# " L A N D - U S E  M A P P I N G  I N  C H I L E "

René Saa

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# LAND-USE MAPPING IN CHILE[1]

R. SAA VIDAL

*Institute for the Study of Natural Resources, Santiago (Chile)*

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SUMMARY

This article describes the development and the present status of the use of air photographs for rural land-use studies in Chile. Special attention is paid to the O.A.S.–Chile Aerogrammetric Project which was carried out by several private agencies. Two classifications were prepared for the interpretation of air photographs: (*a*) for those at a scale of 1 : 20,000; (*b*) for those at a scale of 1 : 50,000 and 70.000.

## DEVELOPMENT OF AERIAL PHOTOGRAPHY

Aerial photographic coverage of Chile on a national scale has been completed several times. The first series was taken in 1944 and 1945 by the U.S. Air Force with a Trimetrogon camera. Because of the difficulties involved in the interpretation of the oblique photographs, this material, with a few exceptions, has not been used for the study of natural resources. Principally, it served as a basis for the production of the preliminary topographic map (1 : 250,000) published by the Instituto Geográfico Militar.

In 1955, the Hycon Company photographed the country from the northern border to as far south as the 37°S parallel of latitude. The photographs were verticals at a scale of 1 : 70,000 and they were used as a background for a variety of studies, especially for the compilation of the National Geological Map. Despite the availability of this material, the mapping of rural land use by means of photo interpretation is a recent innovation.

[1] This is a report from a series written for the Rural Land-Use Working Party of the Commission on Interpretation of Aerial Photographs, International Geographical Union. (See the preface in *Photogrammetria*, 20(1): 13.)

DEVELOPMENT OF LAND-USE MAPPING

The first attempts at land-use mapping were undertaken by the Geographical Institute of the University of Chile in Santiago in a section of the Cordillera de la Costa of the Colchagua Province. Land-use maps at a scale of 1 : 25,000 were constructed by direct observation and subsequently generalized to a scale of 1 : 250,000. Due to a number of difficulties, this work could not be pursued.

In 1959, the Section of Regional Geography of the Geographical Institute, under the direction of Professor Donald MacPhail, initiated land-use mapping work at a scale of 1 : 25,000 for which the classification of the World Land Use Survey Commission of the International Geographical Union was used. In order to use and, at the same time, to test the classification, four transverse strips were selected in central Chile (see Fig.1). The orientation (west–east) of these strips made it

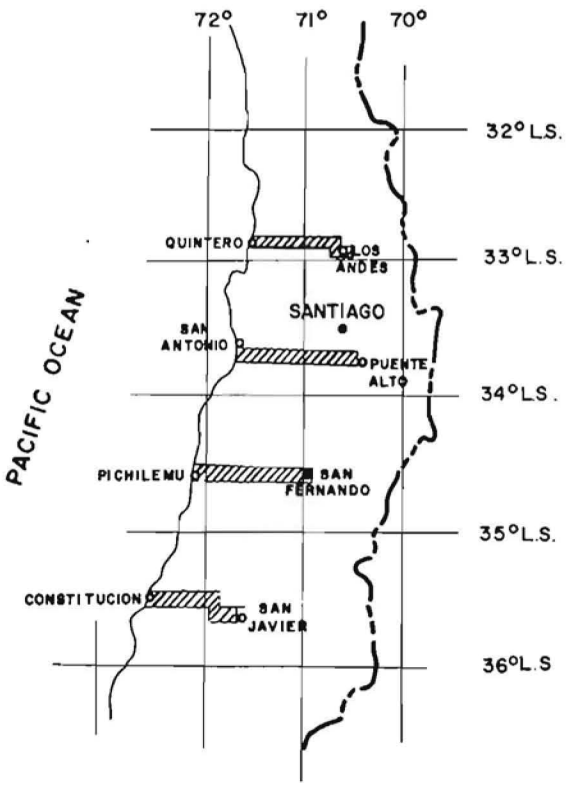



Fig.1. Sample strips used by the Geographical Institute, University of Chile, for experimental land-use mapping. Scale approximately 1 : 5,300,000.

possible to observe clearly the changes in land use occurring with differences in relief, soils, and climate. These differences are more pronounced in the west–east than in the north–south direction.

