A Classification of the Biogeographical Provinces of the World

By

Miklos D. F. Udvardy

Prepared as a Contribution to UNESCO's
Man and the Biosphere Programme
Project No. 8

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INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES
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FOREWORD

This report was prepared for IUCN by Professor Miklos D.F. Udvardy, California State University, Sacramento, California, and it is being submitted to UNESCO as part of IUCN's contribution to the UNESCO Man and the Biosphere Programme. This report is one of two submitted to UNESCO as part of UNESCO Contract No. 618.057. It is complementary to the report by Professor G. Carleton Ray, 'A Preliminary Classification of Coastal and Marine Environments', (IUCN 1975, Occasional Paper No. 14).

Many people have contributed material or suggestions which were used in preparation of this report. Among these contributors are Prof. A. Bannikov (USSR), Dr. G. Budowski (Latin America), Dr. K. Curry-Lindahl (World), Prof. A. de Vos (World), Prof. H. Ellenberg (Europe), Dr. E.J. Fittkau (Latin America), Dr. F.R. Fosberg (Oceania), Prof. W.A. Fuller (Canada), Dr. J.L. Gressitt (Oceania, Antarctica), Prof. O. Hedberg (Africa), Dr. H. Lamprey (Africa), Prof. M. Numata (Japan), Dr. D. Poore (Europe), Prof. H. Sjörs (Scandinavia), Prof. P. Vanzolini (South America) and Dr. C.K. Varshney (Southern Asia). Others, whose work has been of great importance, are listed in the bibliography. Mr. Charles S. Papp expertly prepared the Maps.

The report is the fourth progress report in a continuing effort to devise a satisfactory classification of the world's biotic areas for purposes of conservation. The first of these was 'Towards a System for Classifying Natural Regions of the World and their Representation by National Parks and Reserves' by R.F. Dasmann (Biol. Cons., 1972, 4: 247-255). This was followed by 'A System for Defining and Classifying Natural Regions for Purposes of Conservation' by R.F. Dasmann (IUCN, 1973, Occasional Paper No. 7) and 'Biotic Provinces of the World' by the IUCN Secretariat (IUCN, 1974, Occasional Paper No. 9).

The following paper represents a marked departure from the first three. In terminology, Biogeographical Realm is used in place of the Biogeographical Regions and Subregions of the early papers; Biogeographic Province replaces Biotic Province. The reasons for these changes are presented by Professor Udvardy in the report and appear sufficient to warrant this revision. Further changes of a major nature occur in the division of the world's terrestrial and freshwater lake biota into 8 realms in place of the earlier 7 biogeographical regions. Oceania is given realm status, the Antarctic is extended to include New Zealand, the Australian contracted to Australia-Tasmania and coastal islands, the Palaearctic and Nearctic are extended southward. New names, Africotropical and Indomalayan, replace Ethiopian and Oriental. A major revision of the earlier biotic provinces of the Neotropics and Palaearctic is presented along with more minor changes in the other realms. All of these changes appear, in this writer's view, to improve the system and increase its accuracy. It must be emphasized, however, that Professor Udvardy does not pretend to have presented any final answer to the problem of biogeographical classification. The process must continue and can best be advanced by those with detailed knowledge of local floras and faunas. Their assistance in this continuing study will be most welcome.

R.F. Dasmann

CONTENTS

INTRODUCTION

The plant and animal world occurs within the biosphere of the earth in the form of an intertwined network of individuals, populations, and interacting systems. To be able to view them in a systematic way, the biologist may use the following approaches:

(1) Taxonomic order, based on similarity or difference of characters of definable individual entities: individuals, clones, phena, etc. The living world is thus classified into four basic groups or 'kingdoms': viri, protists, plants, and animals (cf. Dodson 1971) and members of each of these are ranked into hierarchial systems.

(2) Ecological order, based on interrelations. Interacting, inter- or co-dependent systems are discerned, consisting of a number of individual entities belonging to different taxa. These ecological systems, or ecosystems, are then classified according to some guiding principle, e.g., similarity, common historical origin, or both combined.

(3) Phylogenetic order, based on origins and history. Since the prevailing general foundation of organismic biology is the evolutionary thesis, ordering may be accomplished by recognizing the historical ties and the degree of relationships of the entities of the biota with respect to common ancestors. If the phylogenetic tree of the world's biota were known, no separate taxonomic approach would be needed.

More and more biologists realize that ecosystems also have their phylogenies; thus, theoretically, approach (2) could also be made phylogenetic.

(4) Biogeographic order. The above entities each have a spatial element, thus grouping on geographic or palaeogeographic basis is also possible.

THEORY OF CONSERVATION AND THEORY OF BIOTIC PROVINCES

The early efforts of biological conservation were based on sentimentalism or, expressed in a more sophisticated way, upon the duality of mankind's 'social nature' in which some forces always try to innovate, and others to conserve. The resultant is cultural evolution, with a justified role for conservation therein. Thence the eternal watchfulness and vigil of conservationists. The theoretical argument may be put forward that the aims of biological conservation are utilitarian, for they strive to preserve (a) the basic entities of life, among which many have as yet unknown practical importance, (b) ecosystems as mankind's ecological and economical bases, and also (c) the biota and/or ecosystems as necessary bases for further development of the life sciences -- another utilitarian goal.

Biological conservation has then two theoretically founded aims, viz. the preservation of members of the biota (individuals, populations, species, etc.) and the preservation of functional ecological systems. Cataloguing both of these is a biogeographical task, thus we now focus on biogeography.

Following the scheme of A.R. Wallace of one hundred years ago biogeography proceeds along two lines. Geographical biology studies space-related properties of plants and animals, and regularities of distribution. Spatial occurrence of either taxa or ecological systems is studied here, both at present and in the past. Entities (species, associations, etc.) with similar distributions are grouped as geoelements, those with similar historical distribution as historic elements.

The second branch of biogeography, biological geography, divides the earth's surface into geographic units based on similarities and differences in the occurrence of species, higher systematic taxa, ecosystem units, and higher taxa of ecosystems.

In an effort to define useful geographical units for conservation we should consider, as we saw above, (1) the distribution of species (for these are the direct objects to conserve) and (2) the distribution of ecosystem units. It would be desirable, before we undertake to subdivide the map or globe, to catalogue the distribution of all species, and of all ecosystems. The first task is impossible, considering that many species have not yet been discovered and described, the majority of them are only sketchily known, and the occurrence of even the better known species is only known at some parts of their distribution range. The second task is difficult for a different reason: man's cultural activities have altered and are steadily altering the appearance as well as the geographic extent of natural ecosystems. Thus is is academic to designate a part of the lower Yangtze valley of China where agriculture has flourished over millenia, as a natural ecosystem, or to assign the Los Angeles Basin where you only find cemented surfaces or suburban gardens to the coastal sagebrush ecosystem!

Under the present circumstances, using now available information, Dasmann (1973, 1974) suggested a compromise system serving both aims: a hierarchial system of geographic areas which would give a framework for cataloging species as well as ecologic areas to be conserved. In brief, this system consists of a set of biogeographical regions, and each region in turn of a subset of biotic provinces. Each province is characterized by a major biome or biome-complex which dominates, geographically, the area of that province. Due to actual differences in the homogeneity of plant formations (biomes and their subdivisions), floras, and faunas, Dasmann suggests that provincial boundaries subdivide the area of a biome where significant faunal or floral differences occur, and that large areas of relatively uniform faunas and/or floras be subdivided on the basis of changes in the structure of vegetation.

This compromise solution is defendable on the basis of expediency and practicality: (1) it gives a system of worldwide biogeographical provinces which harbor faunas, floras and ecosystems, i.e. units based on vegetational formations. Thus it is able to serve the above dual conservational purposes; (2) it gives a hierarchical system of biogeographical regions, subdivided into provinces which fit the systematic exploration of floras and faunas the members of which may need conservation measures. It also sets up a hierarchical system of biome regions of the world, subdivided geographically and with respect to faunal and floral peculiarities. The biosphere consists of three major regional entities: the sea, azonally occurring biomes and, finally, terrestrial

biomes. Only these latter are treated here. Azonal (limnic, fluviatile, troglobiont, etc.) and marine entities have to be discussed in separate studies.

Dasmann unites the Sclater-Wallace system of zoogeographical regions, faunistic and floristic provinces, and biomes, i.e. physiognomical plant formations with the animal populations that inhabit them. This fact deserves a theoretical comment, in order to make it more saleable to the botanist as well as to the zoologist.

Faunistic and floristic regional systems of classification do not use common terminology. Though all floristic schemes are based on Engler (1879) the major regional taxa are treated differently as shown on Table II. The major differences between the two later modifications, i.e. Good's (1964) and Takhtajan's (1969) are as follows:

(1) Takhtajan subdivides the kingdom of northern, circumpolar flora into three subkingdoms, separating the areas of southern, more xeric-adapted floras both in the New and in the Old World, Takhtajan's limit of the Holarctic kingdom is much further to the south in Caribbean North America than in Good's presentation, and also much further south in the East China Sea area.

(2) Takhtajan establishes five subkingdoms within the Paleotropical kingdom, viz. adding the Madagascan and Neocaledonian, which Good does not rank as subkingdoms.

(3) Takhtajan substantially changes the area of the Antarctic kingdom by including more of Patagonia, and more of the islands around the New Zealand shelf.

(4) The delimitation of the regions often differs between the two systems (for recent discussion, see Hewer 1971).

The higher taxa of the faunistic system are:

Holarctic Region	Palaearctic Region (or subregion)	Arctogaean Realm
	Nearctic Region (or subregion)	
	Ethiopian Region	
	Oriental Region	
	Australian Region	Notogaean Realm
	Neotropical Region	Neogaean Realm
	Antarctic Region	--

The first six regions are classic (Sclater 1858); the term and concept, Holarctic, is used freely by zoogeographers when necessary, mainly as an adjective, e.g., 'holarctic distribution'. The Antarctic region was

Table I. The higher taxa of the regional floristic geographical system.

Good 1964 (No subkingdoms)		Takhtajan 1969: Holarctic Kingdom -
	(1) Boreal Kingdom	1a) Boreal Subkingdom 1b) Tethian Subkingdom 1c) Madrean Subkingdom
2a) African Subkingdom 2b) Indo-Malaysian Subkingdom 2c) Polynesian Subkingdom	(2) Palaeotropical Kingdom	2a) African Subkingdom 2b) Madagascan Subkingdom 2c) Indo-Malaysian Subkingdom 2d) Polynesian Subkingdom 2e) Neocaledonian Subkingdom
	(3) Neotropical Kingdom	
	(4) South African or Cape Kingdom	
	(5) Australian Kingdom	
	(6) Antarctic Kingdom	

Table II Comparison of the status of a geographic region in floristic & faunistic systems.

Floristics (Engler & followers)		Faunistics (Wallace)	
Kingdom:	Palaeotropical	Realm:	Arctogaean
Subkingdom:	African	Region:	Ethiopian
Region:	North African Highlands	Province:	Ethiopian Highlands
District:	Abyssinian-Erythrean	District:	-- (not yet delimited)

Each system uses in better known or geographically more subdivided areas further taxa, viz. subregions, subprovinces, subdistricts. Note that 'region' means a taxon of higher rank for the zoologist than for the botanist.

not used by any major faunistic scheme. The 'realms' (Blanford 1892) had no practical value in zoogeography, except as reminders about affinities of the first four regions, and lack of such affinities of the last two.

The higher taxa of the two systems are as follows:

Floristic system (Kingdoms):	Faunistic system (Regions):
	P A L A E A R C T I C
B O R E A L	N E A R C T I C
P A L A E O T R O P I C A L	E T H I O P I A N
	O R I E N T A L
A U S T R A L I A N	A U S T R A L I A N
N E O T R O P I C A L	N E O T R O P I C A L

The faunistic system has three areas of shifting status: the Arctic, the Middle American, and the Indonesian area called 'Wallacea'. These are properly subregions, as is also the Malagasy subregion (Madagascar with surrounding islands) in some modifications of the Wallacean scheme. The seventh region, the Antarctic region, was not part of the classic, Wallacean system, but has been added since.

