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Commercial Agriculture

Commercial agriculture has long been of major research interest to American geographers. Such an emphasis was and is expected when viewed in light of the discipline's development and its pervasive importance to man's economic and cultural ways of life. Early United States geographers were largely oriented toward an analysis of the physical environment and as geographic interest expanded to man-related activities, agricultural studies formed a logical transition. In more recent years agricultural studies have had continued popularity, but their relative importance has declined as research interests in the discipline have broadened still further.

The research topics pursued by United States geographers interested in Latin America have fairly accurately mirrored most of the profession as a whole. Most early studies focused upon physical geography and agriculture. Prior to and immediately after World War II, the combination of Latin America as a region and agricultural and physical geography as topical specialities was a common program of studies for the then developing graduate student. More recently, as membership in the profession has grown significantly, as topical geography has become more pronounced, and as the field's subject matter has broadened, more and more Latin American oriented geographers have turned toward nonagricultural subjects for research.

Commercial agriculture is a fruitful area of research in Latin America, and the purpose of this paper is to: (1) summarize some of the past and present research trends, (2) indicate some gaps and deficiencies in research, and (3) suggest some prospects for future research (see also Parsons, 1964). Such a task is presumptive and fraught with the danger of author bias, yet is presented as a necessary step not

only in inventorying past and present progress, but also in pointing toward future research needs.

Past characteristics and trends

One might expect that the limited number of research geographers in the pre-World War II era would have influenced the type of investigations carried out, and that limited base data would have led to superficial treatment of agriculture over a large area. A review of the literature proves both these assumptions false. Certainly in the latter nineteenth and early twentieth centuries there was a need for fuller description of areas, but at the same time a wealth of observation and interpretation was present. In order to describe these and other periods of activity, Latin American studies of commercial agriculture can be divided into four broad periods: pre-1930, 1930-post World War II, latter 1940's-1960, and 1960 to the present. The division point between periods is indefinite and somewhat artificial.

Prior to the 1930s, specific studies on commercial agriculture were relatively unknown. Agriculture was but one aspect of the larger picture of man-land relations (Nicholas, 1905; Bengston, 1924; Bennett, 1925; James, 1927; Jones, 1927; Wright, 1929). Those studies which did focus on agriculture were of two basic types. The first emphasized agriculture's relationship to the natural environment, and a survey of the physical setting invariably preceded a discussion of crops and livestock (Bennett, 1926; James, 1926; Marbut and Manifold, 1926). The key in many cases was how well or poorly did the agricultural system fit the physical parameters. The second type of study stressed the characteristics of agriculture within an area (McBride, 1920; Whitbeck, 1922; Rosenfeld and Jones, 1927; Shepard, 1927; Milstead, 1928). The characteristics most often commented upon were: (1) the physical features of the area, (2) crop types, (3) crop quality, (4) farming techniques, (5) use of farm products, and (6) the distribution of crops. Both types of studies were common to Latin America as well as other areas of the world.

There were, of course, some studies which did not fit this twofold classification but they were relatively few in number (Tower, 1918; Romecin, 1929; McBride, 1930). Perhaps the focus of agricultural studies during this period was best understood by Jones' and Finch's (1925) statement:

"Recently a group of geographers met in the field to consider this problem of

mapping, insofar as it is involved in the study of a region dominantly agricultural. It was agreed that the objective of an economic geographic study of a region is the determination of relations between its economic life and its natural environment."

Similar statements on the goal of economic geography were made by other geographers of the period (Smith, 1907).

Practically all of the studies in the pre-1930 period were based upon firsthand field observation. The individual investigator arrived at his conclusions based on what he saw and depended upon other data sources to a limited degree only. Techniques of analysis were confined largely to processing in the mind of the researcher. Maps, for example, were prepared to illustrate points rather than as an analytical device. This was a period of "personalized" geography, yet the resultant published research differed little in outline from one worker to another.

In 1928, Clarence F. Jones (1928-30; 1942) began a series of articles on the agricultural regions of South America which was part of a world survey. This was one of the first attempts to collate and synthesize the state of knowledge on agriculture in Latin America. A perusal of the series showed where gaps in the knowledge of some areas existed and perhaps indicated opportunities to study specific aspects of commercial agriculture not previously considered. The series followed the format of past work, integrating the two basic types of studies common to the period, and marked an end to one phase of agricultural research in Latin America. At the same time a new generation of geographers interested in Latin America actively entered the field, and articles emphasizing agriculture become more prevalent. It was then that the previous goals of economic geography were questioned; no longer was there the almost exclusive devotion to examination of the physical setting and agriculture's "adjustment" to it.

