

GE
AND
04
SLIDE
C.01

" LANDSCAPES OF LATIN AMERICA " SERIES

COLLECTION No. 3

LANDSCAPES OF THE ANDES
FROM THE HIGHLANDS OF PERU AND BOLIVIA
TO THE SOUTHERN TIP OF CHILE

by

PAUL-YVES DENIS



LAURENTIA PRODUCTIONS C.M. LTD.

1980

LAURENTIA PRODUCTIONS C.M. LTD.
1355, ave. Pasteur,
Sillery, Québec, Canada
G1T 2B8

Canada Copyright, 1980 ©
All rights reserved

LANDSCAPES OF THE ANDES:
FROM THE HIGHLANDS OF PERU AND BOLIVIA TO THE SOUTHERN
TIP OF CHILE

This collection concerns itself with the landscapes of the Andean nations south of the Equator, specifically Peru, Bolivia and Chile. This is a region of sharply-contrasting climates and vegetation, of tropical rain forests and parched deserts, of cold steppes and rain-lashed coasts. But it is above all a region of mountains. From northwest Peru to the southern tip of Chile the region is dominated by the rugged Andean Cordillera, whose highest peaks stand close to 7 000 m above sea level and which towers over the narrow and discontinuous coastal plain of the Pacific. And yet the importance of the Cordillera varies markedly from country to country. In Peru the mountains occupy less than one-third of the country. West of this so-called Sierra zone is a narrow coastal desert, the Costa region, where rain rarely falls and which would normally be uninhabitable were it not for the rivers and streams which rise in the Andes and flow across it to the Pacific. Along the valley bottoms and on the coastal deltas the desert blooms thanks to irrigation. To the east of the mountains are the vast tropical forests of Amazonian Peru, the so-called Montaña zone. Between the two is the Sierra, a complex zone comprising the Occidental, Central and Oriental Cordilleras and the high basins between them. The Sierra accentuates the contrast between dry west and humid east and is a massive barrier to communications.

Landlocked Bolivia is the most Andean of all the South American countries. Its most important physiographic region, although not the largest, is the ALTIPLANO, a bleak intermontane plateau standing 4 000 m above sea level and extending from Lake Titicaca in the north (a waterbody shared with Peru) 800 km south to Lake Poopó. About 60% of Bolivians live on the altiplano, although there are also important pockets of population in the mining districts and the subtropical valleys of the adjacent Eastern (Oriental) Cordillera. The vast area of low plains and woodland savannas to the east of the Andes, and accounting for three-fifths of the country, has only 20% of its population.

Chile is also a mountainous country and its eastern boundary with Argentina coincides by and large with the crestline of the principal range of the Andes. The country has tremendous latitudinal range. It extends from the Peruvian border 4 300 km south to the desolate Tierra del Fuego and finally to Cape Horn, the very tip of the continent and regularly buffeted by violent westerly winds (the "Roaring Forties"). The principal concentrations of population are found in the Central Valley, a longitudinal depression sandwiched between the Andes and a rugged coastal plateau (the "Coastal Cordillera"). Between roughly 32° and 37° South latitude the climate of the valley is Mediterranean, with a distinct dry season, and has allowed the development of specialized forms of farming such as viniculture. In contrast, the Andean region is by and large an empty area, although providing an impressive backdrop for the economic activities of the valley and the coastline.

Highly-evolved Indian cultures existed throughout this region well before the arrival of the Spanish CONQUISTADORES, mainly on the high Andean plateaus but also along the Pacific littoral. Agriculture was particularly well-developed thanks to the Indians mastery of techniques of irrigation and of terracing and it has been suggested that in some areas population densities were at least as great as they are today.

Table I shows the total estimated value of the exports and imports of the three Andean republics for 1980 and gives a general idea of the nature of the principal economic activities. Table II shows the area, the estimated population and the population density (1980) of each of the three countries and also the rate of increase of the population between 1960 and 1980. Map I shows the principal land use regions and the geographical distribution of certain economic activities.

