

PACIFIC PLANT AREAS

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INTRODUCTION

HISTORY OF THE PROJECT

Pacific Plant Areas was first suggested by Prof. Dr. H. J. Lam, Director of the Rijksherbarium, Leyden, during the 6th Pacific Science Congress held at Berkeley, California, in 1939.² In the 7th Pacific Science Congress held in Auckland and Christchurch, New Zealand, in 1949, Doctor Lam made a detailed progress report on the project.³

A further report consisting of an enumeration of the collections made in various islands of the Pacific basin was made by Prof. Dr. W.R.B. Oliver of Wellington, New Zealand, who was chairman of the Committee from 1949 to 1953, in the 8th Pacific Science Congress held in Manila in 1953.³ During the Congress, its Standing Committee on Pacific Plant Areas was made a subsection of its Botany Section, and Doctor Oliver was succeeded as chairman of the subsection by Doctor Lam who, during the preceding years, had collected a considerable number of tentative distribution maps of genera and species with the help of a number of collaborators.

In view of his many official commitments with the University at Leyden and other concurrent duties, Doctor Lam invited me in the fall of 1958 to take over the chairmanship of the Subcommittee, to which Doctor Fosberg, who had promoted the project very much, agreed. Doctor Lam specifically desired that a start should be made with the actual publication of maps.

In the present volume a bibliographic list of all maps printed in the past is included. The list was compiled by Mrs. M.J. Van Steenis-Kruseman, Oegstgeest, and shows the surprisingly large number of such maps published.

Though the most important books and serials have been scanned, it is to be expected that not all published maps have been listed, but it is assumed that the bulk has been covered.

² Proc. Seventh Pacific Science Congr. 5 (1953) 5-12.

³ Proc. Eighth Pacific Science Congr. 4 (1957) 9-10.

³ Ibid., 11-14.

AIM OF PROJECT

It is hardly necessary to explain in full the advantages of the project which would contain the precise areas of distribution of each species, variety, genus, and others; in short, of each botanical taxon in the Pacific area. Such a work would be basic for the study of plant geography and of plant taxonomy. From it the geologist may derive arguments for the history of the Pacific basin or parts thereof; the palaeontologist may find evidence for a reconstruction of the history of the Pacific plant world by enabling him to compare the present areas of distribution with those of the fossil records of the same or an allied taxon; and the zoologist would be able to compare distribution areas of animals with those of plants. Finally the work would not be without profits for several branches of applied botany, such as phytopathology (distribution of host plants of pests), ethnobotany, and others.

A specially interesting field for which raw materials are found in this work refers to a basic question of plant geography, viz., the relation between dispersal methods of plants and effectiveness of dispersal structures as materialized in the area of distribution. In this, another factor is also much involved, viz., the age of the taxon and the time during which the dispersal has actually taken place in the past.

The value of plant-geography maps in general, and of Pacific Plant Areas in particular, depends a great deal on the degree of accuracy and care with which the maps will be made.

The importance of this work will increase in proportion to the number of maps published. Because the compilation of accurate maps is both slow and time-consuming, its completion is not to be expected in a short time; it will certainly take many years before a solid mass of reliable information will have been gathered.

An important facet of the Pacific Plant Areas is the fact that its publication will distinctly contribute to, or at least act as a stimulant for the integration of the Pacific flora with that of surrounding countries.

There is no such thing as a 'Pacific flora' comparable to an African, Australian, or South American flora. Different parts of the Pacific flora show intimate relationships with surrounding continental floras to be separated from them. For example; the Bonins cannot be separated from the East Asiatic flora; Micronesia, Melanesia, and Polynesia have a preponderantly Malay-

sian flora; New Zealand cannot be separated from the Australian flora; and the flora of the Galapagos is American.

But the oceanic relations and the checkered geological history of the immense Pacific basin represent fascinating problems of plant evolution and plant distribution worthy of the highest attention. The restricted conditions of insular plant life may offer clues to various basic problems in plant geography and speciation, for example, on the effect of dispersal methods, raiation through isolation, relic endemism, and former land bridges as pathways of distribution, problems which have been discussed by J. D. Hooker, Botting Hemsley, Guppy, and others, in the nineteenth century, but which have remained topics to the present day. The immense increase in factual data and the development of the genetical background of taxonomy with the possibility of experimental research make it possible to renew inquiries into the secrets concealed in Pacific plant life.

METHODOLOGY AND TECHNIQUE ADOPTED

After several discussions with colleagues the following guiding principles have been adopted in order to find a satisfactory scheme ensuring homogeneity.