From the early 1930's to post World War II, research on commercial agriculture underwent a period of transition with to well defined focus. The traditional investigation of relationships between agriculture and the natural environment continued, now defined in terms of man-land relations. Robert Platt (1931, 1932, 1939, 1942), in his studies of individual farm units, emphasized an inductive and occupance approach in studying non-physical factors affecting land use. Shaw (1934), Dicken (1938), Brand (1941), Deasy (1943), and others utilized a single crop approach in which distribution, cultivation methods, and economic characteristics played a dominant role. James (1932), Dicken (1936), Crist (1939),

Picó (1939), Crist and Chardon (1941), and Garloch (1944a, 1944b) studies the effects of land tenure on land use patterns. Shaw (1933a, 1933b, 1942), Harrison (1935), Wakefield (1937), and Starkey (19 42) investigated changing economic conditions on crop choice. Walker (1937) researched trends in agricultural systems through time, relying on past studies for his historical perspective. Russell (1942) indicated the problems of introducing commercial agriculture in an area of mainly subsistence activities, while Holdridge (1939), Rudolph (1944), Weeks (1946), Waibel (1948), and others examined the development potential of areas.

While no central theme characterized commercial agriculture, one objective was classifying or "typing" farming systems (Higbee, 1947) and for developing generalizations about agriculture. Implicit in this objective was a search for uniform criteria by which regions could be ascertained. Underlying the research of the period was an increasing tendency to look away from the physical environment as a primary explanation for the distribution of agricultural systems (see, however, Powers, 1945). The roles of culture, government, and prevailing economic conditions were more fully examined; and while physical features continued to be presented, they often appeared as adjuncts rather than integral components or studies.

Field techniques differed only slightly from those of the pre-1930's. Aerial photographs were introduced early but were used more as illustrative material than for analysis. Platt (1934) thought that using an airplane was an excellent method for identifying occupance units. Statistical data had become more available and greater reliance was placed on them, but statistical methods of analysis were little used. This was in contrast to studies carried out on the United States where a number of analytical devices were becoming increasingly popular.

A third period of research of commercial agriculture extended from shortly after the end of World War II to about 1960. This period was characterized by still greater diffusion of research topics and greater emphasis upon non-physical aspects (see, however, Shaw, 1949; Jonasson, 1951). To be sure James (1953a) and Parsons (1955) considered the underlying physical factors affecting land use but placed within the context of government and culture. James in particular stressed the viewpoint of understanding an entire agricultural system, not just its parts.

Resettlement and colonization became popular topics. Augelli (1958a, 1958b) studies foreign colonists and traced agricultural characteristics within the framework of a larger cultural setting. Waibel (1950) investigated the land use

systems of colonists and analyzed their attitude toward the land. Garrison (1950), Higbee (1951), and Winnie (1958) assessed the agricultural development potential of tropical lowlands with Winnie reporting on the government as an agent of change. In the highlands Keller (1950, 1955) evaluated land tenure systems and other institutional factors affecting land use patterns and Dozier (1956) studied planned economic development in a major coffee area.

Land tenure itself was the focus of still other studies. Tuthill (1949) showed the relation of farm size and tenure to agricultural characteristics. Crist (1949), Batchelder (1952), and Augelli (1953b) investigated some patterns of tenure and associated problems. A typology of farming units was begun by Lounsbury (1955) in which the relationship of farmstead morphology to crops was demonstrated, and by Augelli (1953a) who compared types of agricultural units with differences in size, location, ownership and labor supply and emphasized cultural factors affecting land use.

The evolution of agricultural systems and attendant problems characterized the number of studies, each with a slightly different focus (Higbee, 1948; Parsons, 1952; Fitzgibbon, 1953; Crist, 1956a; Parsons, 1957). James (1953a, 1957) projected future trends based upon an inventory of past and contemporary trends and indicated some problems of applying technological advances. Jones and Morrison (1952) described the development of a farming system and reasons for its changing location. Crist (1956b) surveyed the changes through time of an area shifting from subsistence to commercial agriculture. Dyer (1956) regionalized a crop by examining its historical evolution and aerial features.

The period marked a trend away from investigating techniques of farming and broadened the kinds of subjects encompassed by agriculture. Culture, economies, and governments were considered more fully as influencing agricultural patterns, and the historical basis of farming systems attracted considerable attention.

Techniques of investigation, however, changed relatively little. The unit area method or recording field data became popular (Jones, 1952), and more aerial photography was employed. An increasing concern was voiced by some that advances in data handling were not being applied, and Blaut (1959) suggested a greater use of statistical sampling techniques in gathering data particularly at the micro-regional scale in inventorying an agricultural region. Sommers (1949) explored the use of dot maps in describing the wheat regions of Peru in an attempt to portray more accurately the relative density of concentration. The use

of improved data-gathering systems and analysis, however, was not widespread during the late 1940's and the 1950's.