TABLE I

A. Estimated value (\$US) of exports and imports, 1979⁽¹⁾

	<u>Bolivia</u>	<u>Chile</u>	<u>Peru</u>
Exports	691 600 000	2 407 800 000	3 474 000 000
Imports	1 608 000 000	3 002 400 000	2 091 000 000

B. Value (\$US) of the principal products exported in 1979

	<u>Bolivia</u>	<u>Chile</u>	<u>Peru</u>
Copper	-	1 348 000 000	667 000 000
Tin	420 000 000	-	-
Tungsten, zinc, silver	130 600 000	-	-
Petroleum and na- tural gas	142 300 000	-	646 000 000
Iron	-	-	85 000 000
Fish and fish meal	-	-	237 000 000
Coffee	-	-	245 000 000
Cotton	-	-	49 000 000

C. Domestic consumption of local products, 1979

	<u>Bolivia</u>	<u>Chile</u>	<u>Peru</u>
Copper (tonnes)	-	1 000 000	397 000
Iron (tonnes)	-	8 500 000	-
Tin (tonnes)	29 000	-	-
Cement (tonnes)	-	1 175 000	2 431 000
Petroleum (m ³)	1 900 000	1 050 000	N.A.
Natural gas (m ³)	4 050 000	-	N.A.
Fish (tonnes)	-	N.A.	3 575 000
Cars and trucks	-	N.A.	10 745

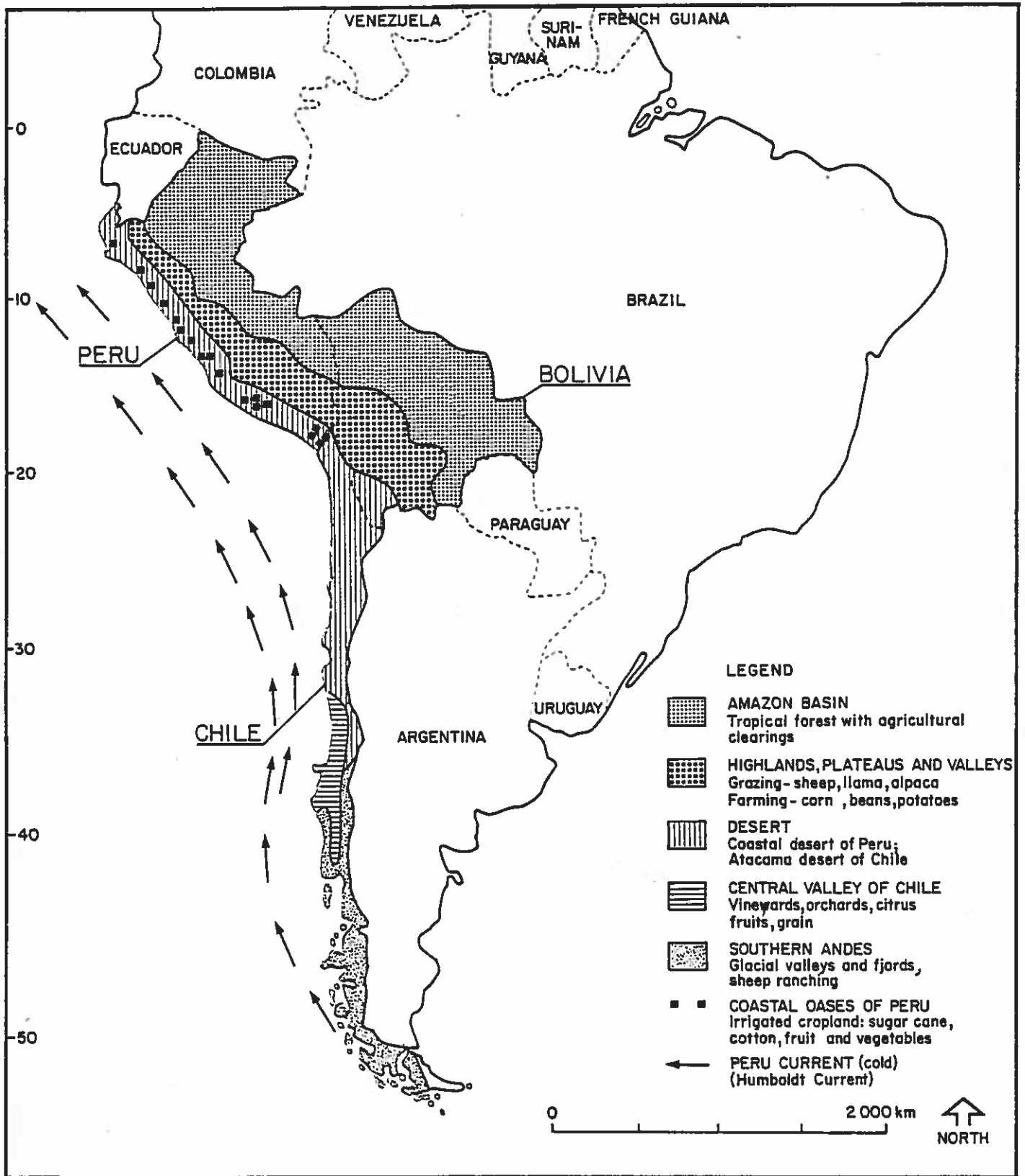
(1) United Nations
N.A. - not available

TABLE II

	Area	%	Population in 1980	Density	Rate of increase of the population, 1960-1980
Bolivia	1 098 600 km ²	35%	6 350 000	5.8/km ²	70%
Chile	742 000 km ²	24%	11 035 000	14.9/km ²	45%
Peru	1 285 000 km ²	41%	17 600 000	13.7/km ²	72%
Total	3 125 600 km ²	100%	34 985 000	11.2/km ²	54.5%

