

CORNELL  
AGRICULTURAL ECONOMICS  
STAFF PAPER

Suggested Strategies for Developing Agriculture  
in Bolivia

Howard E. Conklin

April 1987

87-6

Department of Agricultural Economics  
Cornell University Agricultural Experiment Station  
New York State College of Agriculture and Life Sciences  
A Statutory College of the State University  
Cornell University, Ithaca, New York, 14853

It is the policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

## SUGGESTED STRATEGIES FOR DEVELOPING AGRICULTURE IN BOLIVIA

By  
HOWARD E. CONKLIN

This report contains my suggestions for initial steps toward more fully developing the agricultural sector of the Bolivian economy. It is based upon information assembled in part visually in the field, in part through numerous conversations, and in part by studying written materials dealing with agriculture and agricultural resources in Bolivia. I also have travelled and worked in all of the other Andean countries and in all countries of Central America, and have observed the outcomes of efforts to improve the agricultural sectors in those countries.

My suggestions must necessarily be considered tentative, of course. I have spent only a short time in Bolivia and available secondary data on the productive capacities of the many land types that occur in the country are very limited. In fact one of my major suggestions calls for materially increased investments in inventorying the land resources of the country. I will expand on this suggestion below.

All of my suggestions are designed with a sense of urgency in mind. Bolivia has recently seen the value of its once most important foreign exchange earner -- tin -- decline drastically. I understand also that sales of natural gas to Argentina are expected to terminate in less than 5 years, since Argentina now has its own source of gas. Cocaine at present is bringing in some large, but unknown, amount of foreign exchange that is likely to diminish sharply in the near future.

I have focused initially on improved transport as a means for facilitating and stimulating the kinds of agricultural development that hold the best possibilities for producing early increases in foreign exchange earnings. Following that I consider means for stimulating change that are more indirect, more complex, possibly more costly, and probably with results that are more long delayed.

### Transportation

Even a casual traveler cannot avoid the impact of poor transport facilities within Bolivia. Roads are bad nearly everywhere and I am told that the railroads are in poor physical condition and are operated in an unreliable manner. Only air transport between major cities is modern and reasonably efficient.

I am puzzled by such extreme neglect of transport facilities. Bad roads certainly are increasing the costs of operating trucks and buses far beyond what would be the costs of maintaining better roads. Poor and inefficient railroads preclude the possibility of shipping perishable commodities such as fruits and vegetables to external markets and increase the costs of shipping them to local markets. The need to use airplanes to transport meat from the livestock areas of the northern lowlands to La Paz and other population centers certainly increases the cost of this commodity beyond that in areas where trucks and rail facilities are available. (Venezuela, for example, used large numbers of "meat" planes some years ago but now moves most cattle alive by truck to central slaughtering facilities.)

I can only believe that some inadvertent "quirk" in the institutional arrangements of the country account for the low level of attention paid to transport facilities. (If it is a "quirk," it tends to be a Latin American quirk, however, rather than just a Bolivian one. Transport is poor nearly everywhere in Latin America.) Perhaps inherited deficiencies in the system of taxation have at least partially paralyzed efforts to improve transport. In the United States, for example, local roads are supported in part by local real estate taxes, with state aid funds granted to local governments out of the proceeds of such state taxes as the tax on gasoline. Above the local level, state roads are supported in part from specialized taxes, such as those on gasoline, and in part from general funds raised by sales, income, and other state taxes. At the highest level the federal government builds and maintains some interstate roads and provides aids to state governments for improving state roads.

Transportation surely is an aspect of infrastructure for which higher levels of taxation are more beneficial than lower ones, up to a relatively high level. Actually, levels of general taxation in all major industrialized countries of the world far exceed those in any of the nations of Latin America. Higher taxation obviously will not assure development, but the lack of infrastructure, for which taxation is necessary, can preclude it. More about taxation later.

