division of plant communities obtained by TWINSpan resulted in 11 end-groups, A-K, at the sixth division level; they have been plotted on the CCA diagram (Fig. 2) and ecologically characterized (App. 1). Finally, the pattern analysis (Fig. 4) showed low similarity values but resulted nevertheless in the distinction of certain altitudinal zones and the existence of boundaries between the communities.

## Discussion

The role of altitude and exposure to wind as major environmental determinants of the variation in vegetation on Tenerife (Fig. 2), as recognized early by classical authors, was confirmed. Both are geographical factors with well-known underlying climatic variation patterns.

Altitudinal variation is supposed to lead to variation in temperature; on Tenerife the mean annual temperature shifts from 22°C at the south coast up to ca. 2°C at the Teide Peak. With decreasing temperature the frequency of frost events increases (Höllermaun 1978). Furthermore, altitudinal variation implies variation in relative humidity and radiation values, and hence in evapotranspiration rates (Leuschner & Schulte 1991).

On the other hand, variation in exposure to wind, at least on islands with high mountains within the influence of the trade winds, implies variation in moisture and radiation. The occurrence of woody heath and cloud forest on the NE windward slopes is a function of both the summer drought of the mediterranean-type climate of the Canaries and the counteracting effect of the local fog-drip due to the cloud sea (Höllermaun 1981). A frequent and intense fog-drip effect occurs locally along

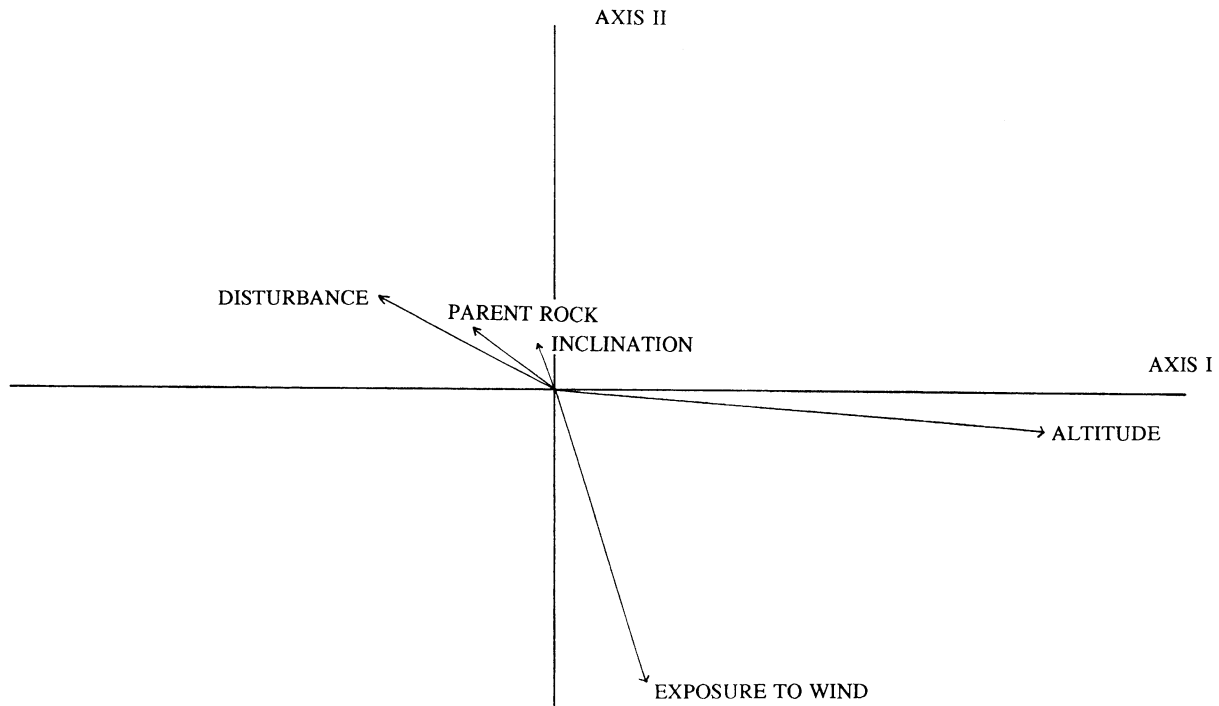


Fig. 2. Biplot scores of the environmental variables introduced into the CCA.

mountain crests and on wind-exposed sites, with a considerable amount of fog precipitation (Kämmer 1974). Above and below the cloud sea layer on the windward slope, vegetation suffers from hydric stress, which is stronger on the leeward slope, beyond the influence of the cloud sea, where the sub-desert scrub is replaced by the pine forest.