The delimitation of regions is uniform among zoologists except for the three areas of transitional nature. The Arctic is sometimes united into one subregion or province (by ecologically minded zoogeographers). The Middle American area and the Indomalayan archipelago area are assigned either to the northern or to the southern bordering region, or they are bisected along various dividing lines (Mayr 1944).

If we try to coordinate floristic and faunistic systems we find further differences in the boundaries, number, and extent of the final units, i.e. 'regions' of the florist and 'provinces' of the faunist. There is, besides, a great difference between the two. The overwhelming majority of florists to date considered only the vascular plants. Angiosperm plant geography has been generally accepted because the angiosperms dominate the vegetation as a whole. They comprise the largest plants, lower plants on land are insignificant compared to them, and besides, many of these latter plants are cosmopolitan. Phytogeography of many fungus, alga or other lower taxon is almost completely unknown. In the animal kingdom the faunal approach was based on vertebrates and partly on molluscs, not-withstanding the fact that other terrestrial phyla (most notably the arthropods) are rich in species and important, even dominant on land. Furthermore the geographic analyses of these other phyla when attempted, show faunal entities often markedly different from those of the land vertebrates.

Besides the floristic and faunistic approach there has been a third attempt to delimit regional entities on synecological basis, that which Dice (1943) called 'biotic provinces'. Dice's biotic province is "a considerable and continuous geographic area and is characterized by the occurrence of one or more ecologic associations that differ, at least in proportional area covered, from the associations of adjacent provinces." In general, biotic provinces are also characterized by peculiarities of vegetation type, ecological climax, flora, fauna, climate, physiography, and soil. This original definition leaves little doubt that Dice meant subdivisions of the biome system of Clements and Shelford, pieces of land which differed from neighbouring pieces of land in their coverage by a certain ecosystem or a combination of certain ecosystems. The rest of their 'peculiarities' are differences between the constituent parts of the ecosystems within separate biotic provinces. Geographic entities thus defined, as Dasmann has (l.c.) already emphasized, would ideally suit our need for a regional system for biotic conservation purposes. However, we are here suggesting the re-naming of biogeographical taxa on the following grounds. Biotic provinces, sensu Dice (1943), have only been described in North and Central America. Elsewhere in the world floristic provinces have been enunciated, delimited, and mapped by botanists, and these have been used by zoologists. Furthermore, the interest among North American zoologists in a regional system caused the 'biotic provinces' of Dice to be used (retaining their name) for solely faunistic purposes. Thus they often become synonyms of what rightly would be called 'faunistic provinces'. Note for instance what H.M. Smith (1960) p. 42 writes: "/Biotic provinces/ are distinguished primarily (or first) upon the basis of faunistic features because always floristic distinctions are amply borne out by faunistic distinctions" and "animals as a more delicate and plastic indicators than plants", or "biotic provinces are, ideally, subdivisions of zoogeographic entities" and "Biotic provinces seem to be the tool primarily of the systematist in zoology". For a botanist (e.g. from Hungary, where floristic provinces were accurately delimited in the 1910s), the chauvinistic pronouncements of the above quoted zoologist can only act as a deterrent. Therefore, though Dice's definition holds for them, our regional units would receive a new and untainted name, i.e. biogeographical provinces.

THE BIOGEOGRAPHICAL DIVISIONS OF LAND AND FRESHWATER AREAS.

In the following we are introducing a unified system for biogeographical and conservation purposes.

In our system for practicality only one major taxon, the realm, would replace kingdoms/subkingdoms, (floristic) and realms/regions and subregions (faunistic). The term, 'kingdom', is also used by taxonomists denoting 'plant' and 'animal' kingdoms. The term, 'region' has different connotations in faunistics and floristics. Realm is not used by florists, and its use is not widespread among today's faunists, who use the 'Wallacean' regions. The following taxa will be used in a hierarchical way:

Biogeographical realm. The highest taxon. A continent or subcontinent-sized area with unifying features of geography and fauna/flora/vegetation. This rank more or less corresponds to the kingdom of the florist and the region of the faunist.

Biogeographical province. Ecosystematic or biotic subdivisions of the above realms. These more or less correspond to the regions of the florist and the faunal province of the faunist, and, mostly they correspond to the biotic province of Dice (l.c.) and his followers.

Besides these taxa others, not used here, are the biogeographical subrealm, subprovince, districts and subdistricts.

Biogeographical realms are established on the basis of geoelements and historic elements, utilizing the ground-breaking work of the published literature. Subrealms should also show distributional and phylogenetic affinities of the flora, fauna, and ecosystems they contain, but for our present purpose they are not necessary and would only add controversial areas and boundaries of which we already have many.

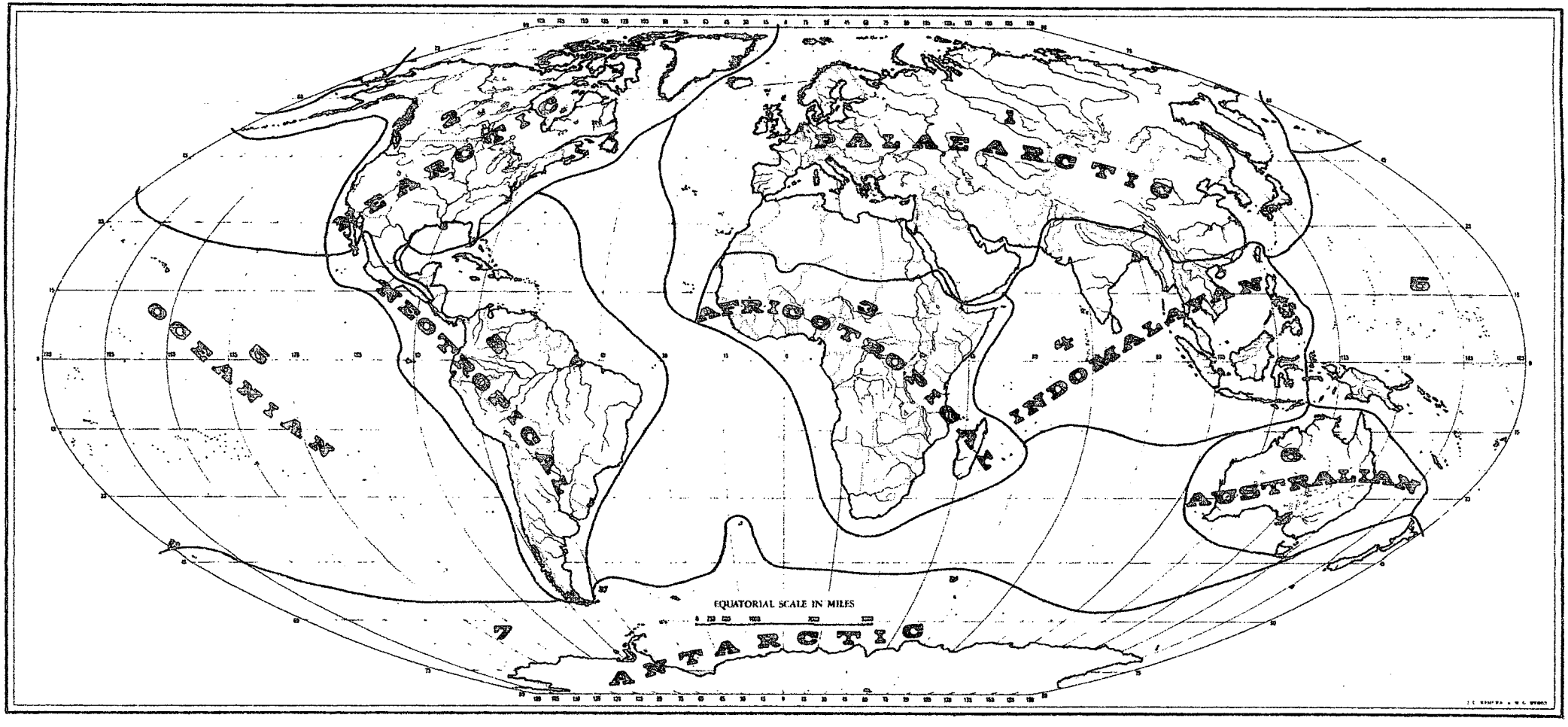
Biogeographical, faunistic, or vegetational criteria may enable the biogeographer to further group provinces of a realm into Biogeographical Subrealms, and to further delimit Subprovinces, Districts and Subdistricts. For the present purpose, i.e. for launching a unified system mainly for conservation purposes, it is not necessary to deal with these ranks. Their elaboration is the task of regional experts.

The following Biogeographic realms are recognized (see Map overleaf):

1. Palaearctic Realm
2. Nearctic Realm
3. Africotropical Realm
4. Indomalayan Realm
5. Oceanian Realm
6. Australian Realm
7. Antarctic Realm
8. Neotropical Realm

PRINCIPAL BIOME TYPES

The International Classification of Vegetation (UNESCO 1973) lists five formation classes and within them 19 major formation types. Numerous further subdivisions of these major taxa are also given. However many of these formational taxa do not form biomes. The biome classification used in this report is set out on page 13. Eleven of the 14 units correspond to major ecosystem groups including all except the azonal formation classes (e.g. the subclass of hydromorphic vegetation). Two units, Nos. 12 and 13, are composites of several vegetational zones and their biota. No. 14 includes those large or ancient lakes which may warrant special consideration as biogeographic provinces. Lakes are the only units of the hydrosphere which are treated here. The first column lists the serial number as used here, and the next lists the serial number of the biome group as used by Dasmann (l.c.)



Terrestrial Biogeographic Realms of the World

(M. D. F. Udvardy (1975)

No.	Old No.	Biome Types
1	7	Tropical humid forests
2	3	Subtropical and temperate rain forests or woodlands
3	2	Temperate needle-leaf forests or woodlands
4	6	Tropical dry or deciduous forests (incl. monsoon forests) or woodlands
5	4	Temperate broad-leaf forests or woodlands, and subpolar deciduous thickets
6	5	Evergreen sclerophyllous forests, scrubs or woodlands
7	11	Warm deserts and semideserts
8	--	Cold-winter (continental) deserts and semideserts
9	1	Tundra communities and barren arctic desert
10	9	Tropical grasslands and savannas
11	10	Temperate grasslands
12	8	Mixed mountain and highland systems with complex zonation
13	12	Mixed island systems
14	--	Lake systems

A UNIFIED SYSTEM OF NATURAL REGIONS OF LAND AND FRESHWATER LAKES OF THE WORLD FOR PURPOSES OF CONSERVATION

The essence of the previous arguments and facts is that (1) we need a geographical regional subdivision of the surface of the earth which respects floristic and faunistic elements important for conservation; (2) we also need a geographical catalogue of the chief and dominant ecosystems (biomes) of the world. We shall not deal with marine and littoral ecosystems (see Ray 1975) but with land and with major and biogeographically important lakes.

Dasmann (1973, in IUCN 1974) suggested that for serving both aims a compromise system be worked out. This is a hierarchical system which consists of (1) biogeographic regions, i.e. major taxa; (2) biotic provinces within the regions. Further, each province is characterized by a (3) major biome or biome-complex. As discussed above, we re-name the first two items (biogeographical realm, biogeographical province). The numbering of the actual entities shall be done the following way.

Each realm receives a number (from 1 to 8) and also each biome type (from 1 to 14). Within each biome, the provinces are numbered consecutively. The sequence is: Realm--Province--Biome type. Thus, e.g., a certain part of South America is delimited on the accompanying map, and called Llanos Biogeographic Province of the Neotropical Biogeographic Realm, and its characteristic biome is in the group 'Tropical Grasslands and Savannas'. This province, then, receives the code number 8.27.10 indicating that it is the 27th province of the Neotropical Biogeographic Realm, and its characteristic biome is biome type No. 10. This way the provinces of each realm are numbered consecutively. Within each realm, provinces are ordinated according to the numerical sequence of the biome types. Where several provinces belong to the same biome type, the order of the provinces is geographic: as much as possible from north to south, and from west to east: N, NE, E, etc.

Attention has been paid, as much as possible, to every geographic area. There are some small islands, however, which are not expressly mentioned.