The mapping of land use was carried out by direct observation in the field without photo interpretation. Air photographs of the 1955 coverage were used only for purposes of updating the base maps and for orientation in the field. After the completion of this project, it was intended to map the whole of central Chile between the two parallels 32° and 37° at a scale of 1 : 100,000 by means of photo interpretation, though eventually this plan was not carried out.

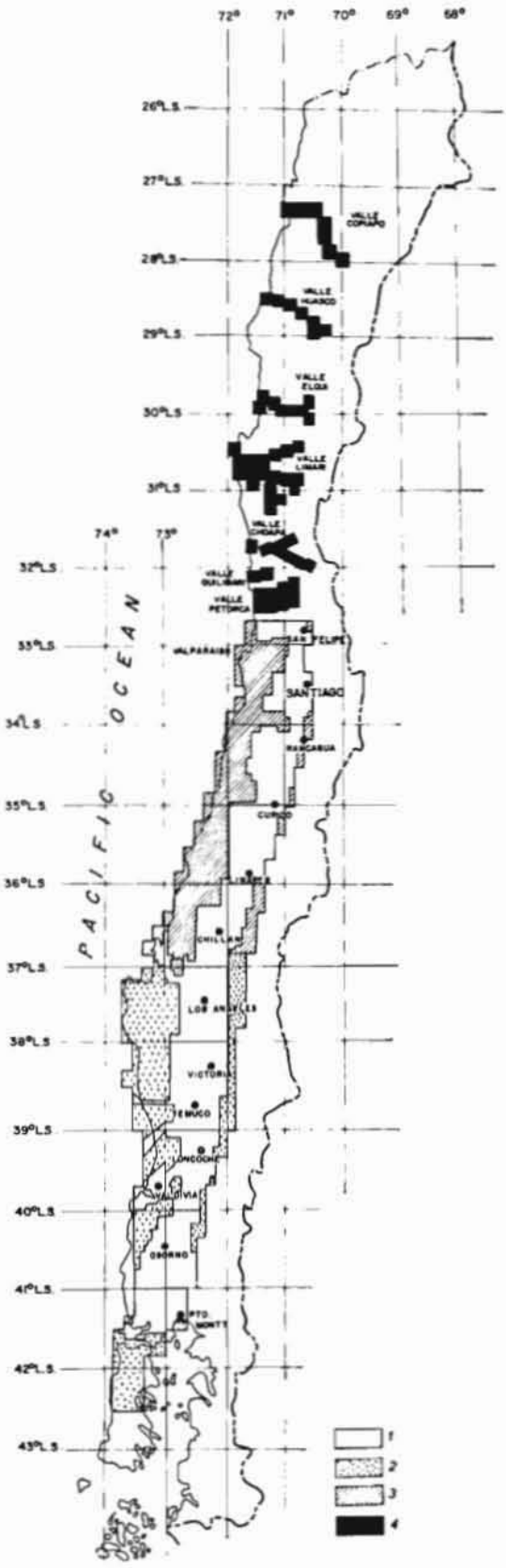
*O.A.S.–Chile Aerogrammetric Project*

As a result of the earthquakes of May, 1960, which affected the central southern part of Chile (from Concepción to Chiloé), the Government of Chile as well as international organizations became interested in the reconstruction of the stricken area. It was recommended in a report by the Organization of American States (O.A.S.) that the devastated area be photographed and that a study of natural resources, using air photographs as a source of information, be undertaken. This study is known as the *Proyecto Aerofotogramétrico O.E.A.–Chile* (VERA, L., 1964). It was felt that the magnitude of the project would exceed the capability of a single company and, therefore, it was carried out by a consortium of four private agencies (Aero Service Corporation, Philadelphia; Fairchild Aerial Surveys, Los Angeles; Geotechnics and Resources, White Plains, N.Y., and Hunting Survey Corporation, Toronto) working in close collaboration with Chilean personnel.