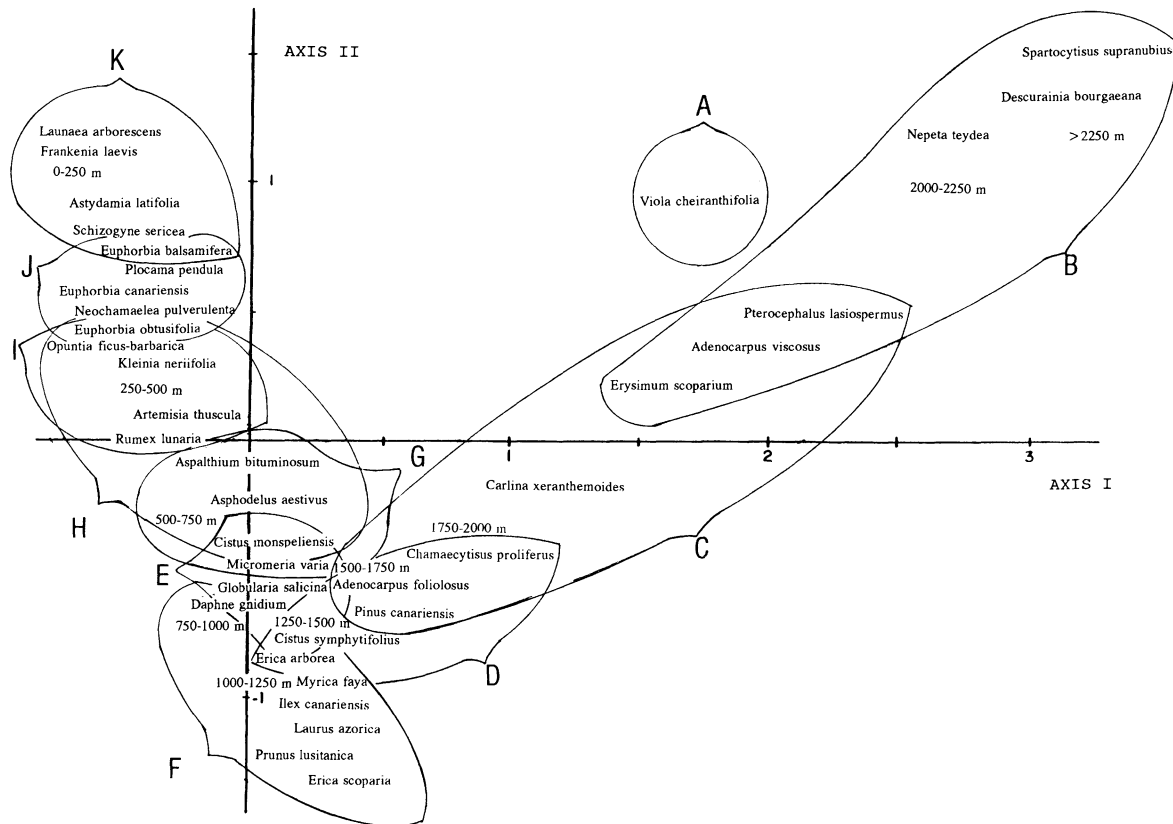
Disturbance has a homogenizing effect on the model of vegetation variation described above. Stands belonging to different altitudinal or wind-exposure classes, but sharing a certain degree of disturbance – as evidenced by the performance of species such as *Opuntia ficus-barbarica*, *Cistus monspeliensis*, *Asphodelus aestivus* and *Aspalathium bituminosum* – have been grouped together in the classification analysis. This effect is due to the larger distribution amplitudes of the generalistic species (cf. Fig. 1) when compared with specialist ones. Nevertheless, it is also important to consider the absence of heavily disturbed areas at high altitudes (> 1500 m) of the island.

Neither lithological composition nor age seem to play an important role in the variation of the vegetation. Although the existence of some species exclusively related to special lithological conditions (Burchard 1929) such as phonolitic doms, has been reported, for islands as a whole such events are unimportant.