Accuracy.—Maps should be as accurate as possible. Literature should be consulted and sometimes critical herbarium studies should be made. No occasional data found in literature can be taken for granted; they should be based on herbarium specimens. Frequently accurate maps can only be made after monographic or submonographic studies of species, and sometimes even of genera, have been made. Such maps can only be compiled through collaboration of several persons and institutes.

Plant areas.—It will fall outside the scope of this work to give a map of the complete world distribution of a taxon. Our maps should in principle be limited to the distribution in the Pacific area and the not-too-far interior of the bordering continents. In the legend to the map the distribution beyond the Pacific can further be elucidated.

Definition of 'Pacific'.—The principal aim is to prepare maps of plant distribution in the insular Pacific. Therefore, we are primarily concerned with those taxa of which at least part of their distributional area is situated in the Pacific basin proper. For this purpose the Pacific basin is defined on the west side by a line east of the Kuriles, Aleutians, Japan, the Ryukyus, Formosa, Philippines, Moluccas, New Guinea, Bismarcks, the Australian continent, and Tasmania.

Accordingly the Bonins, Marianas, Carolines, Solomons, New Hebrides, New Caledonia, Lord Howe, Norfolk, and New Zealand are reckoned as within the Pacific basin.

Along the east side, on the coast of the Americas, delimitation is simpler: Clipperton, Galapagos, S. Ambrosio, and the Juan Fernandez group are reckoned as 'Pacific'.

If desirable for the understanding of a Pacific plant area, areas of non-Pacific taxa can of course be added for comparison; this has been done, for example, in the first instalment for the three sand-beach-bound species of *Triumfetta* of which only one belongs to the Pacific flora in the sense employed here.

Transpacific areas.—A specially interesting group of areas is formed by so-called transpacific affinities. In a number of such areas living representatives are also found in Pacific Islands, such as those of *Nicotiana*, *Acaena*, *Sanicula*, *Oreobolus*, and others. In many other cases, however, the genus or tribe has no representatives in the islands of the Pacific basin as defined here.

Such a disjunction can be found in the temperate North Pacific. It has become well known since Asa Gray and Hooker called attention to it. Some years ago Hui-Lin Li gave a modern survey of this type.

The transpacific disjunction can also be situated in the temperate South Pacific. It can also occur combined in both the north and south temperate zones, as shown, for example, by *Libocedrus* sens. lat. and the affinity of *Tecomathe-Campsis-Campsidium* of the Bignoniaceae.

Finally, the transpacific disjunction can be found between the tropical or subtropical regions on both sides of the Pacific, as for example in *Mitrastemon*, *Hedyosmum*, *Distylium*, *Schismatoglottis*, *Spathiphyllum*, the Trigoniaceae, the affinity *Ploiarium-Archytæa* (Theaceae), the two genera of the Corsiaceae, the genera of tribe Joannesieae (Euphorbiaceae), and the Polygalaceae tribe Moutabeae. All these, specially the latter tropical transpacific disjunctions, represent a formidable problem in plant geography.

Though these disjunct areas do not concern the "island" flora of the Pacific basin proper and are marginal to it, they deserve our full interest, as the history of such disjunct areas must in some way or another be tied up with past Pacific conditions.

For these reasons transpacific disjunct plant areas will also be included in the project.

Opportuna sequence.—Maps are not prepared in any systematic order but are published as soon as there is a good opportunity for having a reliable map made.

Taxa to be mapped.—(1) Families. In a few cases it might be useful to have reliable maps of families as far as they are distributed in the Pacific. Many published world maps suffer from inadequacies in the Pacific basin.

(2) Genera or infrageneric taxa. Even if species are not precisely discriminated, accurate generic maps may be extremely useful for various purposes, so long as there is no doubt about generic or infrageneric delimitation!

(3) Specific and infraspecific taxa. Here taxonomic delimitation and localities must be precisely known and be as complete as can reasonably be expected.

Cryptogams and phanerogams.—Distribution of phanerogams will, in general, be better known than that of cryptogams. In principle both groups will be considered.

Aliens.—Though the distribution of aliens may sometimes be interesting, we should restrict mapping generally to autochthonous plants; areas of aliens are generally of ephemeral value and will only be considered in exceptional cases.

Collaboration.—A wide collaboration of institutes and individual persons is necessary. Once a map has been prepared the intention is to send it, if necessary, for checking and approval, to institutes situated in the area where the plant is distributed and to some world herbaria where there is likely material accumulated of the taxon in question. By this system of collaboration, it is hoped that the desired information would be provided within a reasonable time. The maps which we assume to be able to produce annually (from 20 to 30) are not many and we hope that the system will work advantageously. Only a few maps will need extensive team-work in this way, since monographers have generally already revised all material from the major herbaria.

Herbaria are invited to appoint a special staff-member as a regional representative on whom we can fall back for obtaining necessary information.