Collection no 3 places particular emphasis on the changing role that the Andean Cordillera has played in the life and the economy of these three nations. The first fifteen slides focus on Peru and its three geographical regions: the Sierra, the Pacific coast and the Amazon lowlands. Slides 16 to 25 show the rolling plains, blue lakes and deeply-eroded margins of the alti-plano of Bolivia, the roof of South America. The last fifteen slides (26 to 40) focus on the sharply contrasting landscapes of Chile, from the arid north to the humid south and from the coast to the mountains, but with special emphasis on the fertile Central Valley.

NATURAL REGIONS AND LAND USE ZONES OF THE CENTRAL AND SOUTHERN ANDES



1 TO 15. THE THREE PERUS: SIERRA, COAST AND MONTANA

Peru has a population of about 17½ million (1980) and a land area of 1 285 000 km²; it is the third largest country of South America, only surpassed by Brazil and Argentina. Peru is advantageously situated for it has both an extensive coastline and broad access to the resource-rich Amazon basin. Peru's economy is based on the export of a wide variety of products but notably base metals from the Sierra, refined oil, coffee, cotton and fish.

The three geographical regions of Peru, namely the Sierra, the Coast and the Montaña, are aligned parallel to one another and run the full length of the country, that is, from northwest to southeast. Thus, to travel from west to east in Peru is to encounter enormous changes in climate, vegetation, land use and agricultural techniques over very short distances. Between the coast and the Amazon basin, a distance of only 450 km, farmers must cope with problems of extreme aridity (the Costa), of steep slopes, thin soils and cold (the Sierra), and of heat, humidity and poor drainage (the Montaña).

1 AND 2. THE PERUVIAN SIERRA AND THE ALTIPLANO

SLIDE 1 provides an aerial view of the Eastern Cordillera, the last barrier between the Sierra region and the upper slopes of the Amazon basin (left). This mountain range stands at roughly 4 500 m above sea level in the north of Peru but rises to 6 000 m on the Bolivian border; in the Cuzco area of southeast Peru there are several peaks which are even higher. The section of the range shown in the photograph consists largely of tightly-folded sedimentary rocks upthrust during Miocene and Pliocene times and which now stand vertically to form the sharp crest-line (note the ribbons of snow which demarcate the rock strata). The range is surprisingly narrow. Note the extensive scree slopes along its western (right) flank and the moraine-dammed lake in the centre-ground. The climate on the east side of the range is tropical and is characterized by heavy rainfall. *SLIDE 2* shows part of the surface of a deeply-dissected plateau on the western slope of the Peruvian Sierra and standing at 4 000 m above sea level; a glacial valley and snowfields

are seen in the background. At these altitudes the vegetal cover consists of little more than mountain grasses.

3. THE CERRO DE PASCO MINE NEAR LA OROYA

The central Sierra, an important mining region since the 19th century, is now best known for its copper, lead and zinc. These mines were long under foreign control. However, in 1973 the Peruvian government nationalized the holdings of the giant Cerro de Pasco company and transferred its assets to a public corporation, CENTROMIN. The copper, lead, zinc and silver ores extracted from the high-altitude mine at the top of the slope (SLIDE 3) and from other mines in the vicinity are trucked to the Sierra town of La Oroya where they are smelted and refined. A steep road with hairpin bends leads up to the mine.

4 AND 5. FARMING AND GRAZING ON THE PERUVIAN ALTIPLANO

The Peruvian altiplano, an extension of the altiplano of Bolivia, sprawls between the Eastern and Western Cordilleras and has a maximum width of about 300 km. It consists of a series of deeply-eroded erosion surfaces ranging in elevation from 3 800 to 4 500 m above sea level and largely given over to farming and grazing. The area is dry, even arid, and receives no more than 500 mm of precipitation per year. SLIDE 4 shows the small farms (MINIFUNDIOS) and stony soils that are typical of this region. The land is normally worked either by sharecroppers or by communities of Quechua or Aymara Indians; the principal crops grown are potatoes, wheat and barley but much of the land is in pasture. SLIDE 5 shows a herd of llamas (*Lama glama*), raised for wool and meat, in a dry valley of the altiplano. Farmsteads and ploughed fields are seen on the far side of the ravine.