In the decade of the 1960's, studies on commercial agriculture continued the trend away from the effects of the physical setting. The role of culture, government, and economics as determinants of land use patterns became increasingly important. Eidt (1962, 1966, 1968), Stewart (1965, 1968), Pifer (1967), and others (Pearson, 1960; Augelli, 1962; Winsberg, 1964) discussed the relationship of agricultural developments within colonization projects. Finkel (1964) and Stouse (1967) examined the impact of existing tenure systems on economic activities. Chardon (1963), Dozier (1963), Henderson (1965), Gonzalez (1966, and Leahy and Crist (1969) investigated the effects of government as an agent of change in an agricultural area, and Winnie (1965) explored the role of a communal tenure system in intensity of land use. Hoy (1962) and Kelly (1965) traced the historical aspects of land use in an attempt to understand present patterns, while Lentnek (1969) and Martinson (1969) analyzed the effects of changing economic opportunity upon a traditional agricultural area. Miller (1968) related population growth to agricultural expansion.

Land improvement and agricultural trends constituted a second group of subjects. Wilken (1969) studies the techniques of draining and cultivating reclaimed land, and Morris (1969) made a comparative study of irrigation areas. Stevens and Brandao (1961) inventoried current trends and potential of agriculture in regional development. MacPhail (1963) analyzed the factors contributing to the development of a relatively new agricultural pursuit in the tropics. Stewart (1960) traced the development of cropping techniques and problems of endangered crops while Thompson (1961) and Winsberg (1968) inventoried the cattle industry from the viewpoint of production and marketing characteristics. Dyer (1967) showed the changes in sugar regions made through time and by government policy. Blume (1967) and Wood (1967a) constructed a classification of agriculture.

Numerous studies were published presenting a variety of techniques applicable for the analysis of agricultural data, yet few researchers of Latin American agriculture felt the need to avail themselves of these methods, Henshall and King (1966) applied statistical techniques to determine the structural characteristics of a farming system. The traditional methods of data collection and processing, however, were characteristic of most studies.

Foreign agricultural geographic research

Two other groups of geographers have made important contributions to the study of commercial agriculture in Latin America. They are the Latin American geographers themselves and European geographers.

Since the late 1940's, Latin American geographers have made substantial contributions, practically all of which deal with topics and areas of their own respective nations. Frequently commercial agriculture, or the whole agrarian complex, is treated as a part of general or economic geographies of a particular country. Examples of this approach are the texts by Parales (1955), Romero (1961), and Marrero (1964). These authors, at least, have gone beyond descriptive assessments by: (1) adding details of crop productivity, (2) relating agricultural potential to food and nutritional needs, or (3) treating agriculture as part of the cultural impact upon the landscape.

A special aspect of Latin American contributions to the literature is the frequent cooperative effort by staffs of a single geographic institution, or by individual geographers from different institutions in order to provide comprehensive coverage of certain topics, regions, and even whole nations. Significant documents are the multi-volume Guidebooks (Conselho Nacional de Geografía, 1963), published under the auspices of the Instituto Brasileiro de Geografía e Estatística All volumes contain major sections on the evolution of the agrarian landscape, agricultural systems and economies of Brazilian regions. Similar, but much more specific, is the multi-volume Geografía do Brasil (for example, Guerra, 1949), published by the same institution. Other examples are a work on crop patterns and European colonization by the Brazilian Conselho Nacional de Geografía (1954), and a study of the historical evolution of an agrarian landscape with special emphasis on fragmentation and consolidation of land holdings, published by the how Instituto de Geografía de la Universidad de Chile (1961).

Some outstanding individual research results have also characterized the Latin American geographer's contributions. Sternberg (1956), who until 1963 resided in Brazil, studied the milkshed of Manaus as Part of the "hydraulic ecology" of Careiro Island. Guhl (n.d.), for over two decades analyzed campesino colonization, and contributed maps on soils, soil erosion, and crop distribution to an atlas of Colombia. Alaluf (1961) studies the fragmentation of land holdings in Middle Chile and suggested consolidation according to European examples, while Hotschewer (1953) investigated the evolution of agrarian landscape and economy

of Argentina's Santa Fe Province. One of the rare methodology studies is that by Barthelmess (1967), who by example of contacts and transitions of agrarian systems demonstrated concepts of a dynamic agrarian geography.

Two trends in Latin American agricultural geographic writings are discernible. First and most important is genetic approach, culminating in assessment and analysis of agrarian landscapes which are seen as results of environmental-cultural interactions. Second are works of the socioeconomic problems of land tenure, land holdings, and colonization.