Documents.—If collaboration is requested, the request will be accompanied by blank or tentative "working maps" and a standard geographical map of the Pacific area for localizing

localities. For this purpose a number of copies of 'Pacific Ocean' prepared by the National Geographic Society for the National Geographic Magazine (with index), scale 1:27,500,000, are available. If desirable, identification keys to the taxa will be added in order to enable checking of sheets in the herbarium.

Signs or symbols on maps.—Localities will generally be indicated by dots. Areas which can definitely be delineated will be indicated by a full line. Parts of such lines where accurate delineation cannot well be attained or is supposed to be uncertain will be indicated by a broken interruption.

In the case of families, genera, and sections, the land surfaces where the taxon occurs are preferably filled black, in addition the complete area can be encircled by a line. For generic areas it may be of value to indicate the approximate "density" of species or distribution of section and/or subsections for the various islands or Pacific provinces to show the biogeographic "structure" of their area. Examples of this procedure can be found in *Flora Malesiana*.

Endemism will require special measures which will depend on each particular case.

Models of blank maps.—Provisionally we will start with one standard map, size 47 by 29 cm, fit to be reduced exactly to page size. For certain areas it may be desirable to have other smaller types of maps of parts of the Pacific. More than one taxon may be treated on one map, provided that the "picture" remains clear.

Legend.—Each map will be accompanied by a concise legend which should preferably be fit to be printed on one page, that is, besides the title, a text of about 2,000 lettertypes. It should, in principle, contain the following essential information:

- (1) Full name of the taxon with author's name; first place of publication; later important publications on it; major synonyms; family (and, in cryptogams, also the class) to which it belongs.
- (2) Concise notes on habit and variability if desirable, but not a full diagnostic description; explanation of features of or problems concerned with the area; subtaxial geographical correlation.
- (3) Habitat (forest, strand, rock, soil, altitude, etc.) and ecology (pollination, etc.).
- (4) Frequency and sociology.
- (5) Probable means of dispersal.

- (6) Other notes essential for making the distributional area understandable; for example, its affinity, fossil occurrences, etc.
- (7) Sources used for the compilation of the map.
- (8) Author(s) responsible for the map and legend.

CONTENTS OF THE PRESENT VOLUME

The present volume shows a variety of plants and taxa. Of some (*Crossostylis*, *Gonystylus*, *Sanicula*, *Tecomanthe*, *Gynotroches*, and *Oreomyrrhis*) the entire generic area of distribution is given. Of other genera with a wider distribution only that part which occurs in the Pacific has been mapped (*Rourea*, *Dichapetalum*, *Canarium*). Of still others the species by which a wider distributed genus is represented in the Pacific is mapped in detail (*Dolichandrone*, *Camptosperma*, *Mapania*, *Crateva*, *Cerriops*, *Carallia*, *Styrax*, *Bruguiera*). Of one genus only special species have been mapped, viz., the three Indo-Pacific species of *Triumfetta* which are bound to the sandy beach.

The species mapped in this volume belong also to a variety of biotopes, for example from the beach (the *Triumfettas*), the mangrove (*Cerriops*, *Dolichandrone*, *Bruguiera*, *Rhizophora*), the rain-forest (*Carallia*, *Gynotroches*, *Tecomanthe*, *Styrax*, *Gonystylus*, *Canarium*, *Rourea*, *Dichapetalum*, *Mapania*, *Crossostylis*), the swamp forest (*Camptosperma*), the montane zone (*Sanicula*), the alpine zone (*Oreomyrrhis*).

Among them there are climbers (*Rourea*), trees, and herbaceous plants.

As to dispersal methods of seed and fruit they belong to very different classes.

DEDICATION AND ACKNOWLEDGMENT

I have found it fit to dedicate this first volume of Pacific Plant Areas to Prof. Dr. Carl Skottsberg, of Göteborg, Sweden, who has earned the highest merit for his work on the Pacific flora, notably of the Hawaii and Juan Fernandez groups, and his monographs on Pacific plants. During the present century he contributed more than any other single botanist towards the promotion of Pacific plant geography.

I feel very much obliged to Miss Brenda Bishop, Secretary of the Pacific Science Council for granting some funds for the purchase of geographical maps and for the making of blocks and the printing of blank maps.

Special thanks are due to all colleagues who helped in compiling the maps or gave pertinent information to the compilers; their names appear in the legends to the maps.

The publication is grateful to have found a "home" with the National Institute of Science and Technology of the Philippines, Manila, which will publish the same as one of its monograph series. If possible one volume will be published annually, but if not the publication will appear at irregular intervals.

I am particularly indebted to Dr. E. Quisumbing in this regard for having welcomed this project, which I feel is of distinct value to studies of the Pacific plant world in which the Philippines stand in such intimate relation.