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# MAPPING ACTIVITES OF THE INTERNATIONAL BIOLOGICAL PROJECT.

Among the widely separated mediterranean type ecosystems, no two are more alike, in many respects, than those found in Chile and California. To attempt to better understand the nature and extent of this similarity, a large-scale project was undertaken. Beginning in 1970, the National Science Foundation of the United States funded the Mediterranean Scrub Project of the Structure of Ecosystems Subprogram, Origin and Structure of Ecosystems Integrated Research Program, International Biological Program. As stated in the project proposal, the investigation was to be directed toward understanding the degree to which "very similar physical environments, acting on phytogenetically dissimilar organisms in different parts of the world, will produce structurally and functionally similar ecosystems." Accordingly, two primary sites in matched environments having distinct floras were located, one in Chile and the other in California. In close proximity to each of these, three secondary research sites, dissimilar in both climate and topography, provided an opportunity to compare taxonomically related plants in different environments. The three pairs of secondary sites, together with the two primary sites (eight sites in total) therefore permitted ample cross comparison.

Maps and mapping were essential to the field work from the beginning to the end of this project. The author was invited to supervise the varied cartographic activities, assisted by specialists from a number of institutions in several different

countries.

The initial investigation concerned the identification of widely separated areas of broad physical similarity. Two regions with mediterranean climate centering on about latitude 34 degrees North and South on the west coast of the Americas, were delimited and studied on existing maps and air photographs. From these regions two research areas of about 30 square kilometers each were selected for more specific study. One of these primary sites is located 50 kilometers north-west of Santiago, Chile and the other 50 kilometers east of San Diego, California, U.S.A. Other sites, secondary in importance, were then located within a few degrees of the two primary areas, seaward or landward as the case required. Thus, in total, two desert, (one in Baja California) two coastal and two montane secondary sites, in addition to the two primary research areas, became the subject of an intensive international investigation.

Since topographic map series of Chile and California are quite different in scale, symbolization, contour interval, and other characteristics, and because comparability was essential to the project, special detailed work maps of individual sites were required. Standardization of such basic work maps enabled the field scientists to begin an organized and careful examination of the flora, fauna, soils, geology and microclimate.

While field and laboratory investigations were in progress, cartographers involved in the project mapped out such physical attributes as slope, aspect, profile, etc. which were directly or indirectly derived from the furnished detailed topographic bases. As mappable data were obtained from scientists in the field, new information was added onto work site maps to

facilitate significant comparisons.

In order to disseminate and organize some of the comparable geographical and biological data collected in the course of the project, an atlas was conceived as the ideal solution. Hence, the Chile-California Mediterranean Scrub Atlas was prepared. The Atlas is divided into two major parts which emphasize separately the various living and non-living components of the areas investigated. The volume is as factual and non-interpretive as possible so that it might be of the greatest utility to all investigators.

The interaction between land and life was portrayed in such a way as to enhance comparability. Through opposite-page comparisons by means of maps, photographs, drawings, diagrams, and tables, the two similar yet disjunct areas are presented. These mediterranean areas are first graphically introduced in general. Then there is a page-by-page comparison of various aspects, using appropriate criteria and microscopic as well as macroscopic methodology.

As described in the introduction of the Atlas, the two primary sites focus on the mediterranean scrub vegetation -- "matorral" and "chaparral" (terms used for these plant communities in Chile and California, respectively). The three secondary sites in each country were located along climatic gradients -- coastal to montane and mesic to xeric. Only those phenomena occurring in both hemispheres were portrayed cartographically or by other means, since the format of the Atlas called for facing-page comparisons.

The maps, photographs, diagrams, and other illustrations in Part One of the Atlas provide a visual expression of the

setting for the biological considerations which follow in Part Two. Contents are arranged in order: first, to provide an overview of mediterranean areas in their world setting; second, to focus on the general mediterranean Chile and California regions; and finally, to delimit and describe sites in these two widely separated areas. At the same time, Part One of the volume is organized to take the reader from theoretical concepts at the outset to more pragmatic considerations toward the end.