European influence upon Latin American geographers, especially from France and Germany, has always been strong, and it is therefore not surprising that European agricultural geographic studies are very similar in concepts and contents to those of their Latin American colleagues. Monbeig (1952) wrote a classic on agrarian Sâo Paulo, tracing the history of Paulista agriculture from colonial time through the coffee boom to the 20th century expansion of intensive land use. Waibel (1941, 1955), who as a political exile resided both in the United States and Brazil, investigated in detail the European colonization of Southern Brazil. Earlier, during his stay in the United States, he presented a most farsighted, sensitive and objective assessment of tropical commercial agriculture in which he analyzed the relative merits of ethnic-political versus economic-political critiques of the plantation system.

During the last decade German geographers contributed an ever growing number of books and articles to the agricultural geographic literature. Again, only a few characteristic works are indicated here. Dorneich's study (1960) may be considered as a continuation and expansion of Waibel's work on colonization of Brazil; he included the Japanese colonies in his consideration of Brazilian agricultural changes between 1930 and 1950. Sandner (1962) traced the growth of agricultural colonization in Costa Rica while Otembra (1958) assessed the problems of European colonization in Venezuela. Gerstenhauer (1962) investigated the zones of Mexican agriculture and analyzed the factors limiting increases in productivity. Similar studies are those of Lauer (1956) on El Salvador, and by Riebel (1959) on Nicaragua. Blume (1961) and Niddrie (1901), the Tatter an English geographer now residing in the United States, dealt with the changing patterns of Antillean agriculture, land use and population. Wilhelmy and Rohmeder (1963) wrote one of the most comprehensive agricultural studies in their regional geography of the La Plata countries, combining detailed presentations of the physical-biotic base with the historical processes of land use

and economic changes of these nations. Sick (1963) wrote a similar work on Ecuador, and Bruecher (1968) investigated settlement, land use, and agricultural potential of the southern east-Andean piedmont of Colombia.

In all these studies, the spatial framework has been a "*Grossraum*," a region, The objectives were evolution of agrarian landscapes, the role of agricultural systems, and the untapped potential of an agrarian resource base.

Non-geographic sources on Latin American Agriculture

If knowledge of foreign research on the subject matter is considered by the agricultural geographer merely a matter of professional pride, the knowledge of non-geographic literature must be accepted as a matter of professional competence. This is not only true for the sake of the often professed interdisciplinary approach, but also because of the complexity of agricultural systems. Indeed the agrarian way of life, while seemingly so easily definable as a most direct man-land relationship, is a web of linkages among all elements of the physical and cultural world. A look at the list of participants in the seminar on *Plantation Systems of the New World* (Pan American Union, 1959) is sufficient proof.

It might become a matter of general philosophical and specific methodology hair splitting to raise the question if it is necessary, advisable, or irrelevant for an agricultural geographer who, for example, studies tropical crops to know how a cacao pod looks, where it grows, and how it is processed. To avoid this quarrel, no mention is made of literature concerned with the specific agricultural sciences. It should be pointed out, however, that today a growing technical literature is available whose authors are Latin American agronomists, agricultural economists, veterinarians, or others.

But of definite interest to the agricultural geographer are the publications of the Land Tenure Center (see Parsons, 1966), the studies by Pan American Union-Organization of American states technical terms (Union Panamericana, 1967) and the series on Brazilian agriculture written by economists (Nicholls and Paira, 1969). The United Nations Food and Agriculture Organization symposia (see de Camargo, 1949), and agricultural sciences publications by United States university presses (see Alleger, 1962; McPherson, 1968) are indispensable, as are numerous publications by various United States and Latin American social and agricultural scientists (see Schauff, 1959; Posada and Posada, 1966; Sombroek, 1966; Balhana and Machado, 1968; Smith, 1970).

Research deficiencies

Geographic research on commercial agriculture in Latin America is incomplete both in an areal context and in subject matter. These deficiencies are, in part, illustrated by Table I. In terms of regional coverage there is a preponderance of studies performed in Mexico and the Caribbean, especially the English -speaking areas. This concentration is perhaps due partly to greater accessibility, particularly financial accessibility and to physically less rigorous working conditions. The scarcity of work in the extra-tropical part of South America is nevertheless surprising, as is the limited representation of agricultural studies in the inner tropics and Andean areas.