#### Transport to Facilitate Agricultural Export to the East

Even if Bolivia could in some way jump the institutional hurdle to better transportation, not all needed transport facilities could be provided immediately. Priorities would have to be set. If agricultural

exports are in some measure to replace tin, gas, and cocaine as earners of foreign exchange, it seems clear to me that better transport is needed at an early date on the lowlands and from those areas east and south to Brazil, the Paraguay River, and Argentina.

The agricultural resources, both land and people, of the eastern lowlands appear likely to respond most quickly to infrastructural aid stimulation. Much has been accomplished already in that region, with Santa Cruz having transformed itself from a small frontier town to a thriving metropolis in the past 25 years. Petroleum, of course, accounts for an important measure of the prosperity in Santa Cruz, but agricultural and agribusiness activities also are much in evidence.

Some portions of the eastern lowlands appear capable of producing corn, soybeans, and wheat on a long-run basis. We also saw cotton growing well on the northern edge of the Chaco but pumping lifts for irrigation are very high there and a system for irrigating with river water would be expensive, especially since reservoir storage facilities apparently would be needed for the dry season. Cotton seems not to have proven very profitable elsewhere on the lowlands, inasmuch as the acreage in this crop has declined very sharply in recent years.

Questions also have been raised about the long-run feasibility of wheat production, but those who support its possibilities point to new tropical wheat varieties and to the possibility of following a soybean crop with a wheat crop in the same twelve months. Presumably the market would be within the country since wheat consumption has increased greatly within recent decades. At present PL 480 wheat is being supplied in large quantities by the United States but that is an uncertain source in the long run.

World supplies of corn and soybeans have been in surplus in recent years and this condition is likely to continue for at least a few years more. On the other hand, land costs may be lower in at least parts of the eastern lowland than in Europe and the United States, for example, and the possibility of double cropping wheat and soybeans could provide a further advantage.

These are all matters that need to be investigated before vast sums are put into agricultural infrastructure in the east. Among other things, careful comparisons should be made with the soybean and corn areas of Brazil. These comparisons should include not only crop yields by land types but also comparisons between farm businesses, both existent and possible.

The evidence that came to my attention, however, indicates that enough agricultural activity will be feasible in the near future to justify considerably improving the railroad from Santa Cruz to the Paraguay River. In fact, such improvement seems long overdue, especially since the alternate routes involve passage over a very long and poorly maintained railroad in Argentina or a steep climb over the Andes and down again to the Pacific. Import as well as export activities would benefit from facilitating the use of water transport from the outside world to the eastern frontier of the country.

A highway has been proposed to parallel the railroad from Santa Cruz to Puerto Suarez on the Paraguay River. This could result in even greater efficiencies since the private sector would own the rolling stock and schedule freight movement. (Part of the current problem with the railroad arises from the inertia of the bureaucratic organization that now operates it under government ownership.) But the cost of constructing

an all-weather road the 600 ± kilometers from Santa Cruz to the frontier would greatly exceed the short-term cost of improving the railroad. Scarce capital -- beyond what is needed for the railroad -- probably should be used to improve the road westward from Santa Cruz to La Paz and to improve or build feeder roads on the lowlands, including the livestock areas on the lowlands of the Beni.

#### Transport for Agriculture in the Mountain Valleys and Lower Slopes

Increases in exportable agricultural production from other areas of Bolivia are likely to come more slowly than from the lowlands. Once they are realized, however, they may be more valuable and long lived.

I think in terms of increases in specialty crops for the valleys of the eastern slopes of the Andes; crops such as coffee, a variety of fruits both tropical and temperate, and vegetables. Coca currently is a specialty crop of this zone and has been for centuries. Now that the peoples of the "developed" nations of the world have learned how to "refine" coca into a powerful, addictive drug and have made a fad out of its use, the future of this specialty crop is uncertain. As a fad, its use is likely to drop precipitously at some point, making it an unreliable earner of foreign exchange.