Ideally biogeographic provinces ought to be delimited on faunal, floral and ecological bases. Lack of source material and data caused, as already intimated, that more often than not ecological, i.e. vegetational knowledge, was the only source material available. A further weakness of the provincial system is nomenclature. Geographic, ecological, and historically established area names are used intermittently, e.g. Cuban Province, Yungas, Pontian Steppe Provinces. However, to propose a uniform system of names at this time would add to the difficulties of relating this system to others previously described.

(1) The Nearctic Realm

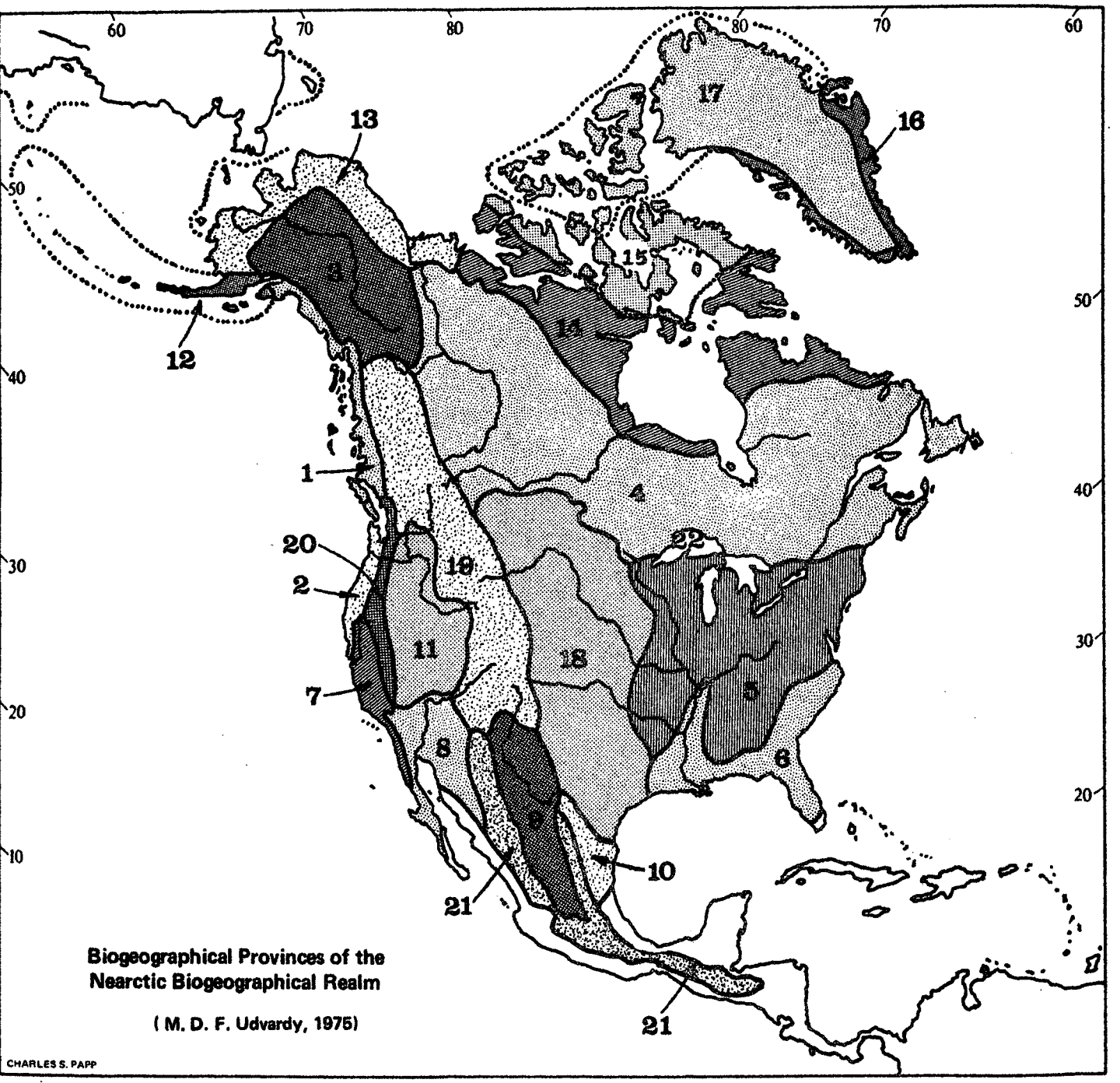
The area of the Nearctic Biogeographic Realm equals that of the Nearctic Region of Sclater, Wallace, and Schmidt (1954) and of the North American sector of Engler's Boreal floral Kingdom: North America with Greenland and all the shelf islands except those on the southeast Atlantic coastal shelf, with Guadalupe, and the Revilla Gigedo Islands in the North Pacific and without the southern tip of Florida (the Everglades and the Keys). The Nearctic Realm extends south and includes Mexico north of Tehuantepec with the exception of the coastal plain and slopes of a varying width (5 to about 50 km) which have a tropical biota. This neotropical area has its northern limits at the northern border of the Sinaloan (Pacific) and Campechean (Caribbean) provinces. The southernmost limit of the Nearctic area has been problematic ever since Wallace's time. In the modern literature it is usually taken as the isthmus of Tehuantepec. South of this place, the highlands of Chiapas, Mexico, of Guatemala and the Honduras-Nicaraguan mountains form what is usually considered an isolated northern, nearctic-temperate community. The new vegetation map of Mexico (Flores et al. 1971) reveals that the gap at Tehuantepec is a mere 55 km between the pine-oak forest of the Cordilleran highlands in the south and the outlyers of the Sierra Madre chains in the north, smaller than other gaps along the valleys of the Sierra Madre Occidental. Therefore we extend the Madrean Biogeographical Province through the Tehuantepec area to include the Cordilleran highlands to about 13°N latitude in northern Nicaragua, which is the southernmost limit of this biome.

Dasmann (1974) revised the biogeographical provinces of the Nearctic Realm and therefore only those ones will be mentioned where we deviated from his revision. Some revision pertains to the tundra biomes of North America. The subdividing of the arctic tundra into several biogeographical provinces seems useful because of a) the large geographic extent of the area, b) the repopulation after the Würm-Wisconsin glaciations which happened from different refugia and resulted in different historic elements of the biota, and c) the climatic belts and different degree of continentality which create different physical backgrounds of these ecosystems. Thus the Alaskan Tundra Province (which includes the Bering Sea islands: the Pribilovs and St. Lawrence, but not the Diomedes) is distinguished by sedge--grass tundra rather than shrubby tundra of the low-arctic Canadian Tundra Province of mainland Canada. The Canadian Arctic Archipelago Province and its sedge--moss--lichen tundra again is separated from the barren Arctic Desert Province of Ellesmere Island and the adjoining Greenland Icecap. We retained the Greenland tundra in one province though we realized that it also has a zonation of low- and high-arctic tundras.

The mountain chains and highlands or valleys of Alaska, and adjacent British Columbia and Yukon are faunistically and floristically sufficiently different from the rest of the taiga belt to be separated into a biogeographic province. In spite of the altitudinal variety of the terrain the high latitude does not allow intensive altitudinal zonation and thus we reclassified this area under the taiga biome (1.3.3.).

We amalgamated the California Channel Islands (1.5.2 in Dasmann 1974) with the rest of California into our 1.7.6. These islands do harbour endemics but these are direct and recent derivates from the adjacent mainland, few in number and the group, in world perspective, is too small to form an independent province, though certainly is a distinct area unit of lower rank.

We established the Great Lakes Biogeographical Province comprising lakes Superior, Michigan, Huron, Erie and Ontario. Though of young age, these very sizeable freshwater bodies have their own ecosystems and large-scale conservation problems. On the other hand, the continuing chain of great lakes in the northeast, Winnipeg, Athabasca, Great Slave, and Great Bear lakes, are surrounded by innumerable smaller but still sizeable lakes and other wetlands characteristic of the Canadian Taiga Biogeographical Province but not warranting special lake province status.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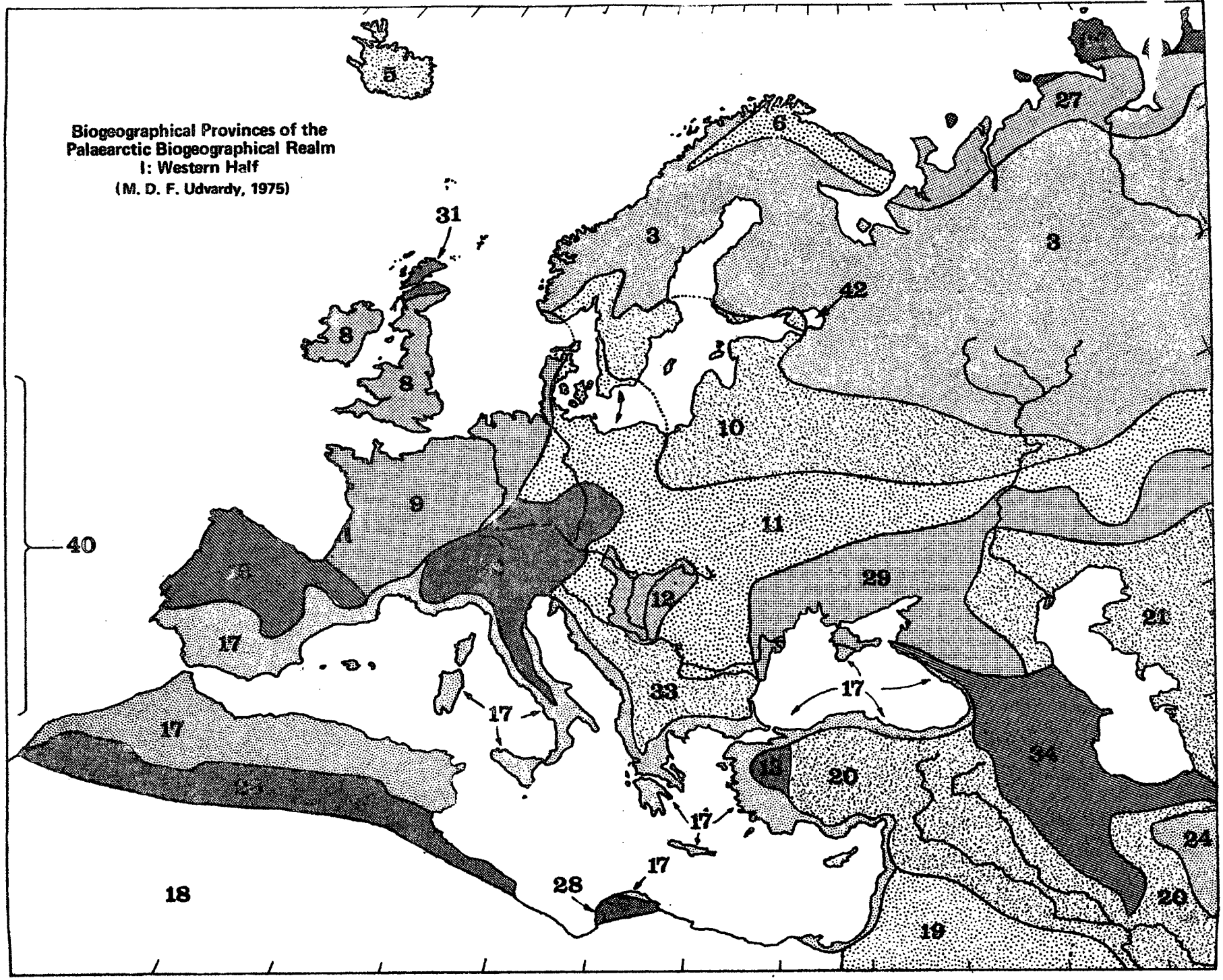
Biogeographical Provinces of the
Nearctic Biogeographical Realm
(M. D. F. Udvardy, 1975)
CHARLES S. PAPP

(1) The Nearctic Realm

No.	Biogeographic Province
1.1.2	Sitkan
1.2.2.	Oregonian
1.3.3	Yukon taiga
1.4.3	Canadian taiga
1.5.5.	Eastern forest
1.6.5	Austroriparian
1.7.6	Californian
1.8.7	Sonoran
1.9.7	Chihuahuan
1.10.7	Tamaulipan
1.11.8	Great Basin
1.12.9	Aleutian Islands
1.13.9	Alaskan tundra
1.14.9	Canadian tundra
1.15.9	Arctic Archipelago
1.16.9	Greenland tundra
1.17.9	Arctic desert and icecap
1.18.11	Grasslands
1.19.12	Rocky Mountains
1.20.12	Sierra-Cascade
1.21.12	Madrean-Cordilleran
1.22.14	Great Lakes