6. FARMLAND HELD IN COLLECTIVE OWNERSHIP, CUZCO REGION

The farm shown in SLIDE 6 is held in collective ownership by the Indian inhabitants of a nearby village; this is a common form of land tenure in the Sierra. Until the late 1960s large, privately-owned agricultural estates (LATIFUNDIA) also existed in this area but these have since

been collectivized or dismembered in a nation-wide programme of agrarian reform. Potatoes (centre), corn (right) and beans are commonly grown in association in this area but pastures and rough grazing land are also seen on the photograph. Most of the fields are irrigated, the water originating in the snowfields of the Eastern Cordillera.

7, 8, 9 AND 10. COASTAL AND NEAR-COASTAL VALLEY OASES OF SOUTHERN AND CENTRAL PERU

The coastal fringe of Peru is a wasteland of rock outcrops, boulder fields and broad expanses of sand. Rain rarely falls here and the winter season (June to December) is especially dry. This desert would be uninhabitable were it not for forty-odd rivers and streams rising on the western slope of the Cordillera Occidental (Western Cordillera), fed by glaciers, snowfields and summer rainfalls and characterized by irregular or intermittent régimes, which flow across it to the Pacific. Most of these watercourses have been harnessed for irrigation, the favoured milieus being alluvial fans, valley bottoms and coastal deltas. Within the twenty-two irrigated oases of the coastal and near-coastal regions of Peru there are now approximately 700 000 hectares of land under cultivation. Cotton, sugarcane, rice, vegetables, citrus fruit and grapes are the principal crops. These areas now account for three-quarters of the total revenue derived from agriculture in Peru and one-quarter of the value of the country's exports.

SLIDE 7 shows the inland oasis of Arequipa, situated close to the important Peruvian city of the same name. The oasis, 2 400 m above sea level, stands at the foot of the dry western front of the Sierra. Total annual rainfall here is only 110 mm. However, irrigation (the Chili river) has allowed the development of a prosperous agricultural economy based on dairying, wheat farming and market gardening. The dark green crops are alfalfa (lucerne) and fodder corn. Note the graffiti scrawled on the escarpment face!

SLIDE 8 shows a portion of the irrigated oasis of Tacna, occupied since Pre-Columbian times and situated only a few kilometers from the Chilean border and the Atacama desert; it is thus the most southerly agricultural settlement of Peru. Its clay and silt soils and its splendid climate have proved highly suitable for the cultivation of vegetables, grapes (foreground) and citrus fruit. Water for irrigation is diverted from the Caplina river and conveyed to the various sections of the oasis by means of small surface canals. Note the immense sand dunes in the background, heaped up by the strong and regular trade winds; they are now slowly advancing toward the oasis and threaten the continued existence of agriculture here.

SLIDE 9 shows part of the irrigated coastal lowland near Lima; shrubs and small trees line the banks of the irrigation canals. Like most of the coast this area receives almost no rainfall. However, during the winter (June to December) there is a high degree of atmospheric humidity (see slide) due to the influence of the cold Peru (Humboldt) Current. This current originates in the Antarctic and flows north along the western coast of South America to about the latitude of Ecuador. Along the coastlines of Peru and Northern Chile it produces a thermal inversion (cold air at the surface of the ocean, warmer air higher up) which normally results in overcast skies, fogs (*NEBLINA*) and even fine drizzle (*GARUA*) but no rain. In the Lima area the high humidity has allowed the development of winter pastures which are used for dairying and for the fattening of beef cattle. Cotton, sugarcane, fruit and vegetables are also grown here.

SLIDE 10 shows an irrigated river valley of the dry western slope of the Sierra. Note the remarkable contrast between the verdant areas under irrigation and the bone-dry valley slopes. The areas of irrigated cropland narrow out toward the headwaters of the river.

11. THE FISHING PORT OF CHIMBOTE DURING THE OFF-SEASON

Over the past twenty-five years Peru has become one of the world's greatest industrial fishing countries. Peru now specializes in the production of fish meal derived from the anchovy (ANCHOVETA), which is sold as livestock and poultry feed in the United States and the Western European countries. Vast schools of ANCHOVETA are normally found in Peru's coastal waters close to the meeting-place of the Peru Current with the warm Equatorial Counter Current; here there is ample food for the fish, notably plankton. SLIDE 11 shows part of the port of Chimbote, a coastal town 425 km northwest from Lima. Chimbote is Peru's leading fishing port and now accounts for about 20% of the nation's annual catch. However, the fishing season has not yet begun and most of the fleet is still in port.