We saw one enterprise that is successfully producing roses near Cochabamba and marketing them in the United States. But we saw another enterprise less successfully producing peaches. A larger number of elements are necessary for success in producing most specialty crops. The market for these crops often is highly selective and far away. Rapid transport with highly controlled conditions often is necessary.



Air transport works well for flowers but modern and efficient rail or truck transport nearly always is needed for fresh fruits and vegetables. More processing of fruits and vegetables would be a possibility, but even then much better transport is needed than is now available for delivering the raw products to the plants and carrying the final items to market.

Good transport alone is not enough, however. High levels of management skill, a variety of expensive inputs such as fertilizers, chemicals, and equipment, and often more reliable irrigation water, are needed. Building systems of specialty production that can put products profitably into the larger cities of South America would be possible in Bolivia but it could not be done quickly enough to earn significant foreign exchange in the short run. If Bolivia were to vigorously pursue the production of specialty crops, a major specialty sector could be created in 20 years. Many other areas in Latin America have land resources equally adapted to use by such a sector. The winner in a competitive race will be the area -- and the nation -- that first puts together a suitable package of infrastructural elements and management and marketing skills.

Similar principles apply to some extent to dairy and poultry production in the mountain valleys, except that these activities are already more advanced. I was very favorably impressed by the milk processing plant we visited in Cochabamba. There are large local markets for animal products and, once processed, at least some of the animal products are less perishable than fruits and flowers, and therefore more easily shipped. I do not, however, have the impression that animal products will be able to earn large amounts of foreign exchange. While less perishable than some specialty crops, animal products are more perishable

than grains. Animal products tend not to be shipped very far in most of Latin America. Local assembly is necessary, however, and feeder roads are very important for this.

Transport thus needs to be improved in the mountain valleys and lower slopes as a matter of firm policy over a long period to encourage specialty crops and facilitate growth of the dairy, poultry, and livestock industries.

#### Transport for Agriculture on the Altiplano

The agriculture of the altiplano is dominated by campesinos of Indian descent. I cannot believe that this sector is likely to change fast enough to appreciably increase its earnings of foreign exchange in the short run. Both the character of the land and the culture of the people argue for this conclusion.

No conceivable production practices could raise crop and livestock output to high levels on such meager resources. The soils are shallow and low in plant nutrients. The climate is dry and there is no reliable frost-free period during the entire course of the year.

The Indian peoples, over the thousands of years in which they have lived on the altiplano, have selected crops and livestock, and developed production practices that are admirably well adapted to their harsh environment. And they cling tenaciously to what their forefathers handed down to them.

European settlers and their descendants controlled agriculture on the altiplano from the date of their first settlement to the land reform in 1952. Some crops and livestock were produced for sale in that period,

but it took a vast area of land and the work of a large number of Indians to keep one settler and his family at a level of wealth that permitted education, international travel, reasonable medical care, and the other amenities of a European style of living. There is little evidence that the white settlers were able to instruct the Indians in methods of production significantly more remunerative than the traditional methods inherited from previous generations.

Today, population densities on the altiplano are higher than historically, and levels of living appear to have been declining for a long period. The campesinos control their own tiny plots but production per family is meager.

Nor is there a guarantee that white people even today could produce a large amount more on these lands than the campesinos are producing, at least not without exposing themselves to the possibilities of starvation if they depended only on their farming for food and if there were no "safety net" to help them in bad years. Any effort to stimulate increased production by the Indians should be taken with the greatest of care.

Some believe that enlarged export markets could be generated for the wools of the camelid animals (llama, alpaca, and vicuna) and for some of the unique crops that are part of the Indian culture (quinua, canahua, and tarhui). I question the speed, however, with which supplies of these products could be increased. There seems to be no surpluses of them now and new land resources are very scarce. Serious research to identify methods of increasing yields has only begun. Extension programs that might effectively encourage the campesinos to adopt new production methods are now very weak (see more below).