Biogeographical Provinces of the
Palaearctic Biogeographical Realm
I: Western Half
(M. D. F. Udvardy, 1975)
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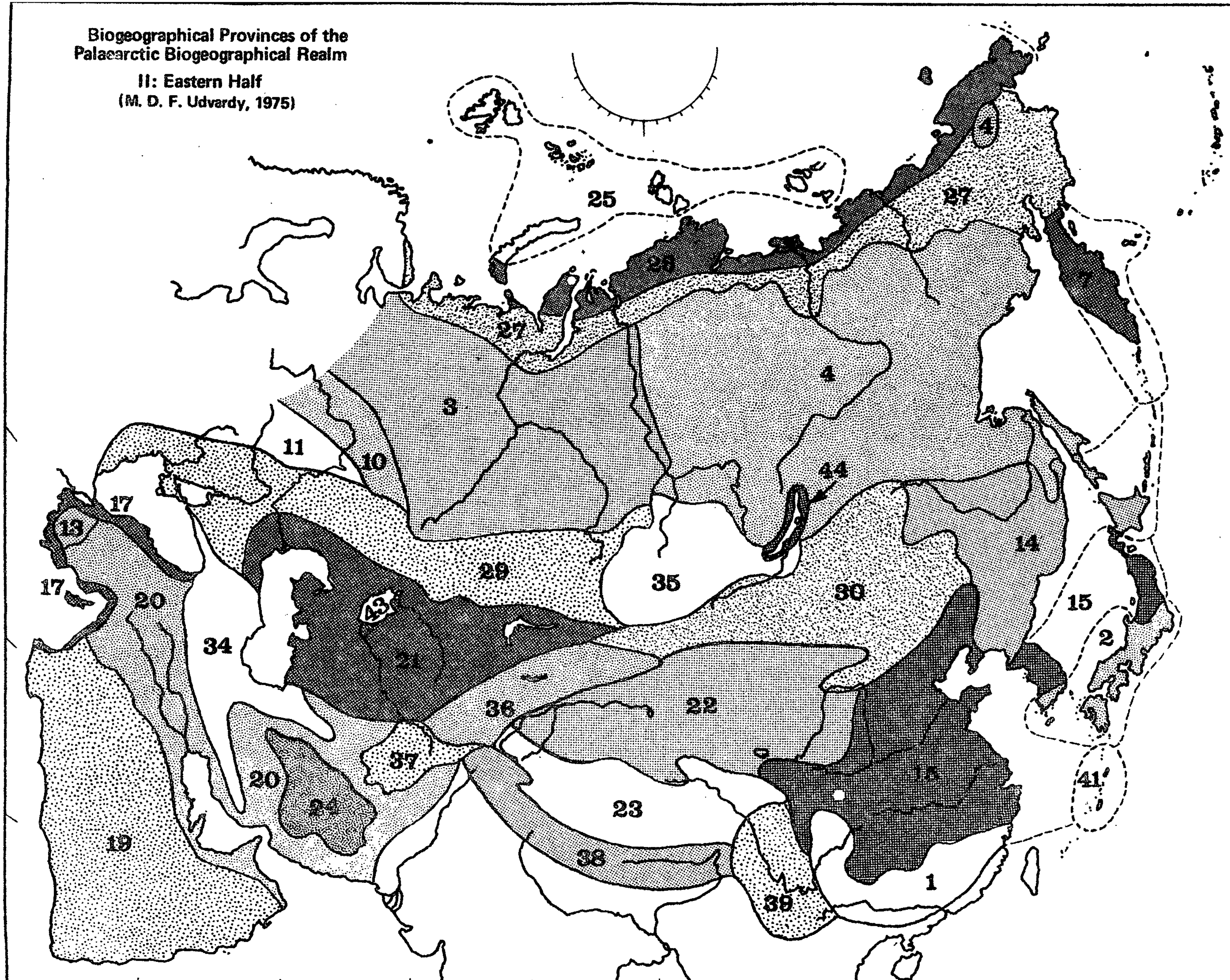
(2) The Palaearctic Realm

No.	Biogeographic Province	No. & Name in Dasmann 1974*	
2.1.2	Chinese Subtropical Forest		
2.2.2	Japanese Evergreen Forest		Japanese Subtropical Forest
2.3.3	West Eurasian Taiga		
2.4.3	East Siberian Taiga		
2.5.5	Icelandian	2.12	Iceland
2.6.5	Subarctic Birchwoods	--	
2.7.5	Kamchatkan	--	
2.8.5	British Islands	--	British+Irish Forest
2.9.5	Atlantic		West European Forest (part)
2.10.5	Boreonemoral		Baltic Lowland (part)
2.11.5	Middle European Forest	2.2.3	East European Mixed Forest
2.12.5	Pannonian	2.10.1	Danubian Steppe
2.13.5	West Anatolian	--	
2.14.5	Manchu-Japanese Mixed Forest		Manchurian+Japanese Mixed Forest
2.15.6	Oriental Deciduous Forest		
2.16.6	Iberian Highlands	2.8.4	
2.17.7	Mediterranean Sclerophyll		composite of many
2.18.7	Sahara		
2.19.7	Arabian Desert		Arabia
2.20.8	Anatolian-Iranian Desert		Turkish-Iranian Scrub-steppe
2.21.8	Turanian		Kazakh Desert Scrub-steppe
2.22.8	Takla-Makan-Gobi Desert		

*Note. 1974 name and number are only listed if different from present one.

(Table continues)


Biogeographical Provinces of the
Palaearctic Biogeographical Realm
II: Eastern Half
(M. D. F. Udvardy, 1975)
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(2) The Palaearctic Realm (continued)

No.	Biogeographic Province	No. & Name in Dasmann 1974	
2.23.8	Tibetan		
2.24.9	Iranian Desert		
2.25.9	Arctic Desert	--	
2.26.9	Higharctic Tundra		Eurasian Tundra (part)
2.27.11	Lowarctic Tundra		Eurasian Tundra (part)
2.28.11	Atlas Steppe	2.8.6.	Atlas Highlands
2.29.11	Pontian Steppe		Ukraine-Kazakh Steppe
2.30.11	Mongolian-Manchurian Steppe		Gobi+Manchurian Steppe
2.31.12	Scottish Highlands		
2.32.12	Central European Highlands	--	
2.33.12	Balkan Highlands	--	
2.34. 12	Caucaso-Iranian Highlands		Caucasus+Kurdistan-Iran Highlands
2.35.12	Altai Highlands		
2.36.12	Pamir-Tian-Shan Highlands		
2.37.12	Hindu Kush Highlands		
2.38.12	Himalayan Highlands		
2.39.12	Szechwan Highlands		
2.40.13	Macaronesian Islands		4 island provinces
2.41.13	Ryukyu Islands	--	
2.42.14	Lake Ladoga	--	
2.43.14	Aral Sea	--	
2.44.14	Lake Baikal	--	

(2) The Palaearctic Realm

This realm includes arctic and temperate Eurasia, and all islands surrounding the continent in the Arctic, in the sea of Japan, and the eastern half of the North Atlantic. It thus also includes the Macaronesian islands, Mediterranean North Africa and the Sahara, and all Arabia. Its boundary in Africa is the southern boundary of the desert vegetation, in West Asia the customary boundary, with the Himalayas chain as main divider, and thence it is a debatable line across Southern China. It is debatable, because on this coastal plain climate and vegetation changes evenly and zonally (Stegmann 1938), the flora and fauna follows, therefore any division is debatable and arbitrary, and one has to use it for convenience and by convention. The status of the island of Taiwan is part of the biogeographical controversy about the border of the Palaearctic or Boreal unit. The lowlands of this island are covered by humid tropical forest (Walter 1974) but its altitudinal zonation, naturally, shows subtropical, warm-temperate and temperate ecosystems. However it is separated from Asia by a considerable strait of the China Sea and thus cannot be treated as an 'outlyer' province of the Palaearctic, as we have done with the Central American Cordilleras in the Nearctic which has similar temperate montane ecosystems surrounded by tropical lowlands.

To sum it up, the boundaries of the Palaearctic Realm do not differ basically from those in Schmidt's re-interpretation of Sclater-Wallace (1954), except in SE Asia; they differ from Engler (and Good) in Africa, where the florist draws the boundary of the Boreal kingdom north of the desert, and in SE Asia.

Though this realm shows great physiographic and floristic-faunistic differences in its southern, mountainous and geographically diverse sectors, all biogeographers treat it as a uniform realm.

Whereas there are abundant sources of floristic and vegetational subdivisions of the Palaearctic, faunistic works are fewer and often follow the vegetational subdivisions for want of more accurate faunistic, distributional data. Walter and Straka (1970) rightly point out that each attempt to subdivide the western Palaearctic is biased by detailed knowledge of the author's home area, and a tendency to lump elements or areas further away from his area of competence. We here follow the areas of 'geoelements' for our provincial subdivisions.

The Eurasian tundra consists (cf. Sjörs 1967, Frenzel 1968, Walter 1974) of three formations. The area covered with low arctic tundra comprises the Lowarctic Tundra Province of northern Russia and Siberia, reaching the shores of the Sea of Okhotsk and the Bering Sea.

It is, however, poorly developed in northwestern Europe and only found at the northernmost fringes of the Scandinavian and Kola peninsulas, and in Iceland. Most of the northernmost biome of these same areas is the birch scrub-forest which also forms the subalpine zone in the Scandinavian mountains. In this latter area we establish the Subarctic Birchwoods biogeographic province, and this formation is also the characteristic one for the Iceland Province. The Higharctic Tundra

Province covers large areas in northern Siberia, and it is only locally developed, at suitable sites, on the Arctic Islands which belong to the Arctic Desert Province.

Plant geographers (Kleopow 1941, Lavrenko 1951) as well as zoologists (Johansen 1955, Lindroth 1961) point out a faunal and floral divider that runs north to south following the Yenisei Valley rather than along the Ural mountains as it was believed earlier. Thus we limit the West Eurasian, and the Siberian Taiga provinces along this line. The southern limit of the taiga in Scandinavia is the 'limes norlandicus' of the Swedish botanists since Linnaeus (Sjörs 1967).

Boreonemoral Province corresponds to the Lake Forest ecotone area of North American synecologists, i.e. where the climax is deciduous forest but successional stages are mixed or even conifer-dominated, and thus often give the impression of a slightly mixed coniferous forest, because second growth predominates in cultivated forests almost everywhere. The southern limit in Sweden is the northern limit of beech (Fagus sylvatica) forests. Elsewhere it follows Walter and Straka (1970).

The Pontian Province - the name long in use among geologists and botanists - covers besides the true steppes (grasslands) of East Europe also the steppe-woodland belt of the Ukraine. This might be a debatable position, as is every drawing of a finite boundary across an area of a rather smooth ecotone between forest and nonforested vegetation. For details of this area, as for Eastern Europe in general, we follow Walter (1974).

Pannonian Province, the plains of the Central Danube in the Carpathian Basin. The steppe-like appearance is secondary and very recent. The Carpathian Basin rather belongs to the woodland-steppe belt with riparian oak forests, and on sand, with mixed Central European deciduous forest. The area is rich in Pontian floral (Soó 1940) and faunal (Udvardy 1942) elements and in endemics; it is uniformly treated by biogeographers as a unit of provincial rank.

The Middle European Forest Province is the heartland of the west Palaearctic broadleaf deciduous forest flora and fauna. We follow Walter and Straka (1970) and Soó (1944) in drawing its limits.

The Atlantic Province is under the influence of a mild oceanic climate and broadleaf evergreen dwarf shrub grows everywhere where forests cannot establish themselves for climatic or cultural reasons. I have restricted this province to a narrow area including westernmost south Norway, west Denmark, the Low Countries and western France. The British Isles and Atlantic Iberia are treated as separate provinces though some may have preferred one long, sinuous Atlantic province.