Finally, the inclination of the surface was found to be irrelevant at least up to 45°. It is nonetheless a fact that when the slope is steep enough, perhaps more than 70°, it leads to the existence of especially adapted bare cliff communities (Santos 1983).

The approximately bell-shaped curves shown in Fig. 1 by some of the more frequent species of the island, as well as the fact that their centres of distribution seem to overlap along the altitudinal gradient, argue in favour of the continuous nature of vegetation variation. Within this framework, our results seem to be closer to Gleason's individualistic continuum concept in which species optima and limits are independently distributed along the environmental gradient, than to Goodall's regular replacement model or Gauch and Whittaker's 'major' species replacement model. In the latter 'major' species are regularly distributed with optima evenly spaced along the gradient and 'minor' species independently distributed (Austin 1990).

A remarkable difference between windward and leeward graphs deals with the distribution of *Laurus azorica*, *Ilex canariensis* and *Erica arborea*, cloud forest trees which are restricted to the middle area (500–1500 m) of the windward slope. This altitudinal range in the leeward slope is in part occupied by *Cistus monspeliensis*, a wide-range shrub, with an optimum at ca. 800 m, and



**Fig. 3.** Projection of frequent species in the diagram of the first two CCA axes, with eigenvalues of 0.853 and 0.604, accounting for 31.7 % and 22.4 % of the total variance, respectively. Position of the TWINSpan end-groups A - K indicated.

by the altitudinal shift of some coastal shrubs: *Euphorbia obtusifolia*, *Kleinia neriifolia* and *Rumex lunaria*, or mountain trees: *Chamaecytisus proliferus* and *Pinus canariensis*, occurring on the windward slope as well.

The continuous variation of vegetation is also supported by the results of the correspondence analysis (Fig. 3), where a continuum in the floristic change with centres of the species distribution varying continually along the altitudinal gradient can be detected. Temperature shows a variation along the altitudinal gradient too, with the highest values at the coast (19 - 22 °C), mesic in the middle areas (12 - 15 °C) and the lowest at the summit (3 - 9 °C). On the other hand, precipitation reaches a maximum in the middle areas (1000 - 2000 mm), coinciding with the inflexion of the ordination diagram, decreasing strongly towards the coast (< 250 mm) and moderately towards the summit (< 500 mm).

It is therefore possible to speak about the existence of a hydric stress between middle areas and coast and a thermic stress between middle areas and summit. In this context, the altitudinal distribution of the plant species

on Tenerife can be interpreted in terms of their response pattern according to their degree of tolerance to both hydric and thermic stresses (Fernández-Palacios 1992).

Nevertheless, results of the divisive classification recognizes the existence of 11 communities at the sixth level of division. All of them have been traditionally recognized, with the exception of the summit pine forest, which is closely related to the summit scrub, due to the number of species shared, but still with the presence of *Pinus* as landscape definer. The ecological characterization of these communities in terms of their tolerance to climatic stress and disturbance, as well as their indicator species, is given in App. 1.

The altitudinal limits between the communities recognized by the cluster analysis are, in general terms, confirmed by pattern analysis. This suggests that the detection of those communities cannot be attributed to an artifact. In fact, the limits recognized by pattern analysis largely matched with those appearing when the distribution of the communities obtained by the TWINSpan analysis were delimited on a map of the island