It is much easier to build roads on the altiplano than in the mountainous areas of the country. Both more level topography and lower rainfall facilitate road construction. It is even easier to build and maintain roads on the altiplano than on the eastern llanos. The rivers that flow from the mountains onto the eastern plain vary widely from time to time in the water they carry. Bridges must be built for peak flows. It also is difficult to confine these rivers to prescribed channels. Expensive bridges may be left standing alone while the river follows in a new channel.

Campeños, however, do not produce large volumes of products for market. Emphasis on the altiplano should be put first and foremost on through roads, railroads, and airports. On the other hand, many local feeder roads at this point are hardly more than trails across the plain. Serious thought should be given to the possibility that local people would improve their own roads, to some extent at least, if there were a mechanism for accomplishing this. Local real estate taxes, or simply arrangements for local people to work together on road maintenance, might accomplish a lot (see more below under taxes).

#### Land Inventory

Some parts of Bolivia have been farmed or grazed for many centuries. The ability of these lands to produce under at least a narrow range of farming practices has been quite well revealed. There are vast areas, however, on the eastern slopes and valleys of the mountains and on the llanos whose productive potentials are unknown. Careful estimates should be made for these areas before large amounts of capital and effort are put into developing them for agriculture.

The performance potentials of a given land area depend, of course, in part on how they are to be used, but they depend also on the soils, climate, topography, location, and present vegetation in the area. It would be much too expensive, however, to describe all of these aspects of land in detail. Systems have been developed for classifying land. Any system of classification covers up known or ascertainable information but it also performs the important task of condensing the whole truth to a level of detail that is manageable. The critical question in any classification system concerns what information is to be ignored and what is to be highlighted. The items that are to be highlighted form the "criteria" of the system.

Criteria can be of two kinds. One kind is morphological. Morphological criteria consist of those characteristics of an object that can be determined by inspection, or simple measurement: color, texture, consistency, temperature, rainfall, miles to points of concern, etc.

In studies of land, morphological characteristics usually have no inherent importance except as they can be used to estimate how a given area would perform if put to use in some particular manner. Actually it would be most useful to use performance characteristics as criteria.

Performance characteristics are the second major kind of criteria. But they are often very complicated to handle in a classification. We cannot observe performance directly unless we put the land actually to some use. Often also we are interested in more than one possible use -- sometimes in a whole array of possible uses and management systems. Manageable performance systems have been set up in forestry in cases where only extensive levels of management are contemplated (the site-index system, for example), but for agriculture, classification specialists

usually have created morphological systems. The systems that have stood the test of time, however, have been those that were constructed with performance in mind. Vast numbers of morphological systems are possible for any set of objects like given land areas, but only a few of them have the power to help predict performance. Specialists have continuously sought to zero in on the systems that have the greatest predictive power. (This means that some changes in productive technology will, and have, made some land classification systems obsolete.)

Another problem in any classification system involves choosing the individuals to be classified. Sometimes this is easy. If one is classifying cattle, the individual cow, calf, steer or bull usually serves as the individual. Herds, however, could serve as the individuals.

In the case of land there is no natural individual. The classifier has to pick the individual arbitrarily. I made a major classification of land in New York State in which I used farms as individuals. My criterion was the estimated capacity of the land to support a farm family, so the farm was a very appropriate unit.

Soil specialists in New York, however, use a very much smaller individual. They call it the "pedon." It is the smallest column of soil that can be adequately described both morphologically and in terms of its performance in relation to the vegetation on it.

Land classifiers have a special problem. Regardless of what is chosen as the land individual, all individuals are fixed in space. They cannot be moved and placed in piles or pigeonholes. They could be tagged in the field but this usually would be awkward. Instead maps are made to record the results of the classification. And the scale of the map determines the degree of detail that can be shown. Rarely is a scale used

that permits showing an individual pedon even if it is very different from the adjacent pedons. The necessity for using maps thus results normally in some degree of "cartographic" generalization.