Commercial Agricultural Studies[1]

Area	Regional[2]	Descriptive[3]	Explanatory[4] Government	Culture	Economic	Physical	Others[5]	Actual No. of Studies
Latin America	1-A,1-D	2-D	1-A,1-D	1-A	1-A,1-D	1-A,2-D	1-C,5-D	9
Middle America	1-A,2-B,2-D	2-A,5-B,1-C			1-A,3-B	1-A		4
Antilles	7-B,5-C,2-D	4-A,10-B,8-C	2-A,3-B,3-C, 7-D	2-A,4-C, 4-D	3-A,8-B,5-C, 6-D	6-A,5-B, 4-C,1-D	1-B,3-C, 2-D	46
Mexico	4-A,4-B	2-A,8-B,1-C, 1-D	2-B,2-C,6-D	1-A,3-B, 3-D	6-B,1-C,5-D	1-A,5-B, 1-C,1-D	1-B,1-D	22
Central America	2-A,4-B,1-C 2-D	2-A,5-B,4-C, 4-D	2-C,2-D	2-B,2-C	2-B,2-C,4-D	2-A,1-B, 5-C,1-D	1-B	22
South America	7-A,1-B	9-A,1-B			1-A	6-A,1-B, 1-C	1-B	12
Guianas	1-B,1-C,1-D	2-B		1-B,1-D		1-B		4
Venezuela	1-A,1-B,1-C	2-B,1-C	1-D	1-B,1-C	1-C,1-D	1-A,2-B		9
Colombia	1-A,3-B	1-A,1-B,1-C	2-C	1-C		2-B		5
Ecuador	4-A,1-B	2-A,1-B,2-C 1-D	1-C,1-D		1-C,1-D	2-A,2-B,1-C 1-D		6
Peru	2-A,1-B,1-D	4-A	5-D	1-B,4-D	1-B,4-D	1-A,1-B,3-D	1-C	11
Bolivia	1-A,1-B	1-A,1-B,1-D	1-B,2-C,1-D	1-B,1-C	1-B,1-C,1-D	1-A,1-B,1-D		7
Paraguay	1-D				1-D			1
Chile	2-A	1-A	1-B,1-D	1-D	1-A	2-A,2-D		5

Area	Regional[2]	Descriptive[3]	Explanatory[4] Government	Culture	Economic	Physical	Others[5]	Actual No. of Studies
Argentina	2-A,1-B,1-C	1-A,2-B,4-C, 1-D	2-B,2-C,3-D	1-B,1-C,2-D	1-B,2-C, 3-D	2-C,2-D	1-B	14
Uruguay	1-C	1-A,1-C	1-C		1-C	1-C		2
Brazil	2-B,1-C	4-A,4-B,2-C, 1-D	1-A,2-B,4-C, 1-D	1-A,4-B,6-C,3-B,7-C,2-D 1-D		4-A,1-B, 3-C,1-D		23
Total	28-A,29-B, 11-C,11-D	34-A,42-B, 25-C,11-D	4-A,11-B,n 19-C,29-D	5-A,14-B, 16-C,16-D	7-A,25-B, 21-C,29-D	28-A,22-B, 18-C,15-D	0-A,5-B 5-C,8-D	201

[1]Based on articles in Annals of the Association of American Geographers, Geographical Review, Economic Geography, Professional Geography, and articles written by United States Geographers in Revista Geografica. Included are articles which are not focussed primarily on commercial agriculture but which contain a substantial section of agriculture. Articles are classified by time of publication: A = pre-1930, B = 1930-1947, C = 1948-1959, D = 1960-1970. Thus under Middle Area Descriptive, there were two articles published prior to 1930, five between 1930 and 1947, and one between 1948 and 1959. Where an article covered more than one topic it was recorded in all appropriate categories.

[2]Regional: Commercial agriculture considered as part of a regional analysis.

[3]Descriptive: Primarily inventory studies which include distribution and/or techniques of cultivation.

[4]Explanatory: Analysis of factors creating or modifying an agricultural system or contributing to certain characteristics of the system.

Governmental: The role of government as an agent of change or control of agricultural production and structure of systems. Included, among others, are studies of land tenure, colonization, and agrarian reform.

Culture: The effects of societal attitudes which place constraints upon and direction of farming systems or aspects of the system as measured through time or during a given time period.

Economic: The impact of the various economic influences upon an agricultural system including factors of production cost, land rent, marketing, as well as changing levels of technology available and modifications in the cost/price structure.

Subject content also presents a lopsided picture. Even a cursory survey of the literature points out the predominance of studies devoted to agricultural products and general description. Land use studies, research on agricultural systems, i.e., plantation, hacienda, subsistence farming, and so on, and technological aspects such as irrigation and drainage have been less emphasized. Even land tenure, agrarian reform, and colonization have received attention only recently. Indeed scanty are studies of agriculture in relation to population-food-nutrition as well as

in the overall geographical context. Also deficient are historical studies which are of great utility in areas of rapid change.