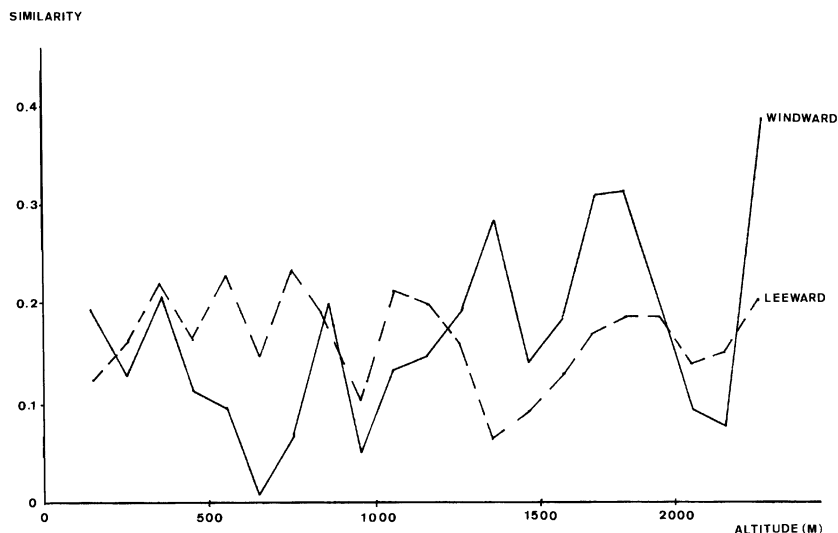


Fig. 4. Variation in mean floristic similarity (Jaccard coefficient) along the altitudinal gradient between random samples of plots located 100 m below and above each altitudinal value.

(Fernández-Palacios in press). Nevertheless, the relief of the windward landscape is much stronger than the leeward one, arguing in favour of slower floristic turnover on the leeward slope.

The recognition of different altitude plant communities on the windward slope of the island could be associated with the existence of strong environmental discontinuities in the altitudinal distribution of temperature, precipitation, radiation, and moisture (Marzol et al. 1988). These factors are largely controlled by the incidence of the cloud sea and by its thickness and altitudinal location throughout the year (Kämmer 1974). The cloud sea shows clear altitudinal limits, the lower one governed by the condensation level, i.e. the altitudinal location of the dew point temperature, just below the clouds, and the upper one by the altitudinal location of the thermic inversion, on top of the clouds (Pineda 1989).

Thus it is possible to recognize four different zones on the windward slope with respect to the cloud sea, each with a specific vegetation type:

- below the cloud sea range: subdesert scrub;
- always inside the cloud sea range: laurel forest and *Erica-Myrica* heath;
- occasionally inside the cloud sea range: pine forest;
- above the cloud sea range: summit pine forest, summit scrub and peak vegetation.

All these zones have specific conditions which are not always well represented by the classic climatic diagrams.

On the leeward slope, the absence of the cloud sea provides environmental conditions closer to a continuum and the altitudinal limits of the plant communities are

not easily detected; here we approach a coenocline (*sensu* Whittaker 1975), as shown in the pattern analysis (Fig. 4). Nevertheless, on both slopes, significantly more plots are located below 1500 m than there are above 1500 m. New field data, mainly from high altitudes, are needed in order to confirm or reject this trend.

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## References

- Ancochea, E., Fuster, J.M., Ibarrola, E., Cendrero, A., Coello, J., Hernán, F., Cantagrel, J.M. & Jamond, C. 1990. Volcanic evolution of the island of Tenerife (Canary Islands) in the light of new K-AR data. *J. Volc. Geotherm. Res.* 44: 231-249.
- Austin, M.P. 1990. Community Theory and Competition in Vegetation. In: Grace, J.B. & Tilman, D. (eds.) *Perspectives in Plant Competition*, pp. 215-238. Academic Press, San Diego, CA.
- Burchard, O. 1929. *Beiträge zur Ökologie und Biologie der Kanarenpflanzen*. Bibl. Bot. 98. Schweizerbart, Stuttgart.
- Ceballos, L. & Ortuño, F. 1951. *Vegetación y flora forestal de las Canarias occidentales*. Instituto Forestal de Investigaciones y Experiencias, Madrid.
- de Nicolás, J.P., Galiano, E.F. & Quintas, M.A.G. 1980. Análisis de la microestructura espacial de la vegetación de los pastizales. *Studia Oecol.* 1: 109-130.
- de Nicolás, J.P., Fernández-Palacios, J.M., Ferrer, F. & Nieto,