The land classification maps I have seen for Bolivia are very generalized and some of them are more concerned with natural vegetation than with how the land would perform in agricultural use. Information on the composition and size of the natural vegetation often can be helpful in estimating agricultural performance capabilities but it needs to be supplemented with specific information on soils, climate, and the like, and the question of translating the whole composite of information into estimated agricultural performance needs to be addressed explicitly.

Soil, especially, needs to be classified and mapped for the eastern lowlands. Many different classification systems -- ecological systems for agriculture, agricultural land types, soil associations, etc. -- would be useful if recorded in sufficient detail. Personally, however, I would prefer the soil association system (not the land capability system) used by the soil scientists in the U.S. Soil Conservation Service. This system uses morphological criteria but is focused on those features of soil that are most closely related to its capacity to perform in the production of crops and pastures. (The land capability system of the Soil Conservation Service is focused on soil erosion susceptibility.) A reconnaissance mapping at a scale of 1 : 500,000 should be undertaken first. This system is designed so that more details can be introduced later and the whole effort made a cumulative process.

Air photos and space imagery should be used but extensive reconnaissance on the ground will be needed. Soil samples of the major mapping units should be collected for laboratory analysis. The classification and

mapping work should be extended westward into areas now being farmed on the western side of the eastern lowlands, and information on crop yields and general farmer experiences in using the land for crops should be at least informally recorded. These activities in areas already being farmed would be very helpful for making performance estimates for the morphological classes being mapped in areas where no farming has yet been attempted.

A land inventory of this kind would spell out the ultimate potential of the eastern lowlands in sufficient detail for planning whatever steps might be taken beyond the initial improvements on the railroad to Puerto Suarez. Our field trip to the area extended only to El Cerro, about one-third of the way to Puerto Suarez. The geology of the area east of there suggests that it may be less well adapted to development than the areas we saw nearer Santa Cruz. But this theory and a variety of other ideas held by many other people need to be confronted with hard facts from a land inventory.

While I would put first priority on inventorying the lands of the eastern plain, I would urge that similar work be undertaken soon for the eastern slopes and valleys of the mountains. Localized inventories certainly should be made prior to undertaking any large irrigation projects and prior to any significant shifts in type of crops, such as the introduction of substantial acreages of fruits and vegetables.

It could be argued on humanitarian grounds that soil surveys, climatological studies, and water resource inventories for lands on the altiplano would be among the most valuable of any inventory studies. The population pressure in that region is very high, considering the limited capabilities of the land. Campesinos there have very narrow margins



for error. Land inventories could help them adapt their farming to natural conditions.

Actually these lands have been farmed for centuries and farmers have accumulated a large amount of unrecorded knowledge about them. Unless some major change, such as a new irrigation project, is contemplated, it is unlikely that scientists can very quickly discover new opportunities in these areas. Efforts to facilitate improved farming should move ahead quietly, carefully, and on a long-term basis.

#### Long-Term Research and Extension

This brings to mind the matter of long-term research and extension. These activities have made major contributions to agricultural development in the United States and western Europe. They could do likewise in Bolivia, but they require large amounts of capital over very long periods to be effective.

Research rewards are inherently slow to materialize and they demand true dedication by some of the best minds in a nation. Extension is a type of education, of course. Its success depends on having reliable information and an ability to transmit it in a convincing manner. Both research and extension workers need to be intimately acquainted with farming and farmers in order to choose relevant subjects for study and in order to recognize workable improvements in the way farming might be conducted.

To date in the United States, a high percentage of the research and extension workers have come from farm families and have brought a knowledge of applied farming with them. They also brought a love of

farming and a deep respect for farm people. They can communicate their findings so their brothers and sisters who remained on the farm can understand them.

These original keys to success in developing United States agriculture will be especially important on the altiplano. Campesinos' sons and daughters must be educated to a point where they can conduct research and extension programs for their own people. Meaningful progress will begin at that point. Strong national leadership will be needed to reach this point but this should not preclude active local participation.