Visual materials of different descriptive contents allow the appreciation of the landscapes from several vantage points--vertical, oblique, and profile. The careful selection of such elements as scale, point of view, and medium for each presentation makes it convenient for the reader to extract maximum information about the areas analyzed.

By design, physical geographical topics, such as climate, relief, geology, and vegetation, predominate in Part One although the work of man is included in certain relevant parts. The rendering and symbolization, both graphic and pictorial, are based on solid field analyses. The texts, captions, and legends are purposely minimized, since an atlas, ideally, should carry its information by non-verbal means as far as possible.

Part Two of the Atlas is designed somewhat differently, because the goal here is to present the results of the biological and ecological research in the Chilean and Californian mediterranean areas. As stated earlier, a major thrust of these studies was to investigate the degree to which the two evergreen scrub ecosystems resemble each other, presumably through evolutionary convergence; however the information in Part Two is presented in such a way as to allow individual opinion on

this question.

Nevertheless, throughout Part Two, the emphasis remains on the structure of the two systems. Thus, most of the data compiled present the reader with such concerns as number, size, biomass, energy content, cover, chemical composition, and some complex organic interactions. Questions of function were generally not addressed here, although certain elements of the structural comparisons obviously have functional implications.

In the location of the comparative sites in the two countries, considerable effort was invested, because these areas have been occupied by man for over four centuries. It was necessary, therefore, to choose relatively undisturbed sites for research purposes. The scientists were fully aware at the outset that the selection of the sites and the choice of certain parameters (to the exclusion of others) by which the respective components of the two systems are compared would inevitably lead to certain degrees of subjectivity. Nonetheless, close supervision and careful coordination of the research methodology in the two countries assured the collection of comparable data.

Cartographic comparisons demonstrate the similarities between the Chilean and Californian primary sites and between the three respective pairs of secondary sites, and illustrate that convergence of ecosystems is approached in disjunct areas of the northern and southern hemispheres. It is felt that the methodology used successfully on these mediterranean scrub areas could be profitably employed on other ecosystems--deserts, taiga, tundra, etc.

The contents of the Atlas speak for themselves; it is hoped, of course, that they tell a consistent story. The

individual contributors to the Atlas interpret their data in other scientific publications, and a major synthesis of the research appears in another volume also resulting from the Mediterranean Scrub Project.

The Chile-California Mediterranean Scrub Atlas contains some two-hundred and fifty plates, each with three or four illustrations, approximately one-thousand in total. Besides the general editors there are twenty-four contributing authors. Moreover, a large number of individuals helped with this work in addition to those specifically listed as editors or authors, namely, administrators, technicians, field assistants and others. The principal co-editors are Dr. Norman Thrower and Dr. David Bradbury who are also the editors of Part One of the Atlas. The cartography and design of the volume is the work of Mr. Noel Diaz. Dr. Jochen Kummerow and Ms. Kathleen Fishbeck edited Part Two of the Atlas, and Professor Harold Mooney of Stanford University and Professor Otto Solbrig of Harvard University supervised and coordinated the entire Mediterranean Scrub Project.

In this International Biological Project maps of various types and scales were used in many different ways. During the reconnaissance phase existing maps proved valuable in the discovery of disjunct areas of considerable physical similarity. After the selection of the primary research areas, large scale topographic maps of comparative values were produced to facilitate analysis of the biota, morphology, and other aspects of these specific sites. Work maps of flora and fauna were used as overlays for analytical purposes, taking into account such elements as soils, vegetation, climate and other physical

characteristics. From the work maps smaller scale thematic delineations were produced to form the basis of a comparative site atlas. Thus, the Atlas in its final form presents a side-by-side comparison of biotic and physical phenomena in central Chile and southern California, U.S.A. and northern Baja California, Mexico. For these two separate yet similar regions of the earth the answers to questions of convergence of ecosystems are presented textually and cartographically within the scope of the Mediterranean Scrub Project.

Slides

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3. Map of General Terrain Types
4. Relief Profiles Through Primary Sites
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