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ARID LANDS OF LATIN AMERICA:
THEIR PROBLEMS AND APPROACHES TO SOLUTION

"Social Solutions for Real and
Perceived Aridity in the Andes"

by

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Cleveland, Ohio

SOCIAL SOLUTIONS FOR REAL AND PERCEIVED ARIDITY IN THE
ANDES ^{1/}

by

Henry F. Dobyns ^{2/}

That the Pacific Coast of South America consists of true arid desert for a stretch of approximately two thousand miles south of Tumbes^{3/} is a relatively well-known ecological fact. That human settlement on this arid coast historically took advantage of oasis conditions in the valleys of streams carrying highland waters across the arid coastal plain is also well known.^{4/}

What of the Andean mountain chain proper? Topographically and climatically, precipitation in this dominant geographical feature of the South American continent is a function of altitude. Many of the higher Andean peaks are covered by mountain glaciers. Immediate sub-glacial tundras are very well-watered, and characterized by glacial lakes and bogs with rich faunas at altitudes little used by man. Between the coastal desert and mountain top glacial extremes the bulk of the Andean population lives under conditions of varying natural water supply. Since the majority of

the Andean population inhabits the higher elevations, most Andean natives in fact live under relatively temperate, well-watered climatic conditions.

The prevailing human attitude toward the immense variety of local Andean microclimates may be characterized, however, as a rather uniform "aridity attitude." The rural peoples living in the central Andes east of the truly arid Pacific Coast perceive themselves as inhabiting a water-scarce environment. This human perception of natural environment constitutes one of the great unifying factors in central Andean subsistence activities and political activities.

The Cornell Peru Project discovered a first clue to the prevalence of this central Andean perception of a water-deficient natural environment when it undertook to analyze a number of letters written toward the end of the past decade by representatives of Peruvian Indigenous Communities to the Secretary-General of the Peruvian Indian Institute. The Institute had mailed to 1,520 officially-recognized Indigenous Communities a publication which emphasized community development programs of the government of Peru and international agencies. Those communities whose representatives responded amounted to only a 6.4 % sample of all those then recognized. We found^{5/} that 12.4 % of these letters mentioned a lack of sufficient water for one purpose or another. This was the second most frequently mentioned complaint appearing in the letters available for analysis.

With this clue to guide research, the Cornell Peru Project included a question about water supplies on a questionnaire it mailed ^{6/} to 1,600 government-recognized Indigenous Communities^{7/} in Peru in 1962.

To our surprise, we found that the smaller sample of these communities had been biased toward reporting proportionately more disputes over land tenure as compared with perception of environmental "aridity." For perceived aridity showed up in no less than 86 % of the replies to the questionnaire,^{8/} which characterized the Indigenous Community populations as lacking sufficient domestic or irrigation water, or precipitation for dry farming.

Perceived lack of water for one purpose or another turned out to be the most frequently mentioned complaint of the Indigenous Community representatives responding to the Cornell Peru Project survey. The next most often mentioned difficulty, community territorial disputes with adjoining landowners, was reported by 73.3 % of the responses.

Considering the number of Indigenous Communities that replied to the Cornell questionnaire, and their wide dispersion in all parts of the Peruvian Andes, it cannot be doubted that the water scarcity reported is greater than the true dearth of environmental water supplies. What the representatives of the Indigenous Communities actually reported was a discrepancy between the amount of

water effectively available for domestic purposes, dry farming and particularly for crop irrigation, and the rising social aspirations of the hitherto relatively isolated Andean rural populations.

In order to emphasize this point that the perception of aridity is more important in the practical affairs of mankind than true aridity, I should like to cite briefly certain urban behavior with regard to domestic water.

One of the major social phenomena of our times in Latin America is the squatters' settlement at the edge of the major city. Lima, Trujillo, Arequipa, Chimbote, Ica, Mollendo, Nazca, Chancay, Ilo, Lurin and Chincha in Peru, Guayaquil in Ecuador [as well as Caracas, Rio de Janeiro, Santiago de Chile, Mexico City, Guatemala City and San Salvador] all have their squatters' settlements. One of the most striking characteristics of the Peruvian squatters' settlement is its utilization of a truly arid natural environment for dense human settlement in urban patterns. Pampa de Comas, one of the squatters' settlements (barriadas) near Lima, has been built on completely desiccated Pleistocene outwash in westward facing canyons of the westernmost Andean foothills edging the Pacific coastal plain. The settlement lies above the irrigated Rimac River Valley in which Lima is located, and introducing water for domestic usages poses considerable engineering difficulties.