I can imagine, at the other extreme, that operators of the larger farms on the eastern plains might hire, through their private associations, specialized research and extension workers to help them fairly directly in designing their management systems and their cultural practices. Possibly a mixture of private and public programs could best serve the expanding specialty lines of the eastern valleys and slopes.

#### Strengthened Local Government

Extension surely, and research possibly, could benefit from greatly strengthened local government, including much enlarged powers of local taxation. I like to think in terms of limiting local taxation to acts of raising money for local expenditures that would be designed to benefit rather directly those who pay the taxes. I have commented about this relative to transportation. In many areas of the United States, extension, also, is strongly controlled at the local level by virtue of local financial support. Police protection is another service whose exclusive

control at the national level seems counterproductive. (In the United States there are independent police forces at all levels of government -- national, state, county, town, city and village. The resulting "checks and balances" seem to improve the service. In Latin America national police forces are dominant and policemen often are paid so little that they have to put part of their services up for sale to the highest bidder -- who may be a cocaine dealer.)

#### Real Estate Taxation

Western Europe, North America and Australia have long traditions of taxing real estate. This would have been a politically unacceptable practice under the feudal system but today Bolivia is much more nearly a land of freeholders. Real estate taxes are reasonably easy to administer at the local level in a freeholder society. They also encourage land owners to keep their holdings in productive uses or sell them to others who will do so. If the taxes are used quite directly for roads, education (including extension), police protection, and other services of benefit locally, opposition to them will be at a minimum. Homestead exemptions undoubtedly should be granted, as they often are in the United States. Under them no taxes are levied on the farm dwelling and associated buildings or on a small plot surrounding the house.

There is a real possibility that a strengthening of local government powers, combined with a real estate tax to implement the exercise of these powers, could mark a major turning point in the development of rural Bolivia. It would be a very logical sequel to the land reform of 1952.

Summary

1. Above all else in the short run, Bolivia needs to improve its transport. I would first improve the rail line to Puerto Suarez, the road from Santa Cruz, to Cochabamba, to La Paz, and selected local roads on the eastern plain and in the Beni. I believe these improvements will reduce the national food bill and stimulate agricultural exports more than any other steps that can be taken quickly.
2. Vigorous efforts to merchandise the resulting exportable agricultural surpluses must accompany all efforts to stimulate agricultural production. Bolivian exports will be projected into a world that is overflowing with food. This is no reason for despair, but Bolivia must capitalize on its unique relationships to its neighbors and it must exploit any other special relationships with peoples elsewhere in the world.
3. Strong research and extension efforts focused on the agriculture and the farm people of the eastern valleys and mountain slopes rank third on my list of priorities for agricultural development in Bolivia. Many of these areas have a well established agriculture, many of the soils are good (even though topography often is limiting) and the people are generally flexible and aggressive. Highly specialized and technical forms of agriculture offer especially important opportunities here but require large amounts of capital and skill. Research and extension programs, and indeed strong agricultural universities, can contribute greatly to the building of an intricate and productive agriculture in this region of the country.

4. I have great respect for the Indians of the altiplano. My father farmed land resources that were only a little more productive than typical farms on the altiplano.  
  
Scientists and extension specialists nearly everywhere find it very difficult to focus their programs on the biological, and especially the economic, realities of environments where alternatives are so limited. Those who farm successfully in these circumstances have learned long ago to be very careful about adopting new ideas. A poor idea can sink them financially or starve them to death.  
  
Progress under these conditions will be slow, and even slow progress will depend on careful research and special efforts to establish rapport with the Indian farmers. Indian young people should be educated to become scientists and educators and then should be encouraged to work with and for their own people.  
  
It will take a long time to create significant exportable surpluses in agriculture on the altiplano, but humanitarian reasons alone would justify special programs for these people. Political reasons may add further urgency.
  
5. The land reform of 1952 fundamentally restructured rural life in Bolivia. Today there is an opportunity to take another step of equal significance. Rural people need an effective means with which to supply themselves with the services that would increase their capacity to produce. Local governments should be strengthened to this end.