12. THE OASIS OF LAMBAYEQUE IN NORTHERN PERU

In the verdant oasis of Lambayeque on the northern coast of Peru near Chiclayo farmers specialize in the production of sugarcane, cotton and rice but also grow vegetables and fruit. Note the many irrigation canals (outlined by rows of trees) and the dense, lush vegetation. Until the introduction of agrarian reforms of 1969 this was an area of great sugarcane HACIENDAS (farm-estates) but these have since been transformed into cooperatives for the greater benefit of the local population.

13, 14 AND 15. LANDSCAPES OF THE AMAZON BASIN NEAR IQUITOS

Most of the vast Montaña region of Peru, a densely-forested territory with an equatorial climate, is either uninhabited or very sparsely populated. Because roads are virtually non-existent most of the settlements are located on rivers. The largest city of the Montaña is the port of Iquitos (about 150 000 inhabitants), the Peruvian capital of the wild rubber trade at the end of the last century. SLIDE 13 shows the principal channel of the Amazon near Iquitos and the floodwaters which have spilled over its low banks. Patches of farmland (shifting cultivation) are found here and there along the river and its tributaries, with bananas and manioc the principal crops. SLIDE 14 shows a large

Catholic mission on the banks of the Amazon near Iquitos; here the Indian population is being instructed in the fundamentals of subsistence and commercial agriculture. The mission is situated on a high, well-drained riverbank; a rough pasture for zebu cattle is seen in the background. *SLIDE 15*, taken on one of the nearby tributaries of the Amazon, shows a small riverbank house perched on stilts and with a thatched roof. It belongs to a *COLONO* (peasant) who practices slash-and-burn agriculture nearby (bananas and manioc) and who also fishes and hunts.

16 TO 25. BOLIVIA: SOUTH AMERICA'S MOUNTAIN FASTNESS

Landlocked Bolivia, without access to the sea since its defeat by Chile in the War of the Pacific (1879-83), perched high in the Andes and surrounded by mountains, deserts and vast forests, is the most isolated nation of South America. It is also one of the most original. For example, although Bolivia is situated in the tropics 85% of its population lives 3 500 m or more above sea level in environments where the climate and vegetation could hardly be described as tropical. Also, Bolivia is the most Indian of the South American nations; although precise data are unavailable it has been estimated that two-thirds of its population of 6 350 000 (1980) is of Indian origin.

Bolivia can be divided into two vast regions: Highland Bolivia, comprising the altiplano and the rugged Cordilleran ranges, and the Lowlands of the east and northeast, a sparsely populated area of forests (*SELVA*), grasslands (*LLANOS*) and semi-desert (*CHACO*). The extension of the agricultural ecumene into the lowland area and the development of its natural resources, notably oil and gas, is now underway but the country's internal communications system is so poor that substantial short-term progress is unlikely.

16, 17 AND 18. TITICACA, AN INLAND SEA

The Bolivian altiplano, a high-level intermontane plateau, is bounded on the west by the volcanic Cordillera Occidental and on the northeast by the glacier-capped Cordillera Real (Royal), whose highest peaks stand 6 000 m and more above sea level. A vast linear depression in the centre

of the altiplano is occupied by lakes Poopo and Titicaca (the latter is 8 300 km² in area and stands 3 800 m above sea level), remnants of a much larger waterbody which existed here in postglacial times. This depression is bounded by a series of low plateaux standing between 4 200 and 4 800 m above sea level and which slope gently up toward the Cordilleran ranges. *SLIDE 16* shows part of the deeply indented littoral of Lake Titicaca. The largest freshwater lake of South America and the highest navigable waterbody in the world, it has no outlet to the sea. Its water temperature remains a constant 10.5°C. throughout the year. The lake has a moderating influence on the climate of the surrounding areas, which has favoured the development of crop farming along its littoral. Note the intensive terracing of the steep slope in the foreground, probably a legacy from the Inca period.

SLIDE 17 shows a small fishing village in a cove on the shoreline of Lake Titicaca's Copacabana peninsula. The terraces (*ANDENES*) on the steep slope behind the village are of Inca origin but most of this land is no longer in agricultural use. The small fishing boats shown in *SLIDE 18* are made of the weeds which grow in abundance along Titicaca's shoreline. The fishermen are Aymara Indians, the majority group in the Titicaca region.