Accordingly, the photographic coverages for the Proyecto were started in January, 1961. Initially, the project comprised the area between Concepción and Chiloé only, but later the study area was expanded to central Chile and to the valleys of the Norte Chico (Provinces of Atacama and Coquimbo).

The air photographs were taken at different scales: The region of major agricultural importance, i.e., the Valle Central (from Aconcagua Province to Puerto Montt), comprising about 71,000 km$^2$, was covered by means of 1 : 20,000 scale photographs. About 110,000 km$^2$ between the two parallels of 37° and 42°30'S, the sea and the Argentine border were photographed at a scale of 1 : 50,000. The coverage for the valleys of the Norte Chico was taken at a scale of 1 : 30,000 (around 8,000 km$^2$). For several cities (Concepción, Talcahuano, Valdivia, Corral, Puerto Montt, Ancud and Castro) a 1 : 10,000 scale coverage was flown (see Fig.2) (RODRIGUEZ, 1962). With this latter material topographic city plans 1 : 2,000 with contours at 1-m intervals were constructed.

Photographic mosaics at scales of 1 : 20,000 and 1 : 50,000 were prepared for the whole area and served as base maps for all the studies undertaken. These included the mapping of cadastral patterns, soils, geomorphology, soil capability, irrigation canals, and land use. In all cases, photo interpretation was used. The information obtained was basic for setting up a new and more realistic taxing system for rural areas as well as for the formulation of an agrarian reform program and for regional planning in general.


72°
71°
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34°L.S.
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36°L.S.
37°L.S.
38°L.S.
39°L.S.
40°L.S.
41°L.S.
42°L.S.
43°L.S.
PACIFIC OCEAN
VALLE COPIAPO
VALLE HUASCO
VALLE ELQUI
VALLE LIMARI
VALLE CHOAPA
VALLE QUILIMARI
VALLE PETORCA
VALPARAISO
SAN FELIPE
SANTIAGO
RANCAGUA
CURICO
TALCA
CHILLAN
LOS ANGELES
VICTORIA
TEMUCO
LONCOCHE
VALDIVIA
OSORNO
PTO. MONTT
1
2
3
4

*Classification of land use*

Prior to the mapping of land use, it was necessary to establish a classification system. The legend prepared earlier by the Geographical Institute of the University of Chile was used as a starting point. Modifications were later adopted after extensive discussions between the experts who interpreted the photographs. Due to the differences in scale of the photographic coverages, two classifications were devised: (*a*) a more detailed classification for the interpretation of the 1 : 20,000 photographs, and (*b*) a less detailed classification for the interpretation of the 1 : 50,000 and the 1 : 70,000 material (see Appendix).

*Present land-use mapping*

At present, land-use mapping has been completed in Chile at a scale of 1 : 20,000 for the irrigated agricultural areas in the Norte Chico and for the area from Aconcagua Province to the Island of Chiloé (see Fig.2). The Norte Grande which, due to its aridity, has no cultivated areas except for the oases, and has not been mapped. In the south, parts of the Provinces of Chiloé, Aysén and Magallanes have not yet been covered, but an investigation of this region's natural resources, including land use, by means of photo interpretation is being planned by the Institute of Natural Resources (Instituto de Investigación de Recursos Naturales, Corporación de Fomento de la Producción, Santiago).

Due to the fact that the landuse maps produced by the Proyecto are of a very large scale, the Institute of Natural Resources is currently compiling a generalized 1 : 250,000 map. Similarly, this Institute has also published soil and geomorphological maps at 1 : 250,000, using the information collected by the Proyecto. At the same time, the areas devoted to different land uses and the areas covered by various land capability classes have been measured and published in tabulated form for provinces and communities (*comunas*).