This unevenness of both aerial and topical spread can be partially explained on the following grounds:

a)The relatively small number of active "agricultural geographers" available from a rapidly industrializing and urbanizing United States in spite of the fact that a considerable number of dissertations are written on agricultural geography;

b)The complexity of attributes required of an agricultural geographer who must work in Latin America without benefit of data on specialized subjects such as credit, soil productivity, farm management, marketing, and transport;

c)The predilection and concern with production, crops, exports-imports, revenues, growth rates of traditional economic geography of which agriculture is considered a subfield;

d)The limited time which geographers have truly concerned themselves with Latin America, the fluctuating emphasis on Latin America, and the varying levels of available support for research and study in Latin America;

e)The only recent development of techniques which provide for more precise data collection and analysis; and

f) The ever present problem of scarcity in basic data such as maps, air photo coverage, and agricultural censuses.

In addition, there are other factors which affect scale, scope and objectives of agricultural geographic inquiries. Research often has been done from the detached viewpoint of an outsider attempting to inventory what exists and explain how it developed. The relation of the research to solving a practical problem has been considered only slightly and many geographers feel that applied work is unprofessional. More recently the tendency has been to move from description toward predictive analysis and from a contemplative to a participatory mood (Cooper, 1966; Wood, 1967b). This does not mean necessarily that researchers today are striving for more "relevancy" than their predecessors, but represents a different background of experience and training.

Many agricultural geographers today do not come from a farming background

and consequently do not have a knowledge of farming techniques. They are less interested in methods of cultivation. In essence, they are looking for other research frontiers in agriculture and because of their experience are more likely to view agriculture differently. Furthermore, with increasing knowledge of Latin America and improving data sources, it is now feasible to view the agricultural complex as part of a larger more encompassing system. Thus emphasis on institutional and non-agricultural production factors are becoming more popular.

Such changes in point of view bring with it greater responsibilities and the need for deeper insights even if only a minute facet of the whole complex is investigated. The more precise and circumscribed the research objective and the more sophisticated applied techniques and methodologies become, the move it is necessary not to lose sight of the complexity of human relations, of the fabric of life. Winsberg (1968), for example, showed that because the English prefer lean beef the butcher could trim off heavy fat layers for sale to soap manufacturers without raising meat prices. When synthetic detergents became popular, however, the price of fat decreased and meat prices increased as a result.

A second set of factors affecting the scope and objectives of agricultural research relates to the philosophy of geography and its definition. Here, we are concerned with the frame of reference within which a geographer performs his research. Some consider the analysis of spatial distribution of phenomena as the prime goal. If indeed this is the goal of geography, then little more needs saving. Research of agriculture in Latin America has progressed and is progressing toward this goal, and encouragement is needed only to spur the acquisition of additional data to complete the picture and eventually to synthesize the investigations into more generalized statements. There is enough work to keep agricultural geographers interested in Latin American researching for many more decades.

Other geographers, however, are more encompassing in their ultimate objectives. They strive to develop a body of theory which will permit the prediction of form, functions, and processes of a component part of a geographic system or ecosystem. For example, within a man-land system the energy flow between environment (biotope, resource base) and man (biocenosis, community) in form of supplies is governed by the "cultural intent" which is composed of human demands, technologies, and the cultural order of the social, political, economic, and psychological setting. If one accepts such a frame of reference, agricultural geography is concerned not only with morphology, but also with processes and functions of the interactions among all elements of the cultural complex of which

economic features are but a small part. The banana which is the daily bread of the Ecuadorean dock worker, the breakfast fruit from an expanded resource base for affluent societies, and the survival food for tropical lowland dwellers, must be viewed in a variety of lights, including: differing technology and economies at variance with indigenous levels, land tenure and management, soil science and import of fertilizers, irrigation and plant pathology, and labor unions and export revenues.

If the latter objective is used, it points to a research approach which has been scarcely tried, but which is potentially highly productive. In essence, it requires a reordering of data and their analysis in a different matrix. The agricultural complex can then be analyzed at different levels of complexity, historical view, and environmental setting, but always systematically and with the goal of assessing input outputs and measuring flows among several or all components of the whole system. Obviously, no single scholar is capable of making a detailed and complete system analysis although individuals could assess independently and without cooperation the component parts. In this context, even morphology and descriptive and analytic concern with form and extent have an important place; for example, the preparation of descriptive and interpretative maps of agricultural phenomena or sets of agricultural characteristics.

Suggested research subjects

In the preceding sections attention has been given to some of the accomplishments and deficiencies which characterize research on commercial agriculture in Latin America. In this section some lines of future research are considered (see also Weaver, 1958; Floyd, 1969). Emphasized are those subjects which have been relatively neglected or of only recent interest. Topics which have long interested geographers are largely omitted from consideration.