19. HIGH-LEVEL PLATEAUS OF THE ALTIPLANO

SLIDE 19 was taken at the foot of a Cordillera Real glacier used as a ski run. The chalet (right) overlooks the barren high-level plateaus of the altiplano, with visibility about 250 km. Such areas are either uninhabited or are used for extensive grazing.

20, 21 AND 22. SMALL FARMS AND LARGE ESTATES OF THE "PUNA" VEGETATIONAL ZONE OF THE ALTIPLANO

SLIDES 20, 21 and 22 show aspects of land use and land tenure on the bleak, high-level *PUNA* (grassland) steppes of the altiplano. *SLIDE 20* looks east across the altiplano toward the snow-covered peaks of the Cordillera Real. As a result of the agrarian reforms of 1954 the vast

ranches of this area were transformed into cooperatives or broken up into small farms. Dairying is important here, with pastures often found in rotation with pigweed (*QUINOA*), barley, potatoes and ollucos (*OLLUCOS*). A coarse fescue called *ICHO* is the dominant pasture grass here and elsewhere on the high steppe. Total rainfall is 400 to 500 mm per annum and the wet season extends from November to April.

SLIDE 21, an aerial view of the central altiplano near the mining centre of Oruro, shows a tremendous sweep of semi-arid land used for the grazing of sheep and alpacas (*Lama pacos*). In the far background are the peaks of the Cordillera Occidental, which forms the border between Bolivia and Chile. A tremendous landslip has occurred in the glacio-lacustrine deposits in the foreground. The streams which cross the floor of this area of slump are headwaters of the Madeira river, a tributary of the Amazon.

A small altiplano farmstead belonging to a family of Quechua Indians and protected from the strong winds by high stone walls is seen in *SLIDE 22*. Sheep and alpacas are raised here but the carrying capacity of the land is low.

23 AND 24. STEEP-SIDED VALLEYS OF THE CORDILLERA REAL

Over the dry season many of the watercourses of the Cordillera Real are reduced to trickles or even disappear. However, during the rainy season (November to March) these valleys are occupied by raging torrents of water, as attested to by the abundance of coarse alluvial material along the riverbed in the foreground of *SLIDE 23*. Another virtually dry valley floored by coarse alluvium is seen in the foreground of *SLIDE 24*. The sides of this so-called "YUNGA" valley have been given over to agriculture and crops are grown at high elevations and on surprisingly steep slopes. The grey fields have only just been ploughed and the yellow fields are in grass or stubble. Corn, grain and alfalfa are all grown here, generally in rotation with grasses for pasture. The mountain face consists of beds of shale dipping about 30° away from the photographer. The friable shales have been deeply eroded and there are extensive areas of loose surface deposits. In the cultivated zones the shaly soils are held in place by low rock walls, some of which probably predate the colonial period.

The *YUNGA* valleys of the Cordillera Real run down to the lowlands of northeast Bolivia. The climate which prevails in the valleys is generally a function of altitude and may vary from temperate to subtropical. Plantations of bananas, coca and coffee are found in some of the warmer valleys.

25. POTATO FARM ON THE HIGH STEPPES OF THE ALTIPLANO

Although much of the treeless high steppe of the altiplano is used for the pasturing of sheep, alpacas, llamas and vicunas, here and there the grassland has been ploughed under for crop farming. The workers in the middleground of *SLIDE 25* are seeding this recently ploughed field with potatoes. The farm is situated at 4 000 m above sea level on the high steppe about halfway between lakes Titicaca and Poopó. The climate is dry (precipitation amounts to only 400 mm per annum) and wind erosion can be a problem once the grass cover has been removed.

26 TO 40. THE CONTRASTING LANDSCAPES OF CHILE: A FUNCTION OF LATITUDE

Although Chile is a mountainous country the great contrasts of its geography are more a function of latitude than of topography. Chile extends through 39 degrees of latitude, more than half the length of the South American continent, and yet it is so narrow (it ranges from 90 to 430 km in width) that its land mass occupies only 742 000 km²; it is thus considerably smaller than either Peru or Bolivia. Also, surprisingly, the mountainous zones of Chile are very sparsely populated. The Cordillera nevertheless plays a vital role in the life of the country. Part of its crestline serves as an international boundary; it is an important source of minerals, notably copper; water from the mountains serves to irrigate the drier sections of the lowlands; and its considerable tourist potential is now being increasingly exploited. But the Cordillera is not the only empty area of Chile, for the deserts of the north and the forested zones of the south have little or no population and there are endless miles of coastline where not a single habitation is seen. In truth, the Chileans have been highly selective in their choice of environments for permanent settlement. About 70% of the population

is found in the agreeable central section of the country, an area of good soils and a Mediterranean climate. In contrast, Southern Chile (i.e., Chile south of Puerto Montt), admittedly a much more difficult environment but nevertheless representing about one-third of the country, is virtually unpopulated.