Similarly I had not enough faunistic ground (cf. though Franz and Beier 1970) to support the floristic choice (Zohary 1973) of lumping the Pyrenees, Alps, Dinarids and Balkan Mt. with the Krim into a 'sub-mediterranean' province. Rather I singled out the Alps and their northern outlyers as a highlands province with much Mediterranean influence, and endemics (Franz & Beier l.c.). Horvat, Glavac and Ellenberg (1974) have been followed on the Balkan Peninsula, Walter (1974) discusses the Black Sea area. Zohary (1973) is followed in keeping the

area of typically Mediterranean, winter-rain broadleaf evergreen sclerophyll vegetation in one single province. The Tyrrhenian Islands show faunal affinities both to the south and to the north, but not enough uniqueness or mutual similarity to warrant provincial status. Mediterranean endemics abound in the flora (Horvat et al. 1974) and fauna (Franz and Beier l.c.) and many of these are spread through this region as well. The northern slopes of the Atlas mountains, and the bordering area do not differ enough to delimit them as a province in a world-wide scheme. The highland-steppe zone to the south, on the other hand, bordering the Sahara, with its predominantly Turanian floral element, forms the Atlas Steppe Province.

The Sahara Province belongs to the Palaearctic biogeographical realm. Though floristically it may be divided in the middle, separating the northern area where Mediterranean geoelements predominate and the south with its Africotropical influence (Walter 1964), the scanty endemic fauna tips the balance, for it has Palaearctic relations (Franz and Beier 1970). Moreover, during the immediate past Pleistocene pluvials the Sahara was covered with Mediterranean-Turanian vegetation and flora, which survive today where winter rains still have some influence (Khalil 1963).

The Macaronesian Province comprises all the North Atlantic oceanic islands off the SW European and N African coasts. Their endemic plants show ancient Mediterranean (or Tethian: Takhtajan 1969) affinities, their animals are predominantly late immigrants from Mediterranean Palaearctic habitats (cf. Lindroth 1960). Exceptions are the Cape Verde Islands which have a strong Africotropical element.

Further to the east the provincial arrangement deviates from that of Dasmann (1973, IUCN 1974) based on vegetation maps of the Soviet Union, and of those in Walter (1974). In Japan, the suggestions of Numata (1969, 1972 in litt.) have been followed. The latest vegetation survey of China is that by Wang (1961) in which the author scrutinizes the subtropical southern Chinese forest. As mentioned at the beginning of this chapter, this forest is ground for controversy. Its many historic and geoelements relate it to the Indomalayan (Oriental) area and have occasioned its inclusion into that floral kingdom, but because of other floral and faunal elements we have kept it within the Palaearctic.

Though the strait of Tokara, south of Japan, has been considered as the southern border of the Palaearctic fauna, south of this strait, the Ryukyu Is. have subtropical vegetation (Numata 1969) and thus belong to the Palaearctic Biogeographical Realm in our system.

The Aral Sea (not treated by Ray, 1975, among the marine areas), ancient Baikal Lake, and Lake Ladoga (endemic fish and a pinniped) are our Eurasian lake provinces, each with a highly distinctive fauna.

(3) The Africotropical Realm

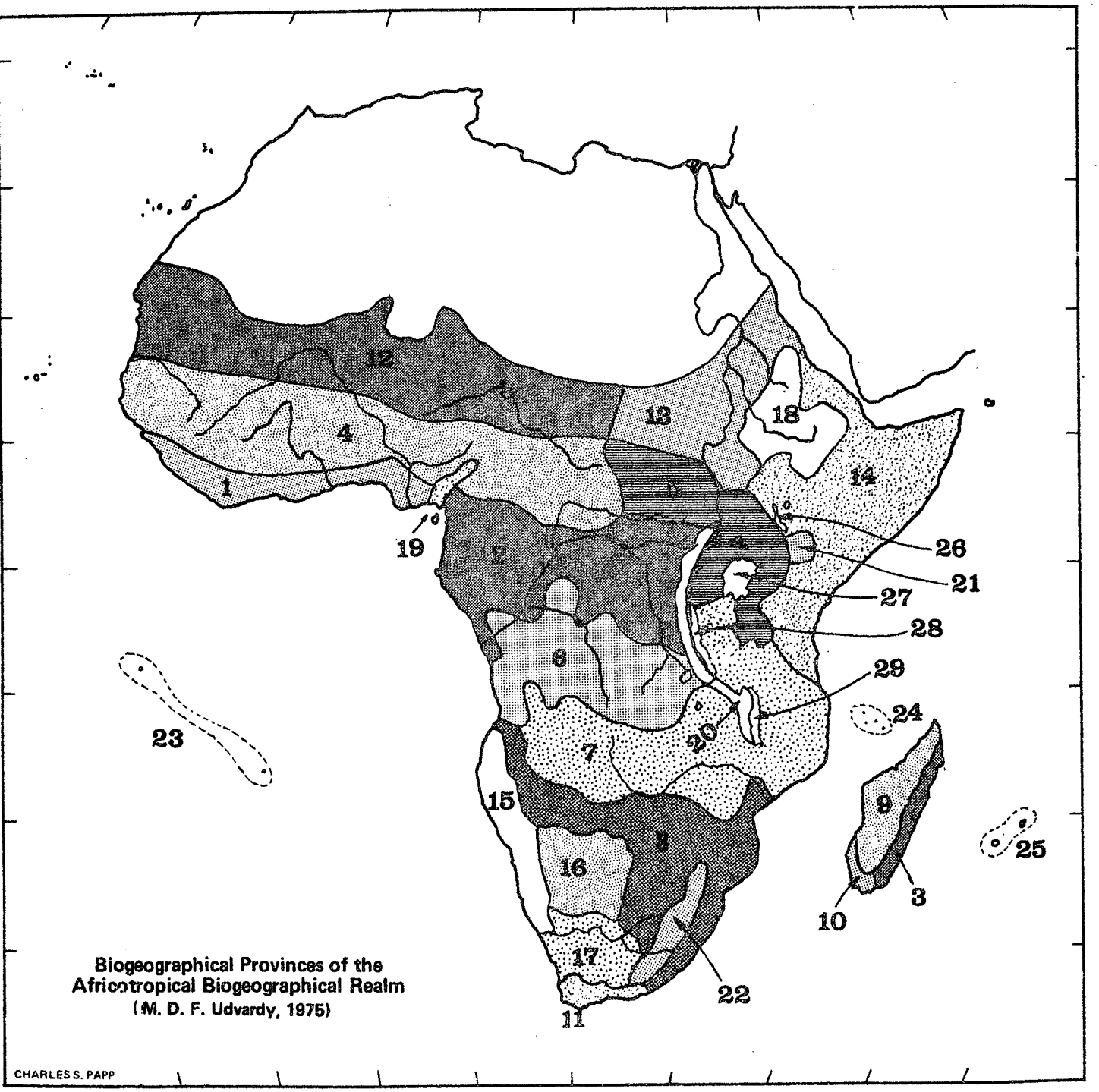
Sclater's name, Aethiopian Region, has been retained by Wallace, whereas it is the African Subkingdom of Engler's Palaeotropical Floristic Kingdom. We are suggesting a new name, Africotropical Realm or for short, Africotropics, because 'Ethiopia' now has connotations for political geography. It is an African realm, the bulk of which is covered by tropical vegetation and faunation.

We delimit the area of the realm as follows: all of the African continent south of the desert biome of the Sahara, with its shelf islands, with the two tropical mid-Atlantic islands (Ascension and St. Helena) and with Madagascar and the islands of the Indian Ocean surrounding it, except the Seychelles and Amirantes. These island groups show ties to the eastern Indian Ocean area, and also have an old, unique, endemic biota.

Floristically, Engler and all his followers considered the Cape Province, with its highly endemic sclerophyll flora, to have the rank of a kingdom. However, recent evaluation of floral evidence (van Zinderen Bakker 1962) shows that Cape floral elements occur in related habitats, diminishing, as one proceeds from the Cape northward. The faunal evidence, in vertebrates and some other groups (Balinsky 1962, Poynton 1964, Winterbottom 1974), shows that Cape endemism is climate-dependent and has ties toward the north. Old endemics have so far only been found in cold-water and cave faunas (Illies 1968). Thus, though historically there is evidence of a Gondwanan biota having had an existence here, the present picture speaks for maintaining the status-quo as Wallace had it.

(3) The Africotropical Realm

No.	Biogeographic Province
3.1.1	Guinean Rain Forest
3.2.1	Congo Rain Forest
3.3.1	Malagasy Rain Forest
3.4.4	West African Woodland/savanna
3.5.4	East African Woodland/savanna
3.6.4	Congo Woodland/savanna
3.7.4	Miombo Woodland/savanna
3.8.4	South African Woodland/savanna

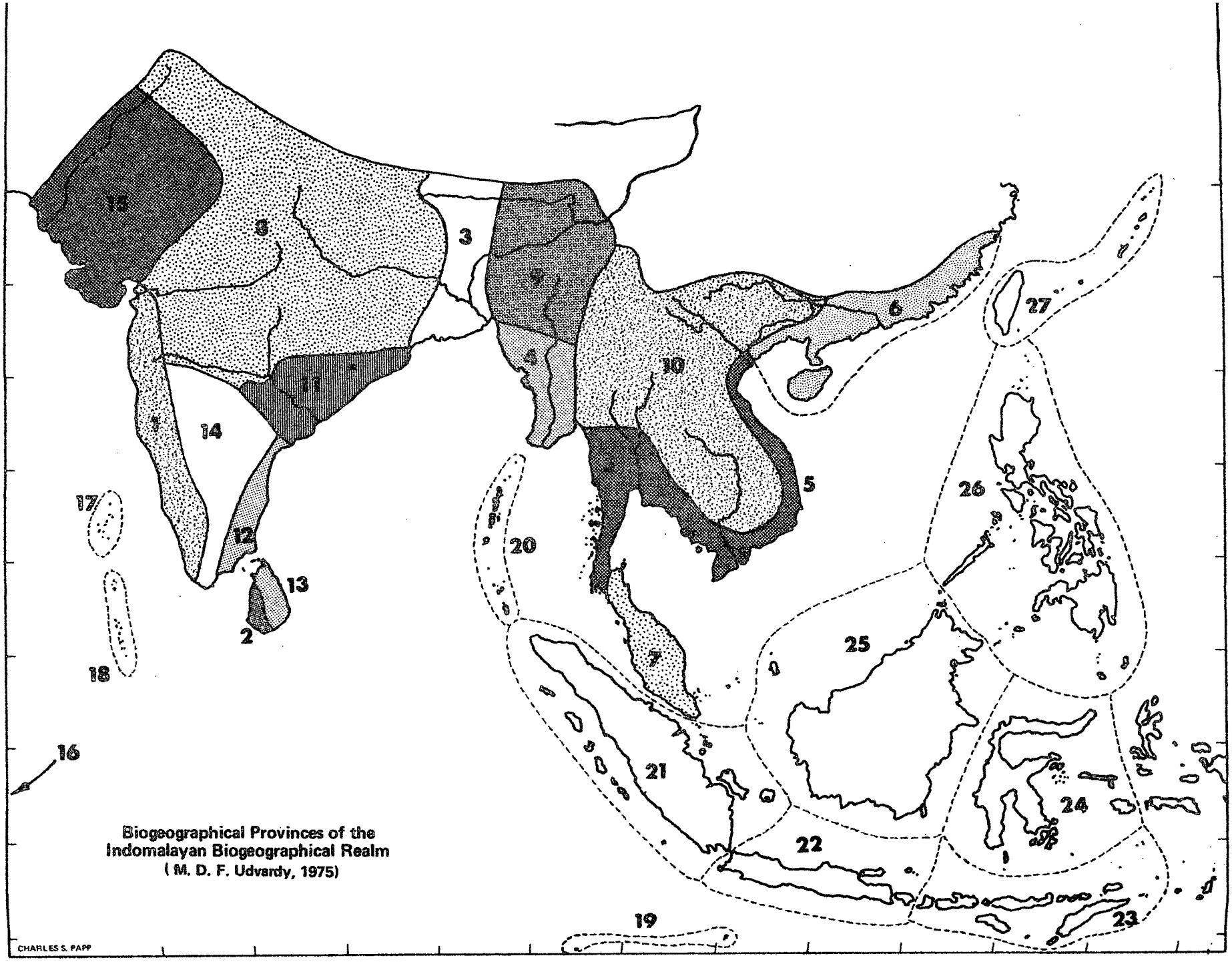


Biogeographical Provinces of the
Africotropical Biogeographical Realm
(M. D. F. Udvardy, 1975)

CHARLES S. PAPP

No.	Biogeographic Province
3.9.4	Malagasy Woodland/savanna
3.10.4	Malagasy Thorn Forest
3.11.6	Cape Sclerophyll
3.12.7	Western Sahel
3.13.7	Eastern Sahel
3.14.7	Somalian
3.15.7	Namib
3.16.7	Kalahari
3.17.7	Karroo
3.18.12	Ethiopian Highlands
3.19.12	Guinean Highlands
3.20.12	Central African Highlands
3.21.12	East African Highlands*
3.22.12	South African Highlands
3.23.13	Ascension and St. Helena Islands
3.24.13	Comores Islands and Aldabra
3.25.13	Mascarene Islands
3.26.14	Lake Rudolf
3.27.14	Lake Ukerewe (Victoria)
3.28.14	Lake Tanganyika
3.29.14	Lake Malawi (Nyasa)

Note: * The only change from Dasmann (1973, 1974) is this new biogeographical province, following Lamprey (1974).