One of the current major trends in geography is that of model-building. As a technique of analysis this method permits the investigation of several factors simultaneously and prediction of various outcomes as variables are altered. In the realm of economic geography, models have become particularly attractive as research tools but have been little applied to Latin America (Synder, 1962; Gould and Leinbuch, 1966; Gould and Sparks, 1969). Many of the developed models, or at least their basic format have come to us from other disciplines, most notably economics, and consequently 'have not been designed to consider primarily spatial attributes. A number of spatially oriented models, however, are available

and useful in commercial agricultural research. For example, actual cropping patterns could be compared to "optimal" or alternative patterns. One could thus illustrate more clearly the forces causing pattern development. Models are excellent techniques to measure the effect of changes in the infrastructure on land use systems, as for example, the effects of improved transport in an area or application of tax, particularly land taxes. These and many other research topics are susceptible to analysis by model-building.

Many behavioral aspects of man have geographic significance but only recently have attracted the geographer's attention. Perception of the environment and diffusion of ideas and innovations are but two which offer fruitful avenues of research (Commission on College Geography, 1969a, 1969b; Harrison, 1969). Useful perception investigations might include how man in different economic settings actually views his resource base (Blaut et. al., 1959; Hill, 1964) , how he appraises his land, or what variations, if any, there are in land selections by members of a society or among different societies. If differences do exist then their effect may be observable in the field. The entire area of decision making is poorly understood but certainly perception plays a significant role. Work on this subject is indeed sparse.

Spatial diffusion is often viewed within a systems approach. A knowledge of how ideas and innovations spread along linkages and are accepted or rejected is of vital concern to those measuring change in agricultural systems. Certainly the rate of change within any region is influenced as much or more by receptivity of its inhabitants as the more traditional explanations couched in economic terms.

Diffusion analysis may be highly useful in explaining several facets of agricultural change as, for example:

a)The rapid increase of pastoralism among tropical lowland agriculturists, especially in wet tropical lowland areas;

b)The adaptation, successfully or unsuccessfully, of settlers to new environments and economic conditions;

c)The rate and degree of adoption of new techniques in traditional agricultural societies and the resulting impact on land use and agricultural productivity; and

d)The process of change of subsistence, pre-industrial agricultural groups into

commercial producers.

Since change is characteristic in many parts of Latin America, agriculture should be analyzed from a time dimension. From the historical perspective an analyses of cropping pattern and cultivation technique in relation to land tenure and transport development may lead to insights on present processes. Similarly the study of areas which in the past apparently supported fairly dense agricultural populations but now are scarcely used may indicate potentials for increased food production (Parsons and Bowen, 1966). Lastly, sequent occupance studies are highly useful in measuring the effects of changing influences on both land use and the farmers themselves.

One agent of change which is playing a more active role in influencing land use is the government. Since World War II many governments in Latin America have begun to exert a positive pressure on various aspects of agriculture. Studies are already available on the effects of agrarian reform and resettlement on man-land relations and changes in products and production levels. More investigations are needed to create a clearer picture. Impact studies of government induced change in price support, credit availability, cooperative movement, import-export restriction, and technical and support assistance have been largely ignored or treated only peripherally. Many studies of this type are susceptible to model analysis.

The demand for agricultural production in relation to national and societal goals offers further opportunities for system analysis and might facilitate improved governmental planning. Faced with problems of poor nutrition, increasing population, urbanization, and declining values of exports in relation to imports a number of studies using a system analysis approach are possible. For example, in areas of dietary deficiencies an investigation of alternative cropping procedures might indicate possible solutions. In many areas regional economies are competitive rather than complementary. An analysis of the potential for regional agricultural specialization may illustrate possibilities for greater efficiency and greater trade both within nations and among them. Birth control has received much publicity but its acceptance in Latin America remains questionable. In this light studies measuring intensity of agriculture and feasibility of intensification are needed. Temporal food surplus and shortage within areas may call for storage investigations (Lewthwaite, 1969).

All of the suggested studies indicated so far are ultimately of limited use as long as

they are confined to a restricted spatial occurrence. Greater utility can come from comparative analysis. Cross-cultural studies in the Caribbean and Central America offer considerable potential as well as cross-regional investigations of dry-land irrigation agriculture on the west coasts. Missing are also refined comparative studies of singular aspects of tropical agriculture, such as of fire agriculture systems, technological adaptions and adoptions, and even of formal aspects such as tools, cultivation methods, food preservation, and other themes.

Geographers might well refocus their interests on the physical environment. Many of the subjects listed above require a sound knowledge of soil, vegetation, climate, water, and landforms without which accurate and useful analysis is impossible. The elements of the physical landscape should be considered from a resource handicap viewpoint (Miller, 1959; Doerr, 1960; Tosi, 1964; Tosi and Voertman, 1964; Momsen, 1965). One might investigate the effects of cropping systems on soil depletion and erosion, the probability of effective precipitation for existing and potential crops, the role of fire as a cropping method and its ramifications, the impact of drainage and irrigation on the water budget, and erosion of slope under different land uses and cultivation practices (see also Chang, 1968, 1970). These analyses and others not only may provide basic data necessary to determine the feasibility of changing land use patterns, but may also indicate ways in which environmental quality can be improved.