The population of Pampa de Comas is currently approximately 70,000 persons. In June of this year, domestic water was still not available to that urban population from pipes laid by the government, even though these had been officially dedicated some months previously.^{9/} While the residents of Pampa de Comas engaged in a great deal of agitation for what would usually be considered adequate urban water services, the fact remains that they voluntarily chose to move out of the Rimac River Valley oasis into the true Pacific Coastal desert in order to establish their squatters' settlement upon lands they could pre-empt,^{10/} in order to construct houses they could inhabit free from the rents charged by the landlords of Lima, and establish claim to ownership of a lot.

What the outside observer would consider a truly arid desert has become, for the residents of Pampa de Comas, a habitable urban environment supported by small per capita water supplies transported from the Rimac River Valley oasis. The Pampa de Comas social solution to the problem of obtaining domestic water supplies in a truly arid setting takes the form of both purchasing from vendors and politically pressuring the Peruvian government to send water tank trucks into this squatters' settlement on a regular delivery schedule to fill squatters' water storage drums. Other squatters throughout Peru join in exerting this political pressure successfully. This means that national tax monies subsidize urban squatting

on arid terrain around Peru's major urban centers.

One encounters, then, the contradiction of Andean highlanders living in a relatively well-watered natural environment perceiving themselves as short of water for social and economic purposes, while thousands of persons seeking socio-economic vertical mobility invade the truly arid desert of the Andean coastal plain in order to establish urban satellite cities.

Pertinent to this point is behavior in a squatter's settlement in Rio de Janeiro. Located in a very well-watered natural environment on the opposite coast of South America, residents in one favela carry water for 20,000 persons in oil cans from from twelve spigots. Men have died fighting over positions in the water-waiting lines.^{12/} For scarcity of public utility installations and short distribution hours, the Brazilian resident of the favela is little better off than his counterpart in the Peruvian barriada, despite the profound difference in precipitation in the two natural environments. The favela family seems just as short of available domestic water as is the barriada family, and obtains what little it does use in the same general ways.

What emerges from such facts is a basic conclusion that while the availability of water in the natural environment is a fundamentally important permissive factor to Latin Americans, their cultural beliefs become much more important in determining their perception of the relative aridity of natural environments.

Having stressed the point that culturally determined perception of the Andean environment is relatively more important in regulating human land use in these mountains than is the true natural environment as assessed by objective criteria, we move on to consider what cultural measures the Andean peoples are taking to remake their natural environment along more desirable water-supply lines.

Two general patterns of behavior may be distinguished. One is a pattern of dependency upon governmental initiative and action. The second is a pattern of local initiative and self-reliance.

In the realm of dependency upon governmental intervention lie tank truck water deliveries to squatters' settlements by government housing agencies, and the large, expensive irrigation works designed to bring under irrigated cultivation additional tracts of truly arid coastal plain. These projects typically are of such a scale as to require resources beyond the capacity of local communities. They are, in fact, frequently beyond the immediate financing capacity of national governments, so the central Andean republics obtain international backing for them. Such is the case at San Lorenzo, a recently completed irrigation project on Peru's arid north coast, now being settled after a number of years of construction and preparation.^{13/}

In the realm of local initiative and self-reliance lie small-scale projects to increase the supply of water effectively available for domestic or productive purposes carried out by community labor. A traditional private enterprise solution to the problem of distributing domestic water to households in settlements lacking potable water piping systems is, aside from one's going to a ditch for water, sale of sweet water from tanks carried on wagons or packed on konkey back.^{14/}