Biogeographical Provinces of the Indomalayan Biogeographical Realm
(M. D. F. Udvardy, 1975)

(4) The Indomalayan Realm

No.	Biogeographic Province
4.1.1	Malabar Rainforest
4.2.1	Ceylonese Rainforest
4.3.1	Bengalian Rainforest
4.4.1	Burman Rainforest
4.5.1	Indochinese Rainforest
4.6.1	South Chinese Rainforest
4.7.1	Malayan Rainforest
4.8.4	Indus-Ganges Monsoon Forest
4.9.4	Burma Monsoon Forest
4.10.4	Thailandian Monsoon Forest
4.11.4	Mahanadian
4.12.4	Coromandel
4.13.4	Ceylonese Monsoon Forest
4.14.4	Deccan Thorn Forest
4.15.7	Thar Desert
4.16.12	Seychelles and Amirantes Islands
4.17.12	Laccadives Islands
4.18.12	Maldives and Chagos Islands
4.19.12	Cocos-Keeling and Christmas Islands
4.20.12	Andaman and Nicobar Islands
4.21.12	Sumatra
4.22.12	Java
4.23.12	Lesser Sunda Islands
4.24.12	Celebes
4.25.12	Borneo
4.26.12	Philippines
4.27.12	Taiwan

(4) The Indomalayan Realm

The tropical ecosystems of the Eurasian continent, and of the neighbouring southeast Asian (Australasian) Archipelago form a subkingdom of the Palaeotropical Kingdom of Engler; Sclater named this area an Indian Region, but Wallace's term, *viz.* Oriental Region, stuck. This term was perfectly acceptable when the world was looked upon from longitude 0° as center, but is not so expressive today. Therefore, and also because we have shorn it from its Pacific Island world extension, we re-name this area as a biogeographical realm - the Indomalayan Realm. It consists of the mainland of Southeast Asia, south of the temperate-Palaearctic Himalayas chain and the continuing Szechwan Mts. Here belongs southernmost coastal China - covered with tropical forest, and Taiwan (as discussed above). The Pacific is clear of islands east of the Philippines and the boundary here is firm. Further to the south, the transitional area often called Wallacea is here divided, true to our principle that only realms and provinces will be used (even if this is scientifically debatable). The Papuan Biogeographical Province (New Guinea with surrounding islands) has more Indomalayan elements than Australian; however, it also has a large endemic element, with strong floristic relations (the Gondwanan flora) with New Zealand, Tasmania, and South America. We have classed it with Oceania, but have left the Lesser Sunda Islands within the Indomalayan Realm. In delimiting the mainland provinces, Champion's (1965, 1968) vegetation maps and Varshney's (C.K. Varshney, *in litt.* 1975) advice were indispensable. Lacking field experience and faunistic works for this area, vegetation remained the sole basis here.

(5) The Oceanian Realm

Both zoologists and botanists agree that the biota of the Pacific islands is to the greatest extent derived from that of the Indomalayan (Oriental) Realm (Gressitt 1961, Usinger 1963, Thorne 1963, Fosberg 1975 in litt.). It is also evident that the degree of endemism is high. Depending on the distance from the source area, the biota becomes more and more derived and less and less diversified, but this latter phenomenon is to a large extent due to the young evolutionary age of the islands, and also to the uniformity and low diversity of island habitats. This large geographic area then has a biota which is only historically related (i.e., at the level of higher taxa) to the biota of its main source, but possesses its own, endemic, adapted life forms, and, due to geography, its common denominators. We rank the island groups of the tropical Pacific as a realm of their own and delimit and subdivide it as follows:

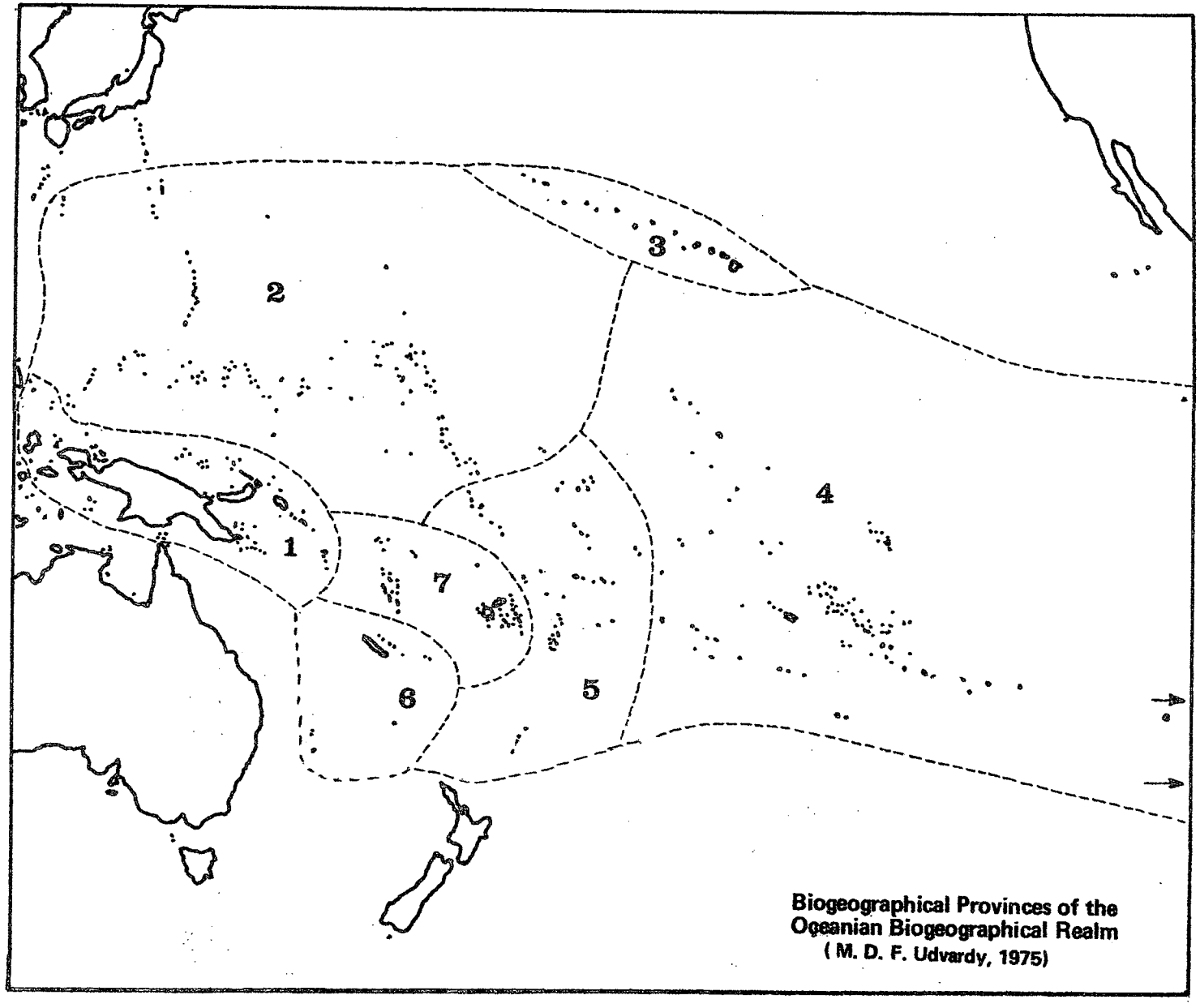
The Papuan Province is a distinct floral and faunal entity, owing to its geographic position, great geologic age and Pleistocene land connections to Australia, showing strong Australian influences besides its predominantly Indomalayan ties. Gressitt (1961) and Usinger (1963) are followed in including, besides satelite island groups around New Guinea, the Bismarck and Solomon islands (as did Wallace (1876)). Wallace's Papuan subregion, however, was subordinate to the Australian region. Among the florists only Takhtajan (1969) follows suit: Engler, and following him, Mattick, Good, and the other florists, count these island groups in their 'Polynesian subkingdom' of the Indomalaysian kingdom. Fosberg (1975, in litt.) suggests that the Solomons are part of the Micronesian-Melanesian island area, whereas the Bismarcks are part of the Papuan. Without having a clear argument - much more field work needs to be done - we keep these islands in the Papuan Province.

Southernmost New Guinea is climatically, vegetationally, and also partly faunistically similar to northernmost, tropical Australia, because of late Pleistocene land connections. Some classify these areas with Australia, or else place both in the Papuan entity. But, for our consideration, the present Torres Strait is a good biotic divider.

The Micronesian Province includes the Bonin and Volcano Islands, Parece Vela, Marcus and Wake Islands, the Mariana, Caroline, Marshall, Gilbert and Palau Islands.

The northernmost members of the Oceanian Islands Realm are the Hawaiian Islands, forming their own Hawaiian Biogeographic Province, with mostly Neotropical faunal influence.

From the Line Islands south including the Danger and Cook Island groups, and eastward stretching beyond Easter Island all the way to include the Juan Fernandez Islands, and in the south, proceeding west, to Rapa, is the extent of the Southeastern Polynesian Province, following Gressitt (1961), and Usinger (1963) who outlined the province. They did not include the Juan Fernandez group which usually figures as a province of the Neotropical. However its strong southeast Polynesian and Hawaiian floral relations and the presence of an endemic insect and plant family (Gressitt 1961, Good 1964, Fosberg 1975 in litt.) enabled us to incorporate the Juan Fernandez Islands into this province. Clipperton Island is an



Biogeographical Provinces of the
Oceanian Biogeographical Realm
(M. D. F. Udvardy, 1975)

Note on the Map of the Oceanian Realm.

The two arrows pointing eastward north and south of Easter Island signify the San Felix-San Ambrosio, and the Juan Fernandez Islands groups, repectively. Those island groups form the eastern boundary of the realm.