In 1980 the population of Chile was about 11 035 000. The country is highly urbanized and much of its population is contained within a few large coastal or near-coastal agglomerations, notably Santiago, Valparaíso and Concepción.

26. NORTHERN CHILE: THE CORDILLERA

The Cordillera Occidental of Northern Chile (the Norte Grande region), highly mineralized in certain areas, is virtually unpopulated except for the large copper mining camps such as Chuquicamata. Much of the range is of volcanic origin and the mountains here are characterized by relatively gentle slopes (SLIDE 26). The highest peaks of the Norte Grande stand over 6 000 m above sea level. Precipitation on the upper slopes ranges from 100 to 200 mm per annum with much falling as powder snow. In some localities meltwater from the snowfields is piped west across the desert to provide water for the communities of the Atacama desert and the Pacific coast.

27 AND 28. THE ATACAMA: WORLD'S DRIEST DESERT

Sprawling between the Cordillera of Northern Chile and the sea is the vast Atacama desert, the world's driest. The Atacama is a rain-shadow desert because the Andes ranges prevent moist air masses from the Amazon basin from reaching the Pacific coast. However, a more or less permanent high-pressure belt sitting over the Pacific at about 30°S also blocks the movement of low pressure systems into the area. Precipitation is thus almost completely inhibited and there are sections of the Atacama where it has not rained in living memory. SLIDE 27 shows the precipitous margin of the coastal plateau (Coastal Cordillera) near Iquique, 225 km south of the Peruvian border. Back of the plateau lies a series of basins (not shown on the photograph) which were formerly the sites of great salt

lakes; the salt pans here have been mined for sodium nitrates since the second half of the 19th century. From the basin floors the land slopes gently up to the Andean Cordillera. Although it almost never rains in the Atacama, coastal mists (*CAMANCHACAS*) nevertheless result in some condensation along the littoral. Despite the hostile environment there are a few scattered pockets of population along the coastline (railway termini, fishing ports, even industrial communities) but these are only found where there is an assured source of fresh water or where water can be made available. *SLIDE 28* shows the even drier slopes of the upper Atacama, well away from the zone of coastal mists. Note the snowfields of a Cordilleran peak in the far background and a steep-sided stream valley (*QUEBRADA*) in the foreground. Some of these streams persist to the sea but others are lost in the dry basins of the central Atacama.

29. SMALL FARMING VILLAGE IN THE NORTE CHICO

The Norte Chico ("little North"), a transitional zone between the Atacama and Central Chile, is also characterized by a dry climate. However, agriculture is well-developed in those foothill valleys where there is sufficient water for irrigation (*SLIDE 29*). Most of the fields shown in the photograph are in pasture but vegetables, fruit and grapes are also grown in this area; in addition, some of the hedgerows consist of chestnut trees.

30. THE ANDEAN (CHILEAN) CORDILLERA AND MOUNT ACONCAGUA

SLIDE 30 provides a high-level aerial view of the principal physiographic regions of Central Chile, all of which are aligned north-south. In the far background is the snow-capped Chilean Cordillera, dominated by the majestic Mount Aconcagua (6 969 m), shared by Chile and Argentina and the highest peak in the Americas. The foothills and spurs of the Cordillera are seen in the middleground. In the foreground is the deeply dissected and sparsely populated Coastal Cordillera. The valley of the Aconcagua river separates the coastal mountains from the Andes.

31 TO 35. CHILE'S CENTRAL VALLEY

The great Central Valley of Chile is a longitudinal depression 300 km in length sandwiched between the Chilean Cordillera and the coastal range. Most of it (specifically the section between 32° and 37°S) is characterized by a Mediterranean climate with dry summers and wet winters and its agricultural land use patterns are not dissimilar to those found in Mediterranean lands. *SLIDE 31* shows a vast plain north of Santiago given over to cattle ranching and grain farming. Because precipitation here is less than 500 mm per annum most of the valley floor has been irrigated, allowing good harvests of wheat, alfalfa and clover. But the vegetal cover on the small hill in the foreground (acacia scrub spotted with cactus (*ESPINAL*)) gives a better idea of the true nature of the climate in this section of the Central Valley. Although the land here is still held in large estates (*HACIENDAS*), successful programmes of land redistribution have been carried out elsewhere in Chile.