The importance of this land use-mapping work for the country's economy may be illustrated by the fact that 42% of the total surface (excluding the Antarctic region) is occupied by agricultural soils. However, of this area two-thirds are natural pastures so that the more intensively used land reduces to 11,000,000 ha. Of these only 6,800,000 ha are actually under cultivation and 1,300,000 ha are irrigation land. It is hoped that, through a variety of agricultural engineering works, especially the construction of new canals, the intensively cultivated land can be expanded considerably.

Fig.2. Land-use mapping in Chile (O.A.S.–Chile Photogrammetric Project). Scale approximately 1 : 5,300,000.
*1* = area interpreted from 1 : 20,000 photographs (1961 coverage);
*2* = area interpreted from 1 : 50,000 photographs (1961 coverage);
*3* = area interpreted from 1 : 70,000 photographs (1955 coverage);
*4* = area interpreted from 1 : 30,000 photographs (1961 coverage).

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## APPENDIX

*Classification for the interpretation of the 1 : 20,000 air photographs*

(*1*) Urban areas
- (*a*) Urban and associated areas
- (*b*) Government installations and other institutional land

(*2*) Horticultural land
- (*a*) Commercial horticulture, irrigated
- (*b*) Commercial horticulture, not irrigated
- (*c*) Domestic horticulture, irrigated
- (*d*) Domestic horticulture, not irrigated

(*3*) Fruit orchards and other permanent crops
- (*a*) Fruit orchards, irrigated
- (*b*) Fruit orchards, not irrigated
- (*c*) Vineyards, irrigated
- (*d*) Vineyards, not irrigated
- (*e*) Trellised vineyards ("parronal")
- (*f*) Multiple use (fruit orchards with intercropping)

(*4*) Extensive cultivation
- (*a*) Rotation of row crop ("chacra")–cereal–pasture, irrigated
- (*b*) Rotation of row crop–cereal–pasture, not irrigated
- (*c*) Rotation of cereal–pasture, irrigated
- (*d*) Rotation of cereal–pasture, not irrigated
- (*e*) Rotation of rice
- (*f*) Principally "chacra", irrigated
- (*g*) Principally "chacra", not irrigated

(*5*) Permanent improved pastures (This category does not occur in Chile)

(*6*) Natural pastures
- (*a*) Pastures on semi-cleared land ("terrenos semi-limpios")
- (*b*) Pastures with or without brush ("matorral"), not cultivated
- (*c*) Pastures with brush, vegetation cover very sparse
- (*d*) Pastures with brush, on river flood plains

(*7*) Forest lands
- (*a*) Natural forests
- (*b*) Planted forests, irrigated
- (*c*) Planted forests, not irrigated
- (*d*) Cut forests, irrigated

(e) Cut forests, not irrigated
(f) Second growth
(g) Brush

(8) Wet lands

(9) Unused lands
(a) Terrain flooded as a result of the earthquakes
(b) Terrain suitable for cultivation

*Classification for the interpretation of the 1 : 50,000 and 1 : 70,000 photographs*

(1) Urban areas
(z) Urban and associated areas
(y) Government installations and other institutional land

(2) Horticultural lands
(z) Commercial horticulture
(y) Domestic horticulture

(3) Fruit orchards and other permanent crops
(z) Fruit orchards
(y) Vineyards (incl. "parronales")

(4) Extensive cultivation
(z) Rotation of row crop–cereal–pasture
(y) Rotation of cereal–pasture–rice
(x) Principally "chacra"
(w) Rotation of pasture (with or without brush) and possibly cereal

(5) Permanent improved pastures

(6) Natural pastures

(7) Forest lands
(z) Natural forests
(y) Planted forests
(x) Cut forests and second growth
(w) Brush

(8) Wet lands

(9) Unused lands