(5) The Oceanian Realm

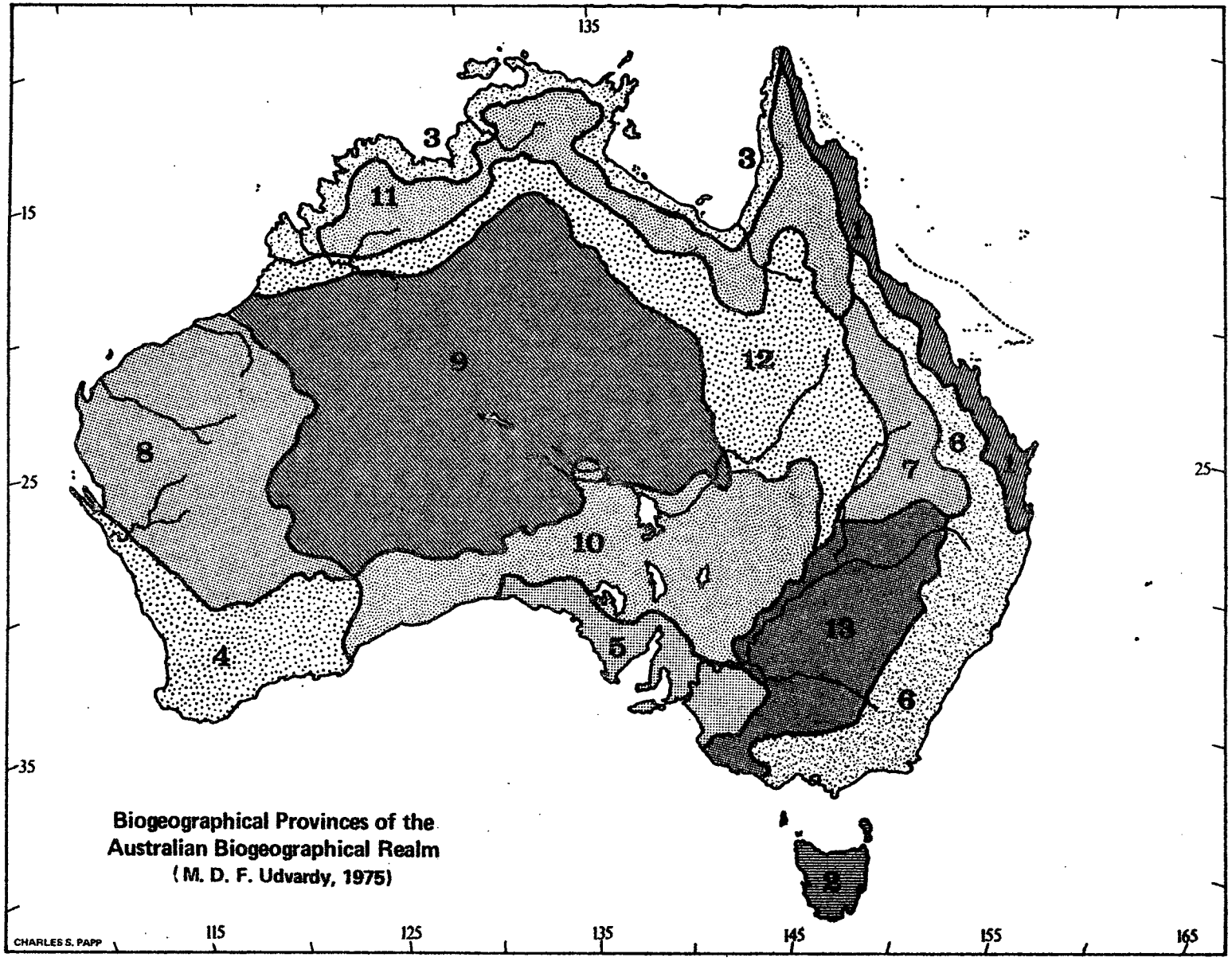
No.	Biogeographic Province
5.1.13	Papuan
5.2.13	Micronesian
5.3.13	Hawaiian
5.4.13	Southeastern Polynesian
5.5.13	Central Polynesian
5.6.13	New Caledonian
5.7.13	East Melanesian

outlyer, and it is included in this province on account of its geographical position rather than its scanty and oft disturbed biota (cf. Sachet 1962).

The Central Polynesian Province includes the Phoenix, Ellis, Tokelau, Samoa, and Tonga Islands, and also the Kermadec group (Gressitt 1961, Usinger 1963) though this latter shows much in common, and is grouped together, with New Zealand by florists (Good 1964).

The New Caledonian Province is unique floristically as well as faunistically. Lord Howe and Norfolk Islands are classified here (Gressitt l.c. but not Usinger l.c.) at least provisionally on grounds of their tropical faunistic affinities in spite of their Gondwanan-Antarctic floral ties.

The East Melanesian Province (Gressitt l.c., Usinger l.c.) comprises the New Hebrides and Fiji Island groups.



Biogeographical Provinces of the Australian Biogeographical Realm
(M. D. F. Udvardy, 1975)

(6) The Australian Realm

No.	Biogeographic Province
6.1.1	Queensland Coastal
6.2.2	Tasmanian
6.3.4	Northern Coastal
6.4.6	Western Sclerophyll
6.5.6	Southern Sclerophyll
6.6.6	Eastern Sclerophyll
6.7.6	Brigalow
6.8.7	Western Mulga
6.9.7	Central Desert
6.10.7	Southern Mulga/Saltbush
6.11.10	Northern Savanna
6.12.10	Northern Grasslands
6.13.11	Eastern Grasslands and Savannas

(6) The Australian Realm

Faunists and florists agree that the Australian continent as a whole is a distinct biogeographical entity, and it is ranked as a Region or Kingdom, respectively. Disagreement begins when we ask what else does belong to the Australian entity? The botanists consistently follow Engler in keep ing the continent by itself. Zoologists, starting with Wallace, have annexed to Australia more or less of the surrounding island worlds. (See, for details, Udvardy 1969). It seems to be easiest to build up our position if we strip Australia step by step of the annexed areas.

Wallace built his system on Sclater's birds, and on the mammals, but thes are absent from New Zealand. Modern zoogeographical study of ground-dwelling invertebrates provides evidence that parallels that of the botanist, viz. that New Zealand's basic fauna is not related to Australia but it is rather of old Gondwanan stock (see at Realm 7). Thus New Zealand is by no strong evidence part of the Australian biogeographic uni Most of the South Pacific Islands which Wallace attached as a subregion t Australia, show overwhelming Indomalayan historic ties both as regards th flora and the fauna (Gressitt, Usinger l.c.). Thus remains the transitional area of the Sunda Islands east of Wallace's line (cf. Mayr 1944) which deserves the name 'Wallacea', and further, New Guinea with the Bismarck and Solomon Islands. Whereas Wallacea is smoothly transitional regarding vertebrates, its insect fauna shows a basic Indomalaysian stock with a trinkling, if any, of Australian influence. Thus it seems easy to follow the florist in incorporating it into the Indomalaysian Realm (cf. Zimmermann 1948, Gressitt 1961).

The consensus of contemporary zoogeographic studies is that though New Guinea and its shelf islands were joined to Australia during several phases of the Pleistocene, New Guinea has a basic, rich biota, much more ancient in origin as well as evolutionary history, and independent of Australian faunal or floral influence. Even though the two land masses continent and almost continent-sized island, respectively - were joined by a land bridge, orography and climatic zonation seemed to aid in preserving their integrity with the exception of the climatic belt of the former land corridor. The present tropical savanna-dry forest zones of extreme southern New Guinea and Torresian Australia have caused and still cause a division among zoogeographers. Whereas Usinger (1963) attached the Cape York Peninsula of Queensland (Australia) to his Papuan subdivision of the Oriental Region, Gressitt (1961) treated it as a clearly transitional area together with southern New Guinea, and he (1975, in litt.) still opines that "the overlap of Australian and Oriental in southern New Guinea and Northern Australia needs to be shown as an overlap zone with dominance of Oriental elements ..."

For our uniform system of realms and provinces we retain the continent of Australia as a realm without showing its biogeographical involvement with New Guinea.

Faunistic research in Australia progresses with leaps and bounds, but, as expected in a state of flux, there is no agreement on faunistic provinces (cf. Keast 1959, 1972, McMichael and Iredale 1959, Horton 1973, and others). Therefore the basis of our biogeographical provinces is vegetational, and follows Dasmann (1974), also considering Leeper 1970.

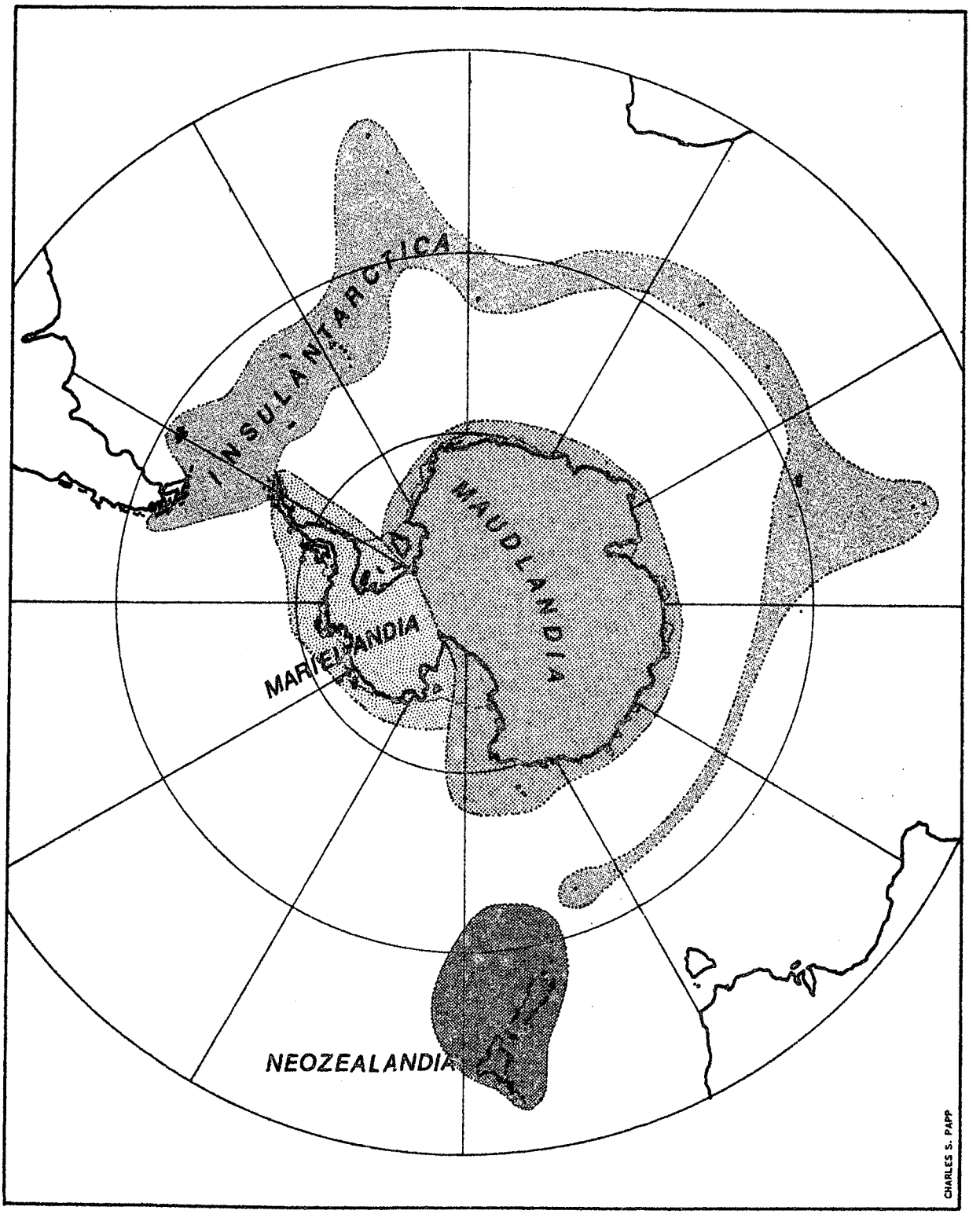
(7) The Antarctic Biogeographical Realm

The antarctic biota is as yet very poorly known, but great advances have been made since the late 1950s. Biogeographic classification of the flora was earliest (Skottsberg 1905-1960), followed by that of the vegetation (Nordenskjöld 1928, Wace 1965), invertebrate fauna (Gressitt 1961-1967, etc., Brundin 1965, 1966, 1970), and vertebrates (latest Watson et al. 1971, birds, and Brown et al. 1974, mammals).

With a terrestrial fauna as sketchily known as all authors readily admit, and with the wide dispersal capabilities of the much better known coastal bird and marine mammal fauna, the biogeographical division of Antarctica here presented is highly provisional.

