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The Substance of Subsistence

Introduction

The study of subsistence peoples has suffered from two basic weaknesses: the lack of detailed quantitative data for specific as well as cross-cultural studies, and the obstructing philosophic underpinnings of our Galbraithean-based probes into the economic life of primitives and peasants. The very word "subsistence" conjures up images of a hard marginal life, continuous work just to survive, inability to produce surplus, low return from labor, little security of life, poor diet and nutrition, and a universal level of livelihood which is an impediment to economic development. Examples of these subsistence stereotypes in textbooks and articles are too numerous to mention, and are generally all false.

The prevalent view of subsistence economies and peoples will be difficult to counter and rebuild without a reconsideration of our economic preconceptions. With respect to hunters and gatherers, Sahlins (1968: 85) remarked that "perhaps then we should phrase the necessary revisions in the most shocking terms possible: that this was, when you come to think of it, the original affluent society." As Sahlins notes, there are two roads to affluence, by either satisfying wants through producing much or by desiring little, The assumption in our economic system is that man's wants are great and his means limited. For many primitive peoples, however, wants are limited and means are great. Or, to put it another way, market economies are based on inadequacy and deprivation while subsistence economies are based on adequacy and dispensation.

"Inadequacy is the judgement decreed by our economy, and thus the axiom of economics: the application of scarce means against alternate ends. We stand sentenced to life at hard labor. It is from this anxious vantage that we look back on the hunter. But if modern man, with all his technical advantages, still hasn't got the wherewithal, what chance has this naked savage with his puny bow and arrow? Having equipped the hunter with bourgeois impulses and Paleolithic tools, we judge his situation hopeless in advance" (Sahlins, 1968: 86).

Subsistence-based peoples in Latin America comprise a significant proportion of

that area's populace and a sizable segment of the subsistence societies of the world. Yet we know little about the content, much less the structure, of subsistence. Hopefully, new studies and trends which are emerging in geography and anthropology will correct this situation. Though focused on cultures in different parts of the world and on different research objectives, these studies do have in common the attempt to quantitatively measure subsistence system components within an ecological matrix. For the most part this research has developed since 1960, primarily in New Guinea and Africa. In contrast, there still has been very little systematic study of subsistence in Latin America.

Field investigations based on the analysis of measured inputs and outputs of subsistence systems, will, I believe, comprise a significant research thrust in Latin America in the decade of the 70s. The following discussion is only a partial review of some of the new approaches. My main objective is to suggest that the application of these methodologies can yield significant insights into aboriginal and peasant behavior, and the capacity of production systems under different human and environmental pressures. At the same time they may provide a means to better evaluate subsistence systems prior to any attempts toward economic or regional development and integration into a national or world economy. Because of the paucity of rigid systematic studies on subsistence systems by geographers in Latin America, it will be necessary to range afield both in space and disciplines in order to present an overview of recent work and promising directions for future geographic research among primitives and peasants.

Much of what we know of Indian subsistence is based on scattered ethographies and geographical field studies offering summary descriptions but which have provided little in the way of accurate measurement of productivity, yields, labor and energy inputs, caloric inputs and outputs, and time and distance factors. Ideally these Measurements should be made over at least a one year period. Because of the lack of quantitative data, there is the difficulty of using present-day subsistence patterns to elucidate historical problems; and because the available data are usually not commensurable, meaningful cross-cultural comparisons are often very shallow. In the past geographers and other researchers have not accounted for the scale of subsistence, nor have they counted subsistence with a scale.

The study of subsistence systems, whether from the viewpoint of systems analysis, cultural ecology, ecosystems, or whatever, has the potential of making

substantive contributions beyond the immediate group and research area. Systematic measurement has direct relevance to the larger questions of carrying capacity, resource use, cultural adaptation, and economic change. The current surge of archaeological interest in prehistoric subsistence systems (e.g. Coe and Flannery, 1964, 1967; MacNeish, 1964) is yielding significant explanations of New World cultural evolution which would benefit from good data on present-day populations in order to test hypotheses such as those offered by Carneiro (1961; 1970).