- E. 1989. Inter-island floristic similarities in the Macaronesian region. *Vegetatio* 84: 117-125.
- Fernández-Palacios, J.M. 1987. *Análisis de la variación ambiental de la vegetación de Tenerife e interpretación en términos ambientales*. Tesis Universidad de La Laguna, Tenerife.
- Fernández-Palacios, J.M. 1992. Climatic responses of plant species on Tenerife, The Canary Islands. *J. Veg. Sci.* 3: 595-602.
- Fernández-Palacios, J.M. In press. Environmental determinants of vegetation variation on Tenerife (Canary Islands). *Proc. 36th Symposium of the IAVS*. Serv. Public. Univ. La Laguna, Tenerife.
- Gleason, H.A. 1926. The individualistic concept of the plant association. *Bull. Torrey Bot. Club* 53: 7-26.
- Hansen, A. & Sunding, P. 1985. Flora of Macaronesia. Checklist of vascular plants. 3rd rev. ed. *Sommerfeltia* 1: 1-167.
- Hill, M.O. 1979. *TWINSPAN - a FORTRAN Program for arranging multivariate data in an ordered two-way table classification of the individuals and attributes*. Ecology and Systematics, Cornell University, Ithaca, New York, NY.
- Höllermann, P. 1978. Geoecological aspects of the upper timberline in Tenerife, Canary Islands. *Arct. Alp. Res.*, 10: 365-382.
- Höllermann, P. 1981. Microenvironmental studies in the Laurel forest of the Canary Islands. *Mount. Res. Dev.* 1: 193-207.
- Huetz de Lemps, A. 1969. *Le climat des Iles Canaries*. Faculté des Lettres et des Sciences Humaines de Paris-Sorbonne, Paris.
- Kämmer, F. 1974. Klima und Vegetation auf Tenerife, besonders im Hinblick auf den Nebelniederschlag. *Scripta Geobot.* 7: 1-78.
- Leuschner, C. & Schulte, M. 1991. Microclimatological investigations in the Tropical Alpine Scrub of Maui, Hawaii: Evidence for a drought-induced Alpine Timberline. *Pacif. Sci.* 45: 152-168.
- Marzol, M.V., Rodríguez, J., Arozena, M.E. & Luis, M. 1988. Rapport entre la dynamique de la mer de nuages et la végétation au Nord de Ténérife (I. Canaries). *Publ. Assoc. Inter. Climat.* 1: 273-283.
- Pérez de Paz, P.L. 1982. *Perspectiva histórica de los últimos 50 años de la Botánica en Canarias*. Instituto de Estudios Canarios, 50º Aniversario, Tomo I: 295-340.
- Pineda, F. D. 1989. *Ecología I. Ambiente físico y organismos vivos*. Síntesis, Madrid.
- Santos, A. 1983. *Vegetación y flora de La Palma*. Interinsular Canaria, Santa Cruz de Tenerife.
- ter Braak, C.J.F. 1987. *CANOCO - a FORTRAN Program for Canonical Community Ordination by [Partial] [Detrended] [Canonical] Correspondence Analysis, Principal Components Analysis and Redundance Analysis*. Agriculture Mathematics Group, Wageningen.
- von Humboldt, A. & Bonpland, A. 1814. *Relation historique du Voyage aux régions équinoxiales de Nouveau Continent, fait en 1799-1804 par A. de Humboldt et A. Bonpland*. Vol. 1. Paris.
- Webb, P.B. & Berthelot, S. 1840. *Histoire naturelle des Iles Canaries*. Tome III. Premier partie. Geographie Botanique. Béthune, Paris.
- Whittaker, R.H. 1970. The population structure of vegetation. In: Tüxen, R. (ed.) *Gesellschaftsmorphologie*, pp. 39-59. Junk, The Hague.
- Whittaker, R.H. 1975. *Communities and ecosystems*. 2nd ed. Macmillan, New York, NY.
- Wildpret, W. & Arco, M. 1987. España insular: Las Canarias. In: Peinado, M. & Rivas Martínez, S. (eds.) *La vegetación de España*, pp. 517-544. Serv. Public. Univ. Alcalá de Henares, Madrid.

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**App. 1.** Ecological characterization of the TWINSPAN end groups.