Perhaps the most impressive finding of the Cornell Peru Project survey of Peruvian Indigenous Communities was that over one-fifth of them have constructed irrigation canals with communal labor within living memory. Most Andean rural agricultural communities rely to some extent upon irrigation, save for the highest altiplano high altitude steppe region in southern Peru and northern Bolivia. Most of those communities which practice irrigation probably utilize water distribution systems originally laid out in prehistoric times. That 21.25 % of the Indigenous Communities responding to the Cornell survey should report having recently built new irrigation canals signifies a very significant expansion of agricultural productive capacity in rural Peru. Such works, whatever minor technical defects they may suffer due to lack of engineering guidance, at least irrigate lands where the need for water is realistically assessed. This contrasts with government irrigation projects engineered by

outsiders in a technically perfect way which fails to take into account critical factors in local environments.^{15/}

In terms of potable water for domestic purposes, governmental initiative in installing safe water distribution systems has been limited almost entirely to the larger urban centers of Andean population.

Rural farm communities and trading centers in the Andes have by and large been left to their own devices so far as potable water supplies are concerned. The problem of perception of natural environment again enters into rural community behavior. For, as Richard W. Adams^{16/} has remarked: "The need for a better drinking water system is felt mainly by people who have learned something of the nature of the contamination of water and have been convinced by their experiences elsewhere that contamination can be avoided." Muddy water has persuaded far more people in the Andes of the desirability of installing potable water systems than has comprehension of hygienic principles.^{17/}

The Cornell University survey of Peruvian Indigenous Communities discovered, despite the low incidence of understanding of sanitation principles among rural Andean residents, that 8.6% of the communities responding had installed potable water distribution systems with their community labor.

The point to be emphasized here is not so much the actual incidence of community labor projects to augment

effectively available local water supplies, as the significance of local Andean community capacity to contribute cooperative labor to modify the microenvironment. One other figure obtained by the Cornell survey can be mentioned in order to indicate the extent to which the will exists to volunteer labor toward community improvement purposes, and the extent to which the leadership capable of initiating worthwhile projects and managing volunteer laborers toward productive ends exists. No less than 83.75 % of the Indigenous Communities responding to the Cornell questionnaire have constructed one or more school buildings with community labor (and local materials, or using government-provided materials). The capacity of the Andean Indigenous Community to apply community human resources to the modification of local natural environment is approximately equal in frequency to the perception of water scarcity among members of these same communities.

The local initiative, leadership, and capacity to labor voluntarily displayed by rural Andean communities constitute major resources for rapid modernization of the Andean states,^{18/} and perhaps their major hope for beneficial participation in the Alliance for Progress. A balanced combination of national governmental or international material support and engineering services^{19/} with local community voluntary labor and locally available contributed materials can achieve notable expansions of economic productivity which can provide the base for in-

dustrialization and improving standards of living in both the cities and on the farms.^{20/}

One example will, perhaps, suffice to illustrate this generalization. Dr. Oscar Nuñez del Prado, anthropologist at the University of Cuzco, has for several years headed a community development project at Kuyo Chico, an Indigenous Community some forty kilometers outside the city.^{21/} The Ministry of Education provides teachers, and the Ministry of Labor and Indian Affairs provides additional personnel as part of its National Plan for Integrating the Aboriginal Population. Nuñez del Prado initiated the Kuyo Chico program by guiding the Indians in improving their housing through their own efforts. Now these Indians are constructing a long irrigation ditch to bring sufficient water to irrigate an area of 400 hectares of hillside land (and provide water to generate hydroelectric power). They now cultivate a much smaller area. Nuñez del Prado's Peruvian staff was reinforced by U. S. Peace Corps Volunteers in October of 1962, and one to three Volunteers have worked with the Indians building the irrigation ditch, providing some technical knowledge not possessed by the local people. The U. S. Agency for International Development provided a portable air hammer, which greatly accelerated the project by enabling the workers to cut through rock outcrops along the ditch route mechanically rather than by hand. This project forms a fine example of

productive utilization of international technical assistance in combination with local materials and voluntary labor.

The people of Kuyo Chico class themselves, along with the vast majority of Peruvian Indigenous Communities, as inhabiting a water-deficient environment. Yet theirs is merely a perceived aridity, not true aridity. They possess the labor capacity to increase the proportion of the free water available in their natural environment which is effectively applied to human ends. With sociological assistance provided by the Peruvian government through the University of Cuzco and Dr. Nuñez del Prado, augmented by Peace Corps Volunteers, plus some technological instruction from the same sources and a small amount of material aid, the Kuyo Chico Indians are markedly altering their microenvironment in the direction of greater water supply effectively available for economic ends.