A greater stress should be made on more precise measurement of inputs and outputs and their relationships to each other in order to provide a basis on which larger theories can be built and tested. Hills (1969: 14) observes in his review of geographical problems in the New World tropics, "...any type of geographical research, whether it be quantitative and model-oriented or of a more systematic type, demands data in quantity and quality."

Subsistence systems

A subsistence system can be thought of as the complex of functionally related resources and activities through which a group secures food for their own needs and by their own efforts, usually by the direct exploitation of their environment. The primary objective is food, whether it is from agriculture, horticulture, silviculture, hunting, fishing, gathering, animal husbandry, or any combination thereof. Production, distribution, and consumption or foodstuffs is generally performed by discrete social units, such as a household or kin group, with little circulation or labor or produce outside the social network. Subsistence groups make their own living rather than earning it. In some societies, production is for consumption and consumption is by the producers, while in other societies, some domestic production may be for exchange, with return receipt of foodstuffs. In subsistence economics, provision is for the people, by the people, and to the people.

The degree of reliance on production for consumption varies depending on involvement with external exchange or market relationships, Various provisioning relationships could be placed along a hypothetical continuum ranging from "pure" subsistence systems to market systems in terms of decreasing production for direct consumption and increasing purchase or exchange of foods. To state it another way, production-consumption relationships are regulated mostly by internal homeostatic mechanisms in closed subsistence systems and are

increasingly regulated by external mechanisms in open or market systems.

Within different subsistence systems there are many things which can be measured and interrelated. Obviously yields, labor, distance, time involved, quantities distributed, and diets can be measured, as can yields as a factor of distance or labor inputs (intensity) and so on. By closely measuring these elements a better understanding of how the system functions can be attained which should serve to generate new hypotheses concerning human ecology and adaptation. Suggested research emphasis is on the closely measured specific in order to elicit hypotheses about levels and strategies of human subsistence in general. As an example, Lee's (1968, 1969) research is an excellent explication of !Kung Bushman subsistence ecology, but its major contribution has been the generation of new ideas and the re-examination of hunters and gatherers in general.

Recent research is suggesting the need and the means to reevaluate the productivity, reliability, adaptability, and capability of subsistence systems. These studies are beginning to answer the question of. whether living at a subsistence level means sweating to barely make it, or making it with no sweat.

Sunsistence productivity

One of the most important aspects of a subsistence system is, of course, its productivity. A measure of productivity is a general indicator of the efficiency of a given exploitation system in a particular environment. Furthermore, according to Sanders and Price (1968: 71-72), the amount of subsistence productivity may affect the pattern of cultural adaptation to an environment: "The level of technology and the degree of productivity of the subsistence pattern of a group affects the degree to which variation in response in other aspects of culture is possible." Less productive systems may limit population growth, thereby restricting the "variability of response in other aspects of culture."

Agriculture

Agricultural productivity is usually determined by measuring the labor-human energy inputs and foodstuff yields per unit area, or yields per hour of labor, or per unit of land. Obtaining long-term information on agricultural yields is one of the major problems confronting the field worker, as many crops, such as manioc, are harvested over many months and old garden sites will continue to yield for two or three years after abandonment. Because several activities may be taking place

concurrently, the researcher is faced with trying to sample all or concentrating on one activity. In order to arrive at statistically valid and meaningful samples, it is necessary to know the relationship and periodicity of the interaction of subsystems (agriculture, hunting, fishing) in the larger subsistence system.