Nevertheless, a tentative classification is necessary, and it follows the recent trend of reassessment of world biogeography, collating it with plate-tectonic geology. The Antarctic continent, or mainland, geologically also sharply dichotomous (Harrington 1965), will be divided into a west-antarctic and an east-antarctic sector. All antarctic endemic arthropods so far were collected in East Antarctica (a geographic term) whereas no terrestrial invertebrate fauna has as yet been found in geographic West Antarctica, save the Peninsula, the west side of which also has a distinct flora and avifauna. Here the only low antarctic vegetation, i.e. tundra, harbors a terrestrial fauna. This, together with the flora and avifauna, is found to be affiliated with that of Magellanic South America. Thus there are enough grounds here to differentiate two antarctic provinces within the Antarctic continent: 7.2.9. East Antarctic Province or Maudlandia (from Queen Maud Coast in the NW, and Queen Maud Mountains in the S) and 7.3.9. West Antarctic Province or Marielandia (from Marie Byrd Land, in SW sector). Peter I. Island joins Marielandia; Balleny and Scott Islands, Maudlandia.

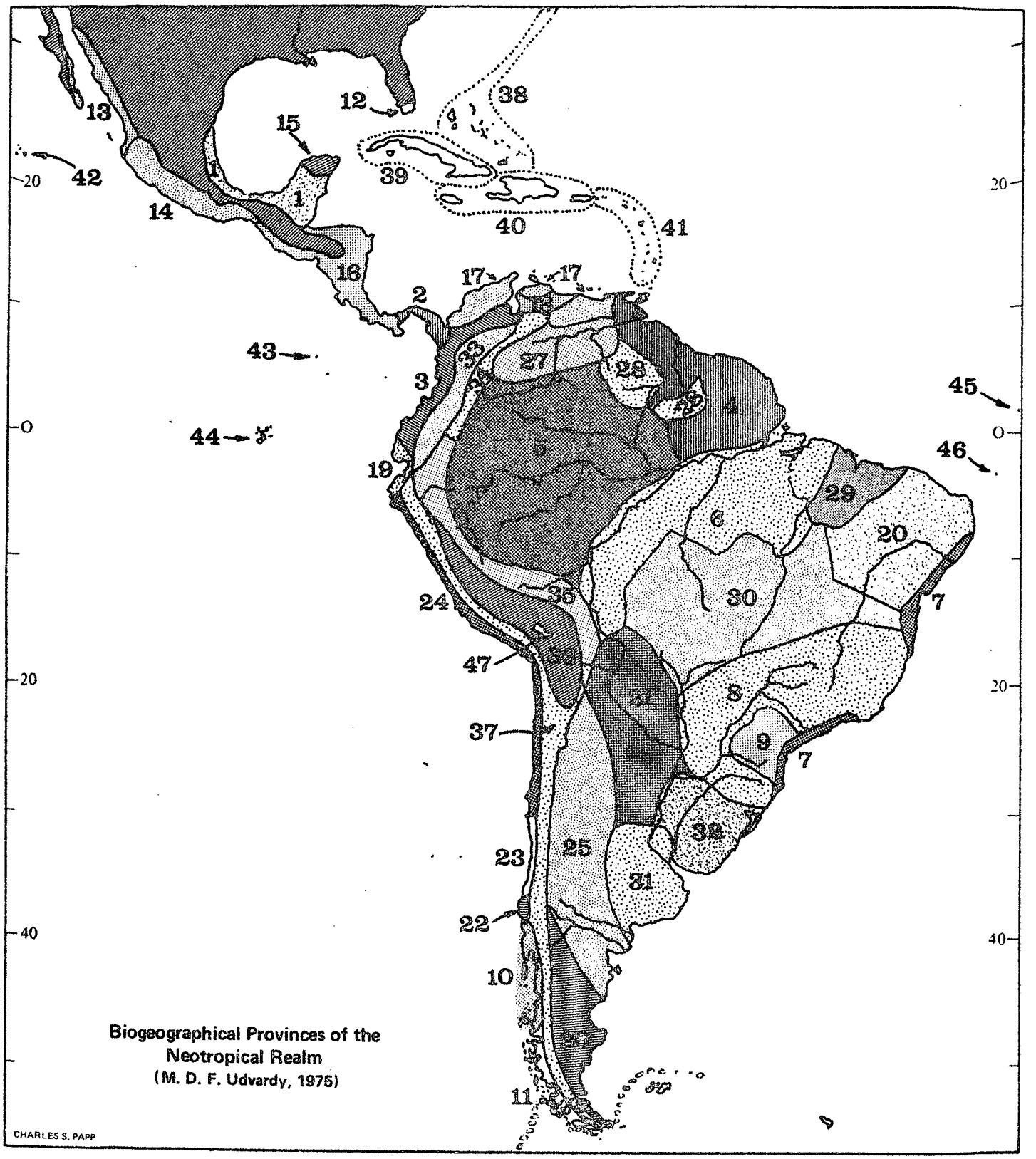
The temperate and subantarctic islands of the southern seas, including those flanking Tierra del Fuego and the Antarctic peninsula, compose the third biogeographic province: Insulantarctica, 7.4.9. These islands are, with the exception of St. Paul and New Amsterdam Islands, south of the subtropical or antiboreal (Ekman 1953) convergence: Falkland (Maldivas) Islands, S. Shetlands, S. Orkneys, S. Georgia, S. Sandwich, Tristan da Cunha, Gough, Bouvet, Marion, Prince Edward, Crozet, Kerguelen, Heard, St. Paul and New Amsterdam, Macquarie, Antipodes, Bounty. The Chatham Islands, the New Zealand shelf islands, (Stewart, Snares, Auckland, Campbell) and New Zealand itself comprise the fourth biogeographic province within the antarctic realm: Neozealandia, 7.1.2. Though the rugged South Island, in particular, has several altitudinal (montane) vegetation belts, New Zealand as a whole is characterized by the subtropical evergreen rain forest resp. deciduous forest (Walter 1968).



Biogeographical Provinces of the Antarctic Biogeographical Realm
(M. D. F. Udvardy)

(7) The Antarctic Realm

No.	Biogeographic Province
7.1.2	Neozealandia
7.2.9	Maudlandia
7.3.9	Marielandia
7.4.9	Insulantarctica


Biogeographical Provinces of the
Neotropical Realm
(M. D. F. Udvardy, 1975)
CHARLES S. PAPP

(8) The Neotropical Realm

No.	Biogeographic Province	No. & name in Dasmann 1974*	
8.1.1	Campechean		Campeche
8.2.1	Panamanian		
8.3.1	Colombian Coastal		
8.4.1.	Guyanan	--	
8.5.1	Amazonian		
8.6.1	Madeiran	--	
8.7.1	Serra do mar	3.7.5	Bahian coast
8.8.2	Brazilian Rain Forest	3.6.6	Brazilian Deciduous Forest
8.9.2	Brazilian Planalto		Brazilian Araucaria Forest
8.10.2	Valdivian Forest		Chilean Temperate Rain Forest
8.11.2	Chilean Nothofagus	--	" " " (part)
8.12.4	Everglades		
8.13.4	Sinaloan		
8.14.4	Guerreran		
8.15.4	Yucatecan		Yucatan
8.16.4	Central American		Carib-Pacific
8.17.4	Venezuelan Dry Forest		
8.18.4	Venezuelan Deciduous Forest		
8.19.4	Equadorian Dry Forest		
8.20.4	Caatinga		
8.21.4	Gran Chaco		
8.22.5	Chilean Araucaria Forest	3.3.2	
8.23.6	Chilean Sclerophyll		
8.24.7	Pacific Desert		Peruvian+Atacama Desert
8.25.7	Monte		Argentinian Thorn-scrub
8.26.8	Patagonian		

(Table continues)

(8) The Neotropical Realm (continued)

No.	Biogeographic Province	No. & name in Dasmann 1974*	
8.27.10	Llanos		
8.28.10	Campos Limpos	3.8.2	Guyana highlands
8.29.10	Babacu		--
8.30.10	Campos Cerrados		Campos
8.31.11	Argentinian Pampas		Pampas
8.32.11	Uruguayan Pampas		--
8.33.12	Northern Andean		Northern Andes
8.34.12	Colombian Montane		--
8.35.12	Yungas		Andean cloud forest
8.36.12	Puna		
8.37.12	Southern Andean		Southern Andes
8.38.13	Bahamas-Bermudan		Bahamas + Bermuda
8.39.13	Cuban		
8.40.13	Greater Antillean		Jamaica+Hispaniola+Puerto Rico
8.41.13	Lesser Antillean		Lesser Antilles
8.42.13	Revilla Gigedo Island		--
8.43.13	Cocos Island		
8.44.13	Galapagos Islands		--
8.45.13	Fernando de Noronja Island		--
8.46.13	South Trinidade Island		
8.47.14	Lake Titicaca		

*Note: 1974 name and number only listed when different from the present one.

(8) The Neotropical Realm

Even though there are still some white spots and areas on the map of bioecological exploration of Central and South America, during the last two decades our knowledge regarding biogeography of the Neotropical realm advanced with leaps and bounds. I draw from sources in the comprehensive volumes 'Biogeography and Ecology in South America' (Fittkau et al. 1968-69) and 'Vegetation and Vegetational History of Northern Latin America' (Graham 1973); about vegetation in particular, from Hueck 1966, Weber 1969, and especially from Hueck's (1972) detailed vegetation map of South America, and from Holdridge (1957). Rapoport (1968) summarizes all the previous attempts at biogeographical, and especially zoogeographical, regionalization of Central and South America. Fittkau (l.c., 1969) and his collaborators, Müller (1973) and Haffer (1974), provide vital new information about zoogeographical centers in the Neotropics. For Central America only, Knapp (1965) and the new Mexican vegetation map (Flores et al. 1971) were useful.

The northern limits of the Neotropical Realm on the North American continent comprise three distinct areas: the coastal areas of Baja California and Sinaloa flanking the Gulf of California, and thence southward the slopes of the Sierra Madre Occidental, then the Chiapan, Guatemalan, Salvadorian Pacific slopes, continuing along the Bay of Fonseca down to about Lat.13° North. The slopes and coastal plain along the Gulf of Mexico from northern Veracruz southward including the Yucatan peninsula and the Caribbean coastal flat or mountainous areas of Honduras and northern Nicaragua; thence south through the whole Central American Isthmus comprising the major part of Nicaragua, and all Costa Rica and Panama. Third, in the east, southernmost Florida, and the Caribbean archipelago, which we divided into three biogeographical provinces, the Cuban, Greater Antillean and Lesser Antillean Provinces. Finally South America, with all islands on the continental shelf, but excluding the southernmost archipelago of Tierra del Fuego, which we classed into the Antarctic Realm. Of the Pacific islands further from the continent, the Revilla Gigedos with Socorro Island are clearly tropical, hence classed with the Neotropical Realm, along with Cocos Island and the Galapagos Islands. The Desventuradas (San Ambrosio and San Felix) and the Juan Fernandez Islands (Masafuera and Masatierra) show Polynesian affinities and are thus excluded from the Neotropical. The two south Atlantic oceanic islands, Fernando de Noronha and South Trinidade, are included. However the Falkland Islands have typically subantarctic fauna and vegetation.

The rich literature enabled us to establish on the South American mainland not less than thirty biogeographical provinces. No doubt, some of them will be found controversial and many of them in need of revision by local experts. Thus the area covered by the Amazonian forest is divided into three provinces; on the other hand, the Atacama desert area is united with the coastal area further to the north and to the south, still of an extreme, semidesert nature. In this and other changes we paid less attention to the historic element (e.g., by Müller 1973 and Haffer 1974) than to the distinct vegetational entities as shown by Hueck (l.c.) and others.

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This objective can be achieved through active conservation programmes for the wise use of natural resources in areas where the flora and fauna are of particular importance and where the landscape is especially beautiful or striking, or of historical, cultural or scientific significance. IUCN believes that its aims can be achieved most effectively by international effort in co-operation with other international agencies, such as UNESCO, UNEP and FAO.

The World Wildlife Fund (WWF) is an international charitable organization dedicated to saving the world's wildlife and wild places, carrying out the wide variety of programmes and actions that this entails. WWF was established in 1961 under Swiss law, with headquarters also in Morges.

Since 1961, IUCN has enjoyed a symbiotic relationship with its sister organization, the World Wildlife Fund, with which it works closely throughout the world on projects of mutual interest. IUCN and WWF now jointly operate the various projects originated by, or submitted to them.

The projects cover a very wide range, from education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction as well as support for certain key international conservation bodies.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.