Another and very different type of social solution to the problem of perceived aridity in the Andes, along with a number of other related problems including the survival of a semi-medieval manor system in Ecuador and Peru,^{22/} extreme fractionalization of land holdings, and rising economic and social aspirations, lies in abandonment of the area of perceived aridity for the well-watered lowlands in the Amazon basin.

The national governments of the central Andean states, Ecuador, 23/ Peru 24/ and Bolivia, 25/ actively promote Amazonian colonization schemes. They are supported by various international specialized agencies including the Andean Indian Programme administered by the International Labour Organisation with Food and Agriculture Organization, World Health Organization, etc., collaboration. In addition, large numbers of Andean highlanders have undertaken spontaneous migration into the Amazonian lowlands or the well-watered eastern slopes of the Andes proper. 27/

Successful colonization in the Amazon Basin by Andean highlanders requires them to change greatly their established customs of diet, clothing, housing, and agricultural practices. Many Andean highlanders have proved their cultural flexibility by making successful adjustments to lowland rain forest life, particularly in Bolivia. 28/

Yet the total number of successful migrants from the Andes into the Amazon Basin is small compared to the wave of rural-to-urban migration in Peru, and compared to the natural rate of increase of the highland population. 29/ The social solution of abandonment of the Andean areas perceived as arid for the rain forest has not yet reached such volume as to lend ground for much optimism as to its ultimately solving the real problems stimulating it.

The real hope for modernization and achieving a decent standard of living appears to lie in the social solution of local initiative in applying voluntary labor to create new capital and capital-producing capacity.

N O T E S

1. This is a report of the Comparative Studies of Cultural Change of the Department of Anthropology, Cornell University. It was prepared under Cornell University contract AID/csd-296 with the Agency for International Development of the United States of America. Original data presented herein were collected by the Cornell Peru Project with a grant to Cornell University from the Carnegie Corporation of New York. This analysis benefited from discussion with Allan R. Holmberg, Chairman of the Cornell University Department of Anthropology, and Paul L. Doughty, Cornell University Research Coordinator in Peru under contract PC-(W)-155 with the Peace Corps of the United States of America.
2. Coordinator, Comparative Studies of Cultural Change, Department of Anthropology, Cornell University.
3. E. Yale Dawson, "Ecological Paradox of Coastal Peru," Natural History, 72:8 (Oct. 1963) 32.
4. Thomas R. Ford. Man and Land in Peru. Gainesville: University of Florida Press (1955), pp. 6-8. Emilio Romero. Geografia Economica del Peru. Lima: Universidad Nacional Mayor de San Marcos (1961), pp. 9-13.
5. Henry F. Dobyns with Ella Carrasco R. Un Analisis de la Situacion de las Comunidades Indigenas en el Ambiente Nacional. Lima: Folletos del Proyecto Peru-Cornell N°1 (1962) p. 12.

6. Henry F. Dobyns. Indigenous Community Response to Mass Medium Stimulus in Peru. Ms, Department of Anthropology, Cornell University.

7. Direccion General de Asuntos Indigenas. Padron General de Comunidades Indigenas Reconocidas Oficialmente al 30 de Junio de 1961. Lima: Ministerio de Trabajo y Asuntos Indigenas (1961) p. 8.

8. The response to the questionnaire amounted to 40% of the entire number sent out, that, 640 of the 1,600 officially-recognized Indigenous Communities returned the completed questionnaire.

9. Despite US AID support for this project, water was not actually flowing through the pipes at the time of the dedication ceremony. Authorities had a man behind the scenes pour buckets of water into the pipes leading to the outlet used for the dedication ceremony, so that some water would trickle out during that event. US AID officials later spent many frustrated months prodding Peruvian officials to complete the water piping and in fact provide water to the barriada.