Finally, in no other area of geographic research except for physical geography, is it as feasible to undertake field experimentation as in agricultural geography. Even so, still missing is the report of an agricultural geographer who moved with a "spontaneous settler" into new lands and recorded the sequence of events, the process of occupance, and the quality and quantity of function changes in the encounter of old attitudes and practices with a new milieu. Below are a few suggested experiments which geographers might attempt:

a)The utilization of volcanic soil for fertilization in the Andean piedmont;

b)The utilization of sediments from rivers and ox bow lakes as fertilizers on tropical lowland soils;

c)The effect of fire in slash-burn agriculture, particularly in the inner tropics, and on the savanna-selva fringe;

d)The suitability of pisciculture as a diversification and nutrient agent in a number

of marginal agricultural economies;

e)The feasibility of supplemental irrigation in humid agricultural zones; and

f)The effect of supplementary irrigation with silted river water on cropland and pastures in the rainy tropics.

The spectrum of these suggestions is broad. This should not be surprising because, paraphrasing a statement about the economic size of farms (Raup, 1964), "agriculture is not only an economic concept, it is a cultural concept as well. It cannot be interpreted without reference to the total setting in which agricultural activity occurs." Yet, basically, the agricultural geographer will always concern himself with the agrarian landscape and with agrarian man.

Regarding the agrarian landscapes of Latin America, three aspects deserve special attention. They are:

a)Changes of spatial extent. Actual changes (such as the spread of cultivation into central Brazil, new irrigation areas in Mexico and Peru, and pioneer areas in the Central and South American humid tropics) as well as potential changes (such as the utilization of Amazonian flood-plain lands) are equally important.

b)Changes of structure and intensity. Examples are the regional specializations in truck and dairy farming in response to urban growth, or the vegetable production areas in response to newly developed canning industries.

c)Changes affecting the ecology of the agrarian landscape. Groundwater depletion, or effects of monoculture, overgrazing, increased riverbank cultivation, and deforestation, are some of the areas of concern.

With regard to agrarian man, the following problems are outstanding:

a)The seemingly incompatible relationship between the rural-agrarian sectors and the rapidly growing urban sectors of most Latin American nations. Here, investigations of the actual and potential changes in technology, socio-economic, and political frameworks are strongly indicated.

b)The effects of rural outmigration and urbanization upon the remaining agrarian society. What are the effects upon society, productivity, resource base, and land use of repeated mass outmigration such as that from the Brazilian Noreste? What

prevents a higher response in market orientation and productivity in the remaining agricultural producers?

c) Long range socio-political implications. Of special concern are the problems of how to maintain and integrate a large rural agrarian sector when all societal changes of today unmistakenly point toward increasing urban societies.

Recommendations

Commercial agriculture has been an object of research by many geographers interested in Latin America. A literature review, however, indicates that there are numerous gaps in our knowledge both in terms of areal coverage and topical content. Below are some recommendations which might be considered in the light of future research needs,

First, techniques of data collection and analysis have not progressed at a pace commensurate with work done in other aspects of geography. Although this lag may be due, in part, to the difficulty of obtaining reliable census data, maps, and air photo coverage it is also probable that these techniques have not been used because of a lack of competence in application. If indeed the latter case is generally correct, then remedial steps should be taken immediately.

Second, research of Latin American topics has been essentially noncumulative. That is, each piece of work has been done as an isolated study and little evidence is available to demonstrate that more recent studies have been built upon past investigations. The result is a continuation of relatively unconnected investigations which, although of utility, do not significantly advance our knowledge. What is needed is to build a structure of investigations, one upon another, which eventually would lead to more complete understanding of commercial agriculture. Such a procedure may create some duplication of investigation but perhaps overlap is needed.

Third, United States geographers, at best in cooperation with their Latin American colleagues, need to find ways and means to study themes of commercial agriculture in an integrated and more encompassing fashion. Commercial agriculture is more than a subdivision of economic geography and more studies should be made of its broader place in Latin America.

Finally, it is hoped that North American agricultural geographers, apart from their

academic and methodological considerations, and whether they investigate the "Green Revolution" of hybrid rice production for export on Peruvian coastal estates or the no less revolutionary risktaking of a subsistence agriculturist in the selva who produces for the first time a surplus for an internal market, will never lose sight of the fact that what gives them food for thought is the food of life for their fellow man.

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