End-group	Indicator species	Ecological characterization
A	<i>Viola cheiranthifolia</i>	Peak vegetation. Inconspicuous community of Teide peak, above 3000 m altitude. Intense thermic ( $T < 5^{\circ}\text{C}$ with common frosts) and hydric ( $P < 300$ mm, mainly as snow) stress.
B	<i>Spartocytisus supranubius</i> <i>Descurainia bourgaeana</i> <i>Adenocarpus viscosus</i> <i>Pterocephalus lasiospermus</i>	Summit scrub. High-mountain cushion-like (1-2 m tall) scrub community between from ca. 2200 m leeward and 2000 m windward, up to 3000 m. Dominated by <i>Spartocytisus</i> and growing under intense thermic ( $T$ 5-10 $^{\circ}\text{C}$ with likely frost as well as wide daily thermic amplitude) and moderate hydric ( $P$ ca. 500 mm, mainly as snow) stress.
C	<i>Pinus canariensis</i> <i>Chamaecytisus proliferus</i> <i>Carlina xeranthemoides</i> <i>Pterocephalus lasiospermus</i> <i>Adenocarpus viscosus</i>	Summit pine forest. Open and low forest (canopy ca. 10 m) dominated by <i>Pinus</i> with common elements of the summit scrub, extending above ca 1800 m on both slopes up to the timberline. Subject to less severe climatic conditions than the summit scrub, but still prone to frost.
D	<i>Pinus canariensis</i> <i>Chamaecytisus proliferus</i> <i>Adenocarpus foliolosus</i> <i>Cistus monspeliensis</i> <i>Erica arborea</i>	Pine forest. Tall forest (canopy ca. 30 m) dominated by <i>Pinus</i> growing on both slopes below 1800 m down to ca. 1300 m at the windward and ca. 700 m at the leeward slopes. Subject to moderate thermic stress, with possible frost. Subject to a high variability of precipitation, the windward pine forest is humid, and the leeward one drier. It is an oligospecific community with the largest biomass of the island.
E	<i>Ilex canariensis</i> <i>Erica arborea</i> <i>Cistus monspeliensis</i> <i>Cistus symphytifolius</i>	Xeric <i>Erica-Myrica</i> heath. Singular community closely related to the unique windward zone of the South slope (Ladera de Güimar) with the characteristic elements of the normal heath - included in 'monteverde' such as <i>Erica</i> , <i>Myrica</i> or <i>Ilex</i> , plus other species with xeric affinities like both <i>Cistus</i> species.
F	<i>Ilex canariensis</i> <i>Laurus azorica</i> <i>Myrica faya</i> <i>Erica arborea</i> <i>Daphne gnidium</i>	'Monteverde', including both (canopy 20-30 m) laurel forest and (2-5 m tall) <i>Erica-Myrica</i> woody heath ('fayal-brezal'). Closely related to windward midlands (ca. 600-1200 m), the contact zone of the cloud sea, due to the NE trade winds. These communities grow under suitable conditions ( $T$ 13-15 $^{\circ}\text{C}$ and $P > 1000$ mm + fog-drip), and are thus not subject to any climatic stress. Zone with highest Net Primary Production of the island.
G	<i>Cistus monspeliensis</i> <i>Chamaecytisus proliferus</i> <i>Aspalathium bituminosum</i>	'Jaral'. Immature (1 m tall) scrub community dominated by the mediterranean <i>Cistus monspeliensis</i> , distributed at different altitudes on both slopes; constitutes a disturbed phase of the potential pine forest.
H	<i>Opuntia ficus-barbarica</i> <i>Euphorbia obtusifolia</i> <i>Cistus monspeliensis</i> <i>Kleinia neriifolia</i> <i>Artemisia thuscula</i>	Vegetation complex of disturbed communities constituting transitional communities between 'jaral' (end-group G) and tabaibal amargo (end-group I). Distributed largely on leeward slopes close to urban areas.
I	<i>Euphorbia obtusifolia</i> <i>Opuntia ficus-barbarica</i> <i>Periploca laevigata</i> <i>Artemisia thuscula</i>	'Tabaibal amargo'. Disturbed phase of the sub-desert coastal scrub, with <i>Opuntia ficus-barbarica</i> and <i>Euphorbia obtusifolia</i> as dominants. Present on both slopes.
J	<i>Euphorbia balsamifera</i> <i>Euphorbia canariensis</i> <i>Plocama pendula</i> <i>Launaea arborescens</i>	'Tabaibal-cardonal'. Sub-desert coastal (1-2 m tall) scrub, dominated by <i>Euphorbia balsamifera</i> and <i>E. canariensis</i> occupying the low zones of windward (up to 300 m) and leeward (up to 600 m) slopes. Prone to intense hydric stress ( $P < 250$ mm in less than 15 rainy days per year) and with the highest values of species richness of the island.
K	<i>Frankenia laevis</i> <i>Euphorbia balsamifera</i> <i>Schizogyne sericea</i>	Halophilous coastal belt. Scattered, low (< 1 m tall) scrub community related to the sea, and thus distributed at sea level around the island and subject to high salt stress as well as zonal hydric stress.