10. Pampa de Comas is typical of most other barriadas on the Andean littoral in its arid site, not exceptional. Stillman Bradfield has studied the similar location of many Chimbote barriadas (described in a lecture to Peace Corps Volunteer-trainees at Cornell University). Only in the "oldest barriadas which are nearest to the old part of town" are there public water spigots "every

- few blocks." Stillman Bradfield. Migration from Huaylas: A Study of Brothers. Ithaca: Cornell University Ph.D. Thesis (1963) p. 96.
11. The Andean peoples place a very high social value upon land ownership. Henry F. Dobyns, "Problemas Sociales del Desarrollo Agrario Peruano," Mensajero Agricola [Lima] 24:148 (Marzo) 8-12, 18.
12. John J. Considine. New Horizons in Latin America. New York: Dodd, Mead & Co. (1958) p. 4.
13. When large numbers of citizens rely upon governmental initiative and public financing to provide them with greater control over their natural environment, both the means of influencing policy-makers to decide to act and the taxation or other means of financing action decided upon constitute critical variables in determining the course and velocity of national development. Technically trained government employees--frequently trained abroad--play a key role in the intellectual dialogue verbal and printed that moves politicians of the Andean nations to decide upon new policies. For example, Ing. Otto Schultz W. ("Contribucion para el Estudio de las Zonas Aridas y Semi-Aridas en el Pais," Boletin de la Direccion General de Agricultura, Ministerio de Agricultura del Peru, N° 15-16, pp. 4-10) in an article published in an official organ of the Peruvian Ministry of Agriculture in 1955 issued a manifesto calling for study of arid and semi-arid regions in Peru. He did so on the basis of his experiences

outside Peru at a salinity laboratory in California and in India.

14. In Viru, a valley town on the Peruvian coast, "Two public water outlets supply the needs of the people who live near the plaza, but those on the outskirts must buy their water from carriers who sell it from barrels carried through the streets by donkeys each day." Allan R. Holmberg, "Viru: Remnant of an Exalted People," pp. 367-418 in Cultural Patterns, Vol. 2, Patterns for Modern Living. Chicago: The Delphian Society (1950) p.

371. In other rural settlements such as Moche, "water supply in most houses is a matter of fetch and carry." Moche had 6 spigots for some 2,100 people. Rural households outside town carried ditch water. John Gillin. Moche: A Peruvian Coastal Community. Smithsonian Institution Institute of Social Anthropology Publication N° 3 (1945) p. 41. Most of Chimbote's population lives in squatters' settlements away from the block-planned port. "The residents of these barriadas must buy all of their water from vendors." (Bradfield, op. cit., p. 96.)

15. That technical innovations must be feasible in the climates where they are attempted, in order to succeed, constitutes a basic principle that has been insisted upon before. Henry F. Dobyns, "Blunders with Bolsas," Human Organization, 10:3 (Fall, 1951) p. 30.

16. A Community in the Andes: Problems and Progress in Muquiyauyo. Seattle: American Ethnological Society (1959) p. 204.

17. Charles J. Erasmus. Man Takes Control. Minneapolis: University of Minnesota Press (1961) p. 28.
18. Paul L. Doughty. Peruvian Highlanders in a Changing World: Social Integration and Culture Change in an Andean District. Ithaca: Cornell University Ph. D. Thesis (1963) pp. 294-298.
19. Despite repeated technical failures of development projects which paid insufficient attention to local environmental conditions, one can only adhere to the general proposition that science can improve the human * condition. As Robert H. Forbes (The Expanding Sahara. Physical Science Bulletin N°3, University of Arizona Bulletin 29:5 [1958] p. 9) stated this proposition rather negatively: "against the destructive practices of ignorant and careless peoples, threatening the resources of a 'crowded world,' the administrative forces of civilized governments have the power and the responsibility for remedial measures."
20. Two cases from Peruvian experience may be cited to illustrate this generalization. Patrick Crooke (Plan Piloto del Sur: Informe Final. Lima: Ministerio de Educacion Publica, Direccion de Estudios y Planeamiento, Departamento de Construcciones Escolares, Servicio de Ayuda Tecnica en Construcciones Escolares [1960] pp. 37-44) demonstrated by constructing nineteen schools or school additions in cooperation with local laborers donating local materials in the Departments of Puno,