SLIDE 32 shows a sector of the Central Valley where the silty soils are particularly fertile and where agriculture is well-developed thanks to systematic irrigation. Grain, beans, peas, sugar beets, oilseeds, grapes and deciduous fruit are the principal products of this area of highly-diversified agriculture. Note the many distinct parcels of land (*POTREROS*) separated one from another by irrigation canals lined by rows of Lombardy poplars. The snow-capped Chilean Cordillera looms in the background.

In recent years many farmers in the immediate vicinity of Santiago have reoriented their production in order to satisfy the requirements of the urban market. On the *FUNDOS* (large farms) shown in *SLIDE 33* dairying is of considerable importance (note the pastures and fields of fodder crops) but market gardening and fruit farming are also significant. All of this area is irrigated. The *FUNDOS* are usually worked by tenant farmers (*INQUILINOS*).

SLIDE 34 shows a large vineyard in south-central Chile; fruit trees line the banks of the irrigation canals which surround it. Chile's wine industry is particularly well-developed and a substantial proportion of

its production is exported. Although grapes are grown in most sections of the Central Valley the heart of the wine industry is Talca, 200 km south of Santiago, where there are 30,000 hectares of irrigated vineyards. Irrigation has also allowed the development of deciduous fruit farming in the Central Valley, particularly in the south where the climate is cooler. SLIDE 35, taken during Chile's winter season (May to September in this area), shows a large irrigated apple orchard and, in the background, the Chilean Cordillera. There is considerably more rain here than in the Santiago area... 300 km south of the capital there are about 800 mm of rain over an average winter.

36. GRAZING LANDS OF THE COASTAL CORDILLERA

Population densities are low in the Coastal Cordillera and much of the available agricultural land is devoted to ranching. SLIDE 36 shows a gently rolling area of maquis grassland (MATORRAL) broken here and there by pepper trees (MOLLES). Stands of conifers occupy the hill tops and the slopes of the small valleys.

37. SMALL FARMHOUSE, COASTAL CORDILLERA

SLIDE 37 shows the simple house of a peasant who works a small farm (MINIFUNDIO) in a marginal area of the Coastal Cordillera. Red peppers, garlic and various tubers are drying on the roof of the farmhouse. Note the parched and steeply sloping pastures in the background.

38 AND 39. THE WET SOUTH AND THE ISLAND OF CHILOE

Chile south of latitude 38° is a wet and heavily forested country, sparsely settled and with land use patterns suggestive of those of cool temperate coastlines of the Northern Hemisphere. Along the rugged coast precipitation falls mainly in the form of rain and 2 500 mm per annum is not uncommon; in certain parts of Patagonia up to 4 000 mm of precipitation per annum have been recorded. In the north the forest cover consists largely of dense stands of mixed forest with false beech (NOTHOFAGUS) the dominant species. These forests gradually disappear toward the south and are replaced by conifers, generally stunted, or by bare rock. Only

in the north, around Puerto Montt and on the island of Chiloé, is there any agriculture worthy of mention. Dairying, grain-growing, orcharding (apples) and potato farming are the most important agricultural orientations. SLIDES 38 AND 39 show typical dairying and grazing landscapes of the east coast of Chiloé, the west coast being too wet and too densely forested to farm. The rolling pastures are separated one from another by hedgerows, a cultural feature suggestive of the Gaspé coast and Prince Edward Island. Fishing is an important if not essential adjunct to farming here. Chiloé is a depressed area and for many years the island has experienced a steady erosion of its population, which is largely of Indian (Araucanian) origin.

40. PUERTO PORVENIR ON THE STRAIT OF MAGELLAN

The bleak and windswept island of Tierra del Fuego forms the southern tip of South America and is shared by Chile and Argentina. However, the broad passage of the Strait of Magellan, which cuts across the Cordillera thereby allowing vessels to avoid the stormy and dangerous Cape Horn route, lies entirely within Chilean territory. This is a region of great economic importance for Chile because there are oil and gas fields here which supply much of the nation's domestic requirements. It is also an area of vast sheep ranches (ESTANCIAS) on which wool is produced both for domestic use and for export. SLIDE 40 shows the tiny port of Porvenir on Tierra del Fuego, looking across the Strait of Magellan toward the Chilean mainland. The bales of wool stacked by the sheds and on the docks will be transported across the Strait to the port of Punta Arenas and from there to other destinations in Chile or overseas.