One of the most interesting and sophisticated attempts to measure agricultural productivity, as well as other elements of a subsistence system, was made by Rappaport (1968) in his study of the ecology of ritual among the Tsembaga Maring in New Guinea. He kept daily records on the harvests of three taro-yam and sugar-sweet potato gardens for ten months. Labor inputs were expressed in terms of calories expended on agricultural operations based on Hipsley and Kirk's (1965) work. The caloric labor inputs then were compared with the agricultural yields, which were also reduced to calorie levels. Rappaport was able then to arrive at a ratio of calorie return to input. Such caloric ratios could allow one to compare different crop-labor combinations from area to area and from people to people. For example, Rappaport found that the Tsembaga had a calorie ratio of 15.9:1 for sugar-sweet potato gardens and 16.5:1 for taroyam gardens. Thus, for the latter, the crops yielded 16.5 times more calories than were expended in clearing, cultivation, and harvest. Marvin Harris (n.d.) estimates caloric ratios for the Dyak (Borneo) rice swiddens at 10:1 and Tepoztlán (Mexico) maize swiddens at 13:1 on poor land and 29:1 on good land. Leeds (1961: 23) reported that the Yaruro (Venezuela) had ratios only of 8:1 or 9:1, principally for manioc swiddens. A ratio of 30:1 was measured by Nietschmann (1970a) for coastal Miskito swiddens in eastern Nicaragua. Lee (1969: 62-63; 1968: 38) in his study of !Kung Bushman subsistence uses the number of man-days of work divided by the number of man-days of consumption to get at the surplus productivity which is expressed as "subsistence effort".

The tremendous range of reported caloric ratios, from 8:1 to 30:1, nevertheless, prompts a variety of questions about cultural adaptation, technology, and resource use. Are the high calorie ratios of 30:1 for the Miskito Indians and 29:1 for Tepoztlán peasants a response to external market involvement and a demand for surplus crops? Or are they a result of greater population pressures? Do the low ratio of 8-9:1 for the Yaruro, 10:1 for the Dyak, and 15.9-16.5:1 for the Tsembaga stem from subsistence-regulated production; that is, production below capacity to meet only nutritional and social needs? Or are the lower ratios a result of marginal environments, higher labor expenditure, or less population pressure? At the same time, the range of caloric ratios could result from inadequacies in measurement.

The use of accurately measured calorie ratios has a great potential for comparisons of present-day agricultural systems and the evaluation of the evolution of these systems. In addition, this method has the added advantage of reducing all work inputs, including distance to garden site (as expressed by energy expended), to equal units which can be directly compared to caloric returns.

These and other studies which have included measured assessments of agricultural systems indicate that shifting cultivation can be extremely productive as determined by yields and labor expenditures. Under most conditions, shifting cultivation is by no means unproductive or inefficient. In fact, in terms of labor inputs, it is probably one of the most productive agricultural systems. In addition, long fallow shifting cultivation has the added attribute of closely duplicating tropical forest structure and ecology (Geertz, 1953).

Before condemning shifting cultivation as "wasteful", "unproductive", and "labor demanding", as many investigators have done, intensive studies should be carried out on the multitude of different systems which are found in Latin America. Conklin's (1963) outline for the study of shifting cultivation and Miracle's study of shifting cultivation in the Congo Basin (1967) provide a good starting point to grasp the diversity and complexity of these supposedly "simple" agricultural systems.

Hunting and Fishing

For many people in Latin America, hunting and fishing still play an important role in the subsistence system. For example, Carneiro (n.d.) noted that the Amahuaca of Peru rely on hunting and fishing for about 40 percent of their subsistence, and fishing provides 15 percent of subsistence for the Kuikuru of Brazil. Murdock (1968: 18-19) listed a number of groups in Latin America where hunting and fishing is still extremely important, including the Seri of Sonora, the Warrau of the Orinoco delta, many Amazon peoples, Gran Chaco tribes, and remnants of hunters and fishermen in southern South America. Gordon (1969) reported that the Térraba, Guaymí, Bókata, and San Blas Cuna Indians of Panama still do significant amoWts of hunting and fishing, as do the Bayano Cuna and the Chocó, according to Bennett (1959). In addition, the Miskito, Sumu, and Rama of eastern Nicaragua all obtain large proportions of their diets from hunting and fishing. Many peasant groups also get at least some of their food from hunting and fishing.

Denevan (1966), Carneiro (n.d.), and Lathrap (1968) have all commented on the possible importance of protein obtained from hunting and fishing in terms of population distribution and settlement location, especially for people with few or no domesticated animals. Yet very few studies have been done in which the amounts and types of fish and game animals taken by a specific group were recorded. In reviewing ecological research in Middle America, Bennett (1967: 18) noted that "we have only vague ideas about the quantitative aspects of hunting and fishing success under different environmental and technological conditions." This is really an understatement of the situation, as few published studies exist for any one group where hunting and fishing yields were measured. In his study of diet and livelihood of the Bayano Cuna Indians of Panama, Bennett (1962) presented detailed information on 14 days of hunting and fishing catches, including species, number, and weights. Hunting and fishing yields over a one year period were described by Nietschmann (1970b) for a Miskito Indian village in eastern Nicaragua. In this study, caloric ratios were found to be 7.1:1 for hunting and 5.5:1 for green turtle fishing, while protein returns (grams of protein yield per hour/calories expended per hour) were .78 for hunting and .99 for turtle fishing. Hunting and fishing activities were not carried out on a "catch as catch can" basis but were finely tuned to species, site, and season. Measurement of caloric ratios and protein returns served to partially explain hunting and fishing strategies and the restricted focus.

Carneiro (n.d.) compared horticultural and hunting productivity among the Amahuaca of the Peruvian Montaña by establishing how many hours were spent hunting and farming by an individual to procure the 1,000,000 calories which Carneiro estimated were necessary to feed one man per year. He found that for the Amahuaca, horticulture required 603 mail-hours per 1,000,000 calories, while hunting took 795 man-hours for the same number of calories. While not being as productive as agriculture in terms of calories, Amahuaca hunting is much more productive for protein. Even though Carneiro's method of estimating hunting and horticultural productivity is based on extrapolating from the percentages each activity contributes to an individual's diet, rather than from measurement of hunting and horticultural yields over time, his efforts do provide some commensurability between the two systems.

Time and labor

In understanding the functioning, interaction, and a rational of subsistence

systems and subsystems, one finds that a unit of measure applicable to diverse classes of phenomena is needed. Time appears to be a good common denominator measure facilitating comparison and generalizations both within and between different systems (Bergman, 1970). The amount of time available to any one group is fixed, finite. There ire neither withdrawals from or deposits made into the timebank, only allocations. With respect to the measurement of time expended as a means of analyzing and comparing groups, Brookfield (1968: 434) remarked:

"Time is the only valid common measure by which we call quantify labor inputs, traveling distance, leisure time, social and ceremonial intercourse, and political discussion. In viewing the interconnections of the ecological system and the social system, in assessing the impact of changes in social, economic, and natural factors, we are often only making inspired guesses without data on the allocation of time. Yet solid data on this aspect are scanty and inadequate.."

What we usually find in field studies is a fairly crude breakdown of man-days by various tasks. Such data, while certainly being useful, as exemplified by Lee's (1969) study, do not provide the accuracy and depth necessary for comparison with agricultural yield data for which field workers have more often gone to great lengths to obtain.

A few studies have furnished good data on the allocation of time in primitive and peasant communities. For example, Erasmus (1955: 322) presented a detailed description of Mayo Indian (Sonora, Mexico) work inputs to test Herskovits' generalization that "nonliterate peoples, like ourselves, do as much work as they feel they must to meet the basic demands of getting a living, plus as much more as their desire to achieve any given end not encompassed by those basic demands calls for. Unlike workers in a machine economy, however, they take their ease at their own pleasure" (Herskovits, 1905: 90).

For many groups the subsistence sector may take up only a small percentage of all time inputs. For example, McCarthy and McArthur (cited in Sahlins, 1968: 86-87) noted that Arnhem Land aborigines spend only four hours per capita per day in the food quest. Lee's (1968: 37) figures for the !Kung Bushmen indicate that adults spent an average of twelve to nineteen hours per week getting food with hunting and gathering. Figures for labor allocation in peasant societies, such as those given by Erasmus (1955), Foster (1948), Tax (1963), and Lewis (1963), tend to support Sahlins' contention that "the amount of work per capita increases with

the evolution of culture and the amount of leisure per capita decreases" (1968: 86). Labor inputs may increase with the evolution of culture and the attendant complexity of social stratification, material desire, and demands from asymmetrical power relations.

The dilemma between what are needs and what are desires, and what is work and what is leisure often traps both producer and field worker alike. Most North American investigators carry with them a set of preconceived criteria for interpreting the economic and social strategies of the societies they study. Surplus is economic security and money or credit is social security. For subsistence groups, however, economic security is a confidence in their exploitative capabilities and social security is found in their social network. Subsistence groups do not spend their time producing surplus as a business; their business is production under capacity and time is their surplus. The solution to many problems of peasant and primitive livelihood may not be found in complex bourgeois answers and examples. Thoreau observed that the North American farmer "is endeavoring to solve the problem of a livelihood by a formula more complicated than the problem itself. To get his shoestrings he speculates in herds of cattle. With consummate skill lie has set his trap with a hair spring to catch comfort and independence, and then, as he turned away, got his own leg into it. This is the reason he is poor; and for a similar reason we are all poor in respect to a thousand savage comforts, though surrounded by luxuries" (1962: 35).

Distance

Distances to swidden sites or to hunting and fishing areas lend themselves to measurement. Brookfield (1968: 420-427) suggested that von Thünen analysis "can ... be meaningfully applied to agricultural distributions in a society far removed in space, time, culture and technology from the one within which it was conceived." He cited several studies in non-Western societies where agricultural yields were shown to be a function of distance. Lee (1909: 60-61) presented a "cost curve" for the Bushman in which distance is plotted against time and effort taken to secure mongongo nuts, one of the bases of Bushman subsistence. He also has commented on the intensity of land utilization as a factor of distance for the Bushman (Lee 1969: 50-57).

Distance to swidden sites from farmers' residences may show tremendous variations in different areas and For different peoples. (Conklin (1957: 34) observed that the Hanunóo of the Philippines rarely go farther than one kilometer

to a swidden site. The Miskito of eastern Nicaragua, on the other hand, often walk as much as six miles to a swidden site and also journey by dugout 15 to 20 miles to riverside gardens, without a relocation of settlement site. With respect to different distances traveled to farm sites, Chisholm (1902: 148) stated that:

"any distance up to about a kilometre from the dwelling is of such little moment for any but specialized farming... that little adjustment is called for in either pattern of settlement or land use. Beyond about 1 kilometre, the costs of movement become sufficiently great to warrant some kind of response; at a distance of 3-4 kilometres the costs of cultivation necessitate a radical modification of the system of cultivation or settlement..though adjustments are apparent before this point is reached."

Distance traveled to secure food can be measured in many ways which can be helpful, if not crucial, to understanding a subsistence system. Agricultural yields will probably drop off proportionately with increasing distance as labor costs become higher through inputs of added miles from settlement sites. On the other hand, hunting yields may increase away from the settlement site because of greater isolation from human pressure. In addition, final populations are not spread evenly throughout an area, and thus do not readily lend themselves to von Thünen analysis. Instead, concentrations of game animals and fish commonly occur in restricted areas, under specific ecological conditions, and at certain times of the year (see Bennett, 1959, 1962; Coe arid Flannery, 1967; and Nietschmann, 1970a).

Although yields from man's subsistence activities may broadly reflect declining labor inputs over distance, whether or not yield and labor input curves coincide is yet another question. The relationship of yield and labor curves over distance, say from the settlement, may offer a significant measure of human cognition and resource evaluation.

Carrying capacity

Many geographers arid anthropologists have worked with the idea of population carrying capacity among subsistence groups. Allan (1949, 1905), Carneiro (1960), and Conklin (1959), among others, have presented formulas which express the relationship between population, area, and agricultural productivity. Carrying capacity refers to the maximum level of population at a subsistence level which can be supported in an area with a given technology without environmental

degradation. However, Street (1969) challenged the assumption that technology, cropping patterns, and per capita food consumption are ever qualitatively or quantitatively constant in any given subsistence system. Street also remarked that few investigators have attempted to look for "environmental degradation".

So far all attempts to measure carrying capacity have been based primarily on how much land is needed to supply a given amount of crops for a given amount of people. However, in South America, Carneiro (1960, 1961, 1964) has shown that most tropical forest agricultural systems are capable of producing vegetable foods far in surplus of what is needed by existing populations. It may not he the agricultural potential nor the size of the area available for agriculture which influences the size of the population, its mobility, and the area's carrying capacity, but other factors such as availability of protein-rich fish and game resources (Carneiro n.d.; Denevan 1966; Lathrap 1968). More work should be done following Lathrap's (1968) suggestion that Amazonian tropical forest groups were much more adapted to aquatic resources of riverine environments than they were to the tropical forest.

Any consideration of carrying capacity should include all sources of food. Even if meat from hunting, let's say, makes up only 5 or 10 percent of a diet, it may be one of the most important factors in the group's ecological adjustment to the area and therefore has to be considered along with agricultural yields when assessing carrying capacity. For Indian groups such as the Miskito, Sumu, and Rama of Nicaragua, who are very dependent upon fishing as well as hunting, the land-water area which will support a given human population is many times the size of the area needed for shifting cultivation alone. Thus for societies where hunting and fishing are still important in terms of subsistence, more attention will have to he given to the frequency and degree of success in obtaining fish and game if more accurate analyses of carrying capacity or subsistence system inputs and outputs are to be made.

Aschmann (1959: 78) brings another dimension into the problem of carrying capacity by suggesting that for the Indians of the central desert of Baja California:

"the carrying capacity of the area, in terms of a human population which made little effort to store food, must be stated in terms of what was available in the poorest season out of several years, not in terms of average food supply. Consequently, a food available only in small quantity arid ordinarily ignored may be the one that at critical moments prevented starvation. A consideration of only

the ten or twenty most important foods may miss this critical aspect of the food economy."

The measurement of carrying capacity, then, has been disappointing because of the failure to devise something better than "environmental degradation" to indicate the degree, frequency, and scale of a human population exceeding an ecosystem's ability to maintain homeostasis. For a more accurate appraisal of carrying capacity, ecosystem energetics should be studied and all sources of energy evaluated, not solely the most visible means of supporting human populations' manioc cultivation). Carrying capacity requires consideration of the entire ecological system with which man interacts, not just the system's reaction to man nor man's actions. Furthermore, more attention should be directed towards defining cultural and biological regulating mechanisms of population increases. Population pressure appears to be a critical factor in the modification of cultural and ecological systems (Boserup, 1965; Carneiro, 1970). Population growth in a particular region might be a response to a variety of factors which may be social, cultural, religious, and not even subsistence oriented.

Other measurements

Diet and Nutrition

Increasing numbers of geographers and anthropologists are including dietary studies as part of their research. Some anthropologists have suggested that food-dietary patterns should be the focus of studies of subsistence systems (Beals, 1964; Greenfield, 1965). Dietary patterns are the end result of the entire food system and are reflective of the system's efficiency and ecological adjustment. Dietary analysis shows how the subsistence system functions by indicating in a concrete mariner what percentage of food production per person arrives on the table. By studying dietary patterns over the course of one year, changes in productivity and sources can be accurately defined and measured.

One of the largest gaps in our knowledge of subsistence and human ecology is our ignorance of diets and nutrition. It seems incredible that we know so little about what, why, and how much people eat. After all, eating is the major purpose of subsistence:

"To a hungry man, food is to get and to eat. The key questions in most men's minds, arid thereby the major determinants of their behavior, have to do with

how food will be gotten, when it will be gotten and who will get it. Similarly, those who are concerned with the nature of subsistence activity, rather than its historical origins, might well concern themselves with the three stages of such activity: making preparations, food-getting and food use" (Beals, 1964; 135).

Good available data on primitive and peasant diets in Latin America is meager. Personnel of the Instituto de Nutrición de Centro América y Panamá have conducted several dietary and nutritional studies, principally in Guatemala. Work in the social sciences related to diet and nutrition has been reviewed by Adams (1960),. Among the few detailed village dietary surveys which have been made in Mexico, for example, are those by Anderson, et al. (1946) on the Otomi of Mexico, Bonfil Batalla (1962) on a Maya village in Yucatan and Beals and Hatcher (1943) on a Tarascan village. The Food and Agricultural Organization of the United Nations (1964) has compiled a bibliography of food consumption surveys including a large section devoted to Latin America.

Aerial Photography and Remote Sensing

The possibilities of using infrared film and specific color sensitive film for subsistence system analysis have only recently been explored. Brookfield (1968; 422) noted that "by means of film sensitive to light of particular wave-length, such as infrared film, minus-blue color film, and camouflage detection film, it is possible more readily to isolate particular crops and trees, crops at different stages of growth, soil disturbance, and some water conditions ... " One of the major problems of research on subsistence systems in the tropics is getting information on the size of fields and field location with respect to one another and to settlements. The use of infrared film (Ektachrome Infrared Aero, for example) will help the field worker recognize various stages of regrowth in swidden sites and isolate them from new garden sites, as well as distinguishing different crops. Similarly, infrared film should be able to detect differences in waterlogged soils and vegetation which might emphasize patterns of pre-hispanic ridge fields. For more information on the use of infrared film with auxiliary filters see Pease and Bowden (1969).

Detailed photogrammetric coverage has become a standard research tool in ecologically-oriented archaeological work. Coe (1969) has relied heavily on aerial photography and large-scale field maps of vegetation soils, and land-use in his study of the Olmec site of San Lorenzo Tenochítlan. Coe (1969: 20-31) remarked that models for the understanding of the interrelationships between production,

population, and labor inputs, and the evolution of agricultural change and the rise of civilization, will depend

"... upon the microgeographical studies of the sort that photogrammetry can provide and I am also convinced that they are going to stem less from what anthropologists have been talking about and more from the "new geography" ... Locational studies, including central-place theory, nearest-neighbor analysis, and von Thüünen's "isolated state" theory for the location of agricultural activity are the kinds of models I have in mind. These would necessarily be based upon very accurate, large-scale mapping of settlements, fields, communications, and other data for which photogrammetry is a *sine qua non*."

Conclusions

Recent field research among subsistence peoples in many parts of the world has increasingly emphasized accurate measurement of the inputs and outputs of production systems. Lack of common methodologies has prevented the results from being compared, however. Measurements made in more depth and over longer periods of time will permit better appraisals of productivity and efficiency, historical implications, correlations with settlement size, density, and stability, and relevant location theory. Such appraisals are essential for understanding subsistence systems and their relationship with population growth and ecological change.

Our conception of primitive and peasant subsistence economies is marred and unsatisfactory due to inadequate evidence and prejudicial interpretations of economic systems. We know little of the rationale, structure, ecology, or content of subsistence activities. For many researchers the word "subsistence" connotates an image of inadequacy, of barely getting by as if an individual could produce no more if he wanted, instead of the idea of adequacy at a socially and culturally prescribed level. Even though for many subsistence-based groups there may be affluence without abundance and sufficiency without display, interpretations are often slanted in terms of North American business economic philosophy of insatiable wants and limited means.

Past research efforts have sketched the overall pattern and form of subsistence activities in Latin America. It remains for the internal dynamics of subsistence to be quantified and analyzed for we are now capable of doing so. This will not be backtracking over already covered territory but breaking new ground with smaller,

measured steps. Increased awareness of motivations and aspirations of subsistence groups is needed. However, as Joubert said, "to see the world is to judge the judges":

Song of the Tribal Economist

The primitive farmer says Cash
is unsatisfactory trash;
It won't keep off the rain
And it gives me a pain
If I use it to flavor my hash.

So why should I work out my guts
At the whim of these government mutts,
My liquor comes free
From the coconut tree
And my Mary makes cups from the nuts.

Cash cropping is all very well
If you've got to have something to sell;
But tell me, Sir, why
If there's nothing to buy
Should I bother? You can all go to hell.

--Free translation of Papuan Tribal Song, quoted in Clark and Haswell (1966: 47).

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