Cuzco, Arequipa and Moquegua, that the cost per square meter under roof was S/. 415.36 to the central government, compared to average contractor bids for the same structures of S/. 623 per square meter under roof. The Indians of Vicos, a former manor, have under the leadership of the Cornell Peru Project and aided by its local investment of commercial agricultural profits, constructed their own complete elementary school including kitchen and animal husbandry, carpentry and metal shop facilities and auditorium, teachers' quarters, clinic, and undertaken to purchase the land they occupy for S/. 2,000,000. (Henry F. Dobyns. Monetary Credit and Transculturation. Paper read at the 1961 annual meeting of the American Anthropological Association. Lima: Cornell Peru Project [1962] pp. 10-18)

21. Oscar Nuñez del Prado. El Proyecto de Antropología Aplicada del Cuzco: Informe Anual 1960. Kuyo Chico: Proyecto (ilimeo).

22. Mario C. Vazquez. Hacienda, Peonaje y Servidumbre en los Andes Peruanos. Lima: Editorial Estudios Andinos Monografía Andina N°1. Gonzalo Rubio Orbe. Promociones Indígenas en América. Quito: Casa de la Cultura (1957) pp. 306-307.

23. Edmundo Perez Guerrero. Colonización e Inmigración en el Ecuador. Quito: Casa de la Cultura (1954) pp. 139-160.

24. Fernando Belaunde Terry. La Conquista del Perú por los Peruanos. Lima: Ediciones "Tawantinsuyo" (1959)

pp. 102-114.

25. Junta Interministerial Directiva del Plan Nacional del Desarrollo Rural. Plan Nacional del Desarrollo Rural. La Paz: Republica de Bolivia (1963).

26. Panel of Consultants on Indigenous and Tribal Populations, International Labour Organisation. Appraisal of the Achievements of the Andean Indian Programme. Geneva: International Labour Organisation (1962)/

27. Hector Martinez. Las Migraciones Altiplanicas y la Colonizacion del Tambopata. Lima: Ministerio de Trabajo y Asuntos Indigenas, Plan Nacional de Integracion de la Poblacion Aborigen, Serie Monografica N° 1 (1961). Hector Martinez A., "La Migracion Puno-Tambopata," in H. F. Dobyns y M. C. Vazquez (eds.) Migracion e Integracion en el Peru. Lima: Editorial Estudios Andinos Monografia Andina N° 2 (1963) pp. 135-142.

Elias Flores, "Modelo de Migracion a la Frontera Selvatica," in Ibid., pp. 160-174. Jose Monje Rada and John S. Marus. Estudios de Colonizacion en Bolivia. II. Analisis de las Caracteristicas Socio-Economicas de las Colonias. La Paz: Ministerios de Economia Nacional y Asuntos Campesinos, Agencia de los Estados Unidos para el Desarrollo Interamericano, Naciones Unidas (1962).

28. Richard W. Patch, Roberto Gumucio Amestegui and Jose Monje Rada. Estudios de Colonizacion en Bolivia.

I. Informe del Director. Tablas Estadísticas. La Paz:

Ministerios de Economía Nacional y Asuntos Campesinos, Agencia de los Estados Unidos para el Desarrollo Interamericano y Naciones Unidas (1962).

29. Urban growth is discussed in several papers in H. F. Dobyns y M. C. Vazquez (eds) Migración e Integración en el Perú. Gregorio Garayar, "Notas Demográficas sobre la migración interna," pp. 30-33. Joseph Stycos y Cara Richards de Dobyns, "Fuentes de la Migración en la gran Lima," pp. 37-44. Marcial Aranguri, "Teoría de la Migración y Migración en la ciudad de Trujillo, 1940-1956," pp. 61-71. Jose Matos Mar, "Consideraciones Generales acerca del Proceso Migratorio en la ciudad de Chimbote," pp. 72-77. Cesar A. Solis, "Fuentes de Migración al Puerto Industrial de Chimbote, 1960," pp. 78-81. Eduardo Soler, "Fuentes de Migración al Complejo Agrícola-Industrial de Paramonga," pp. 82-87.

See also Anonymous. The Problem of the Growing Population at Talara. Coral Gables: International Petroleum Company (1959?)