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# FARM FRAGMENTATION IN THE COMMONWEALTH CARIBBEAN

## Some Preliminary Observations and Analysis

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*Fragmentation of agricultural land* is a phenomenon of worldwide occurrence. It is not typical of North American agriculture but in the recent past it has been present in Europe in a far more extreme form than in any part of the tropical world today. An F.A.O. publication<sup>1</sup> has defined fragmentation as a stage in the evolution of the agricultural holding in which a single farm consists of numerous discrete parcels, often scattered over a wide area. Whether or not fragmentation is an evolutionary phenomenon is debatable. What is more certain, is that excessive fragmentation is ordinarily associated with high rural population densities and laws of inheritance, though these two factors are far from being the only or even the most significant causes of the phenomenon, especially in the Caribbean. Fragmentation is often considered to be associated with a particular type of land tenure, but on a world or Caribbean scale this is not so.

*Consolidation of the farm* in one contiguous block is generally considered as the desirable alternative to the fragmented farm, and in many recent agrarian reform programmes consolidation has been presented as a major objective. However, before any steps are taken to eliminate fragmentation and before consolidation is given any high priority in an agrarian reform programme, careful consideration should be given to the origins of the phenomenon and to all contemporary justifications for it. For example, in Guyana one encounters cases of fragmentation which were carefully planned in order to provide all farmers in a given settlement with a parcel in each of several blocks of land, which varied in respect to soil quality, and in access to drainage and irrigation canals. The question that must be asked and answered is whether or not these factors which led to fragmentation in the first place are significant in light of modern technologies. There is little doubt that under certain circumstances fragmentation of the farm is a necessity and may be economically and socially advantageous.

The objective of this paper is to present some data and ideas drawn from the experience of the authors while involved in the Caribbean Research Project of McGill University, Department of Geography. It is hoped that the material presented will be of value for purposes of discussion in the workshops organised as part of the programme of the 7th West Indies Agricultural Economics Conference, Grenada, West Indies.

The phenomenon that is the primary concern of this paper is *fragmentation of the farm* not fragmentation, in the sense of minute subdivision of the land, though the latter phenomenon may be one result of the former. Following a consideration of origins and patterns of fragmentation in the Caribbean, attention will be given to the perception of fragmentation by all those influenced in any way by the phenomenon. The consequences of fragmentation will then be discussed with particular regard to the spatial aspects, especially the impact of the distance factor upon the farm inputs and outputs. Samples and models of characteristics and relationships described will be provided, to serve, both from an illustrative viewpoint and for purposes of discussion. Findings based upon the McGill Project, and presented here, are preliminary in nature.

### Fragmentation - Nature and Origins

#### *Spatial Arrangements*

Farm fragmentation may be seen spatially as numerous adjacent small parcels of land, with each one

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<sup>1</sup> F.A.O. *Consolidation and Farm Fragmentation*. Development Studies No.11. 1955.

operated by a different person. The phenomenon can also be demonstrated as several separated parcels of land operated by one farmer. The degree of separation of units could vary from a few feet to several miles; and a wide variety of tenurial arrangements (owned, rented, shared, squatted, etc.), shapes (regular and irregular) and sizes of parcels is exhibited throughout the Commonwealth Caribbean.

### *Origins*

Fragmentation has its origins in a number of factors that, in a general sense, could be classified as physical, social cultural and economic.

The physical factors that contribute to fragmentation include such natural features as escarpments, rivers, lakes, swamps, hills, extensive rock out-crops and the like, that create barriers to surface continuity, and thus necessitate the fractioning of arable surfaces. Differences in soil, degree and direction of slope and micro-climatic features also introduce constraints or hazards sufficiently great to prevent continuous cultivable surfaces.

Cultural landscape features also in the form of highways, railroads, dams, canals, etc. may also fracture the existing surface available for crop production and contribute to farm fragmentation.

The socio-economic and cultural factors in which fragmentation may have a basis are numerous, and in most cases more important and more readily recognised as contributory than are the physical factors.

Without doubt the plantation system in its many forms, and with its many ramifications has had a major influence upon the nature and degree of fragmentation. Even prior to emancipation fragmentation had its beginning on the estates in the separation of dwelling location from the land made available to slaves for the cultivation of their own provision crops. For example in St. Kitts today, many villages are wedged in between the estates and the sea and farmers must go to the inner and upper limits of the estates to reach their fields.

Another major step in the direction of excessive fragmentation was taken in the early post-emancipation era when amongst the options open to the freed 'slave' was the located labourer or the free 'peasant' in a free village. In the case of the located labourer the amount of land made available was so small that as soon as savings were sufficient he strove to obtain another parcel or two. With the free villages one encounters both the planned fragmentation of many Guyanese free villages and the location on the rugged and often poorer lands of the interiors of many islands especially Jamaica, which subsequently led to fragmentation due both to physical factors and to others that are to be discussed below.

Subsequent to the above developments in the Commonwealth Caribbean, the pattern of agrarian reform most commonly encountered is that involving the subdivision and redistribution of both abandoned estate land and newly developed land (e.g. Black Bush Polder, Guyana) and rather surprisingly fragmentation has resulted.

The settlement pattern instituted on many of these subdivided tracts of land enhances fragmentation. In many cases (e.g. Greenvale Land Settlement in Jamaica) the settlement was organised into 'village' and 'agricultural' lots. The former were essentially 'house spots' with some kitchen garden space, while the latter were intended to be devoted to any farming beyond the kitchen garden level. Such an arrangement automatically creates a nucleated settlement with its farmlands separated from the village, with its residents having their total farm acreage in two parcels. In other cases the village allocation has been as much as 2 acres or more.

In some of the territories resettlement of population - as a precautionary measure against threatening environmental hazards (e.g. Rawlins in Nevis, Basin Hole and New Sandy Bay villages in St. Vincent) - has made its contribution to fragmentation. In these instances the original agricultural holdings are kept by the villagers, who invariably establish kitchen garden plots in their new surroundings. The very least effect in these instances would be the changed distance relationships between the home (a fraction of the farm unit)

and the other cultivated unit or units.

Binding "laws" of succession (such as are seen amongst the East Indians of Guyana) and the less binding but almost as pervasive "customs" of succession (common throughout the region) have contributed in no small measure to the complexity of the fragmentation picture. This inheritance aspect functions at both the subdivision of existing holdings among heirs, and in some cases at the acquisition of holding stage in anticipation of succession. Some farmers have revealed that they have acquired additional fragments of land in order to facilitate division of their estate at death. Excessive fragmentation due to inheritance institutions must be regarded as very closely interrelated with increasing population and inadequate alternative employment opportunities.

While fragmentation is not peculiar to any particular form of land tenure, it does seem that some types of tenurial arrangements encourage the phenomenon. For example on estates in Nevis share croppers have such limiting stipulations attached to the privilege of cultivating these lands that every effort is made by the small farmers involved to secure additional land for cultivation. In St. Vincent a precarious labour situation has led small land owners to hand over the cultivation of sections of their lands on the share basis. This means that a single holding formerly operated by one farmer is now being managed by two or more persons. Possible types of tenure on the different parcels or fragments at a farm are illustrated in Fig. 1.

It is interesting to note that in some areas of St. Vincent the adverse attitude towards labour referred to above could be partly accounted for by the return of remittances to the island by emigrants. In some other parts of the state remittances from abroad have enabled some farmers to purchase additional plots of land. It means therefore that remittances have played both a direct and an indirect role in the fragmentation process in this island.

As already indicated, ownership of land does not preclude farm fragmentation, but any other form of tenure seems to encourage the practice. This is due in part to some of the contract stipulations involved which might very well restrict cultivation to certain types of crops (farmers at Albion, Jamaica on Alcan lands are not permitted to cultivate perennial crops). In an effort to obtain some measure of economic security such farmers tend to seek other land in a bid to produce for as varied a market as possible.

There are obviously many ways of interpreting the desire to own or at least have the use of additional parcels of land. It is not the purpose of this paper to investigate the motives of the farmer, in this respect. It will suffice for now to note that when a farmer adds a parcel to the land he already has use of, he may be trying to do one of the following: reduce the risks involved in the farm operation by diversifying the available environmental resources; he may primarily, or as a result of diversification, be attempting to increase the markets open to his operation; he may be trying to provide additional collateral in order to improve his credit rating; he may simply be safeguarding against old age, in that a parcel of land is in most cases readily convertible into cash.

With the exception of the cases where fragmentation was planned from the outset, most farmers with two or more parcels have come by them over a period of a decade or more. One develops a picture of periodic additions to a farm as savings become available, in part from the farm operation, from labouring off the farm or abroad or from remittances. There is every possibility, when three or more parcels are encountered, that at least one is being operated on behalf of a friend or member of the family.

### Perception of Fragmentation

The phenomenon of fragmentation has varying significance depending in part upon the role and responsibility of the individual involved. Thus far in this paper the causes and effects of fragmentation have essentially been those as seen through the eyes of the farmer, with the context of the different types of tenurial arrangements with which he must cope. Produce disposal institutions such as government marketing agencies, produce boards, sugar factories and rice mill operators perceive fragmentation in the context of the problems of handling a range of quality of any one product raised by the same farmer from

several different scattered parcels of land. The hired agricultural worker sees scattered parcels of land belonging to one farmer in terms of the time and energy spent in getting to the separate units. The employer farmer might find it necessary to provide transportation to widely separated fields or be made to suffer loss of working hours in travelling time.

The provision of infrastructural facilities such as roads and water, etc. become problems to local governments when farm fragmentation exists. Official surveys of any kind also have their difficulties multiplied by fragmentation. Officers of the Agricultural Extension Services see fragmentation as a hindrance to the efficient dissemination of information on farming techniques, and a brake on the rate of demonstration, problem solving and essential field inspection.

#### *Caribbean Distribution*

Farm fragmentation, as a phenomenon of the agricultural landscape, is perhaps more typical of the Commonwealth and francophone Caribbean than it is of the countries of the Greater Antilles. The situation in Haiti is obscure but it is likely that fragmentation is significant. The 1960 census indicates that in the Dominican Republic 442,166 farms had 1 parcel only, 4,733 had 2-3 parcels, 155 had 4-5 parcels while only 4 had 6-9 parcels. In contrast in Jamaica 94,859 had 2-3 parcels, 6,622 had 4-5 parcels and 927 had 6-9 parcels. In Jamaica approximately one-half of all farms have 2 parcels or more.

It is interesting that the greatest degree of fragmentation in Jamaica is encountered in Clarendon Parish, a parish characterised by the plantation system, and subdivided plantation land on the lowlands and free peasant settlement and government land settlement schemes in the more rugged, hillier interior.

Table I illustrates the degree and distribution of fragmentation on farms between 0 and 50 acres in a representative group of islands of the Commonwealth Caribbean. The island totals suggest that fragmentation has little significance. What is significant, is that the highest degree of fragmentation is associated with those farms which in most islands, are considered to be of a more economically viable size, that is in the 5-25 acre group.

### Consequences of Fragmentation

At this stage in the processing of data collected on small farms in the Caribbean by the McGill project, it is too early to offer any definitive statement on the consequences of fragmentation. Some tentative conclusions can however be presented on the influence of the distance factor and the degree of separation upon land use and yields. This will be done by means of reporting on field observations and by presenting some conceptual farm management models.

Figure II illustrates typical spatial distribution of parcels, absolute distances involved and the necessary time allocation. The range of spread and total absolute distances involved vary considerably. In some instances observed, all farm parcels have been within  $\frac{1}{2}$  mile of the homestead lot, while at the other extreme total distances of 30 to 40 miles have been measured for farms of 7 to 8 parcels. Quite obviously the quality of these distances will vary a great deal depending upon such factors as relief, proportion of surfaced and unsurfaced roads, tracks etc., and the type of transportation available.

One of the most readily observed and most widely understood land use features reflecting distance and spread, is the cultivation close to home of these crops that require a great deal of attention, are used most often and are most likely to fall prey to marauding livestock or praedial larceny.

Everywhere there is evidence of the influence of distance upon the type of crop or crop combination in relation to the bulk and weight of the harvestable product. This distance will not necessarily be the distance from the specific parcel to the homestead, but rather the distance to the nearest market outlet or pick-up point.

The more important relationship is surely the influence of distance upon a variety of inputs which

will in turn influence both yields and the sizes of parcels at greater distances. In a study of five Guyanese villages Richardson<sup>1</sup> showed that of 560 parcels primarily under rice, of the 23 over 10 miles from a village, 20 parcels were larger than 10 acres, of 128 over 6 miles, 70 were over 10 acres in size while of 160 parcels between 2-4 acres in size 120 were less than 4 miles from the village with 60 of them less than 1 mile from the village. The impact of distance upon rice yields in the above cases is commented upon later in the text.

### Effects of Fragmentation on Farm Management

A simplified description of the basic functional characteristics, in terms of geographic linkages, and input and output levels, at the *consolidated* compact farm (in a dispersed settlement situation) and of the *fragmented farm* (in a nucleated settlement - village situation) is presented in Figures III and IV.

Each model is behavioural, i.e. the farm operation is seen through the eyes of the farmer, conducting his farming from a fixed geographic location - his dwelling, which in Figure III lies in the center of his fields, whereas in Figure IV it is located within the village. The main features of the models are (a) input suppliers and their locations, (b) input application and cultivation, (c) produce flows: (i) output - displacement, (ii) produce collection and marketing destinations.<sup>2</sup>

The *consolidated compact farm* is usually characterised by managerial control of the cultivation and output - displacement levels. It is at the input and marketing levels where geographic diffusion of the links occur. However, the management of the marketing generally falls beyond the immediate responsibility of the farmer. On the input side the farmer of the consolidated unit must deal directly with the suppliers and negotiate delivery agreements on the basis of his own needs, and sometimes even organize the transportation of the supplies to the farm.

The operation of the fragmented farm is handicapped by the physical separation of the farm homestead from the parcels, which results in the need for a more complex "production programming". Through his homestead village location the farmer may cut costs on bulk purchases of inputs via different supplier agencies. On the other hand, whereas the consolidated farmer has his inputs delivered directly to his farm, the fragmented farm requires an additional stage, the input application, in order to have the inputs distributed to the parcels. As this stage generally involves the transportation of smaller quantities it may be logical to assume that these services can be obtained either within the village, or provided by the farm itself. Thus it can be argued that the local multiplier effects generated by the village - based fragmented farmer will be greater than those generated by his dispersed but consolidated confrere.<sup>3</sup>

On the produce flow levels one can anticipate a more centralized system for the consolidated farm, with a central marketing service being responsible for different crops.<sup>4</sup> Most likely, through the more

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<sup>1</sup> Richardson, B.C. *The Rice Culture of Coastal Guyana: A Study in Location and Livelihood*, Unpublished Ph.D. Thesis, University of Wisconsin, 1970.

<sup>2</sup> A useful review of agricultural activity as it relates to land use, markets and farmer behaviour is provided by Janet Henshall in Ch. II of *Socio-Economic Models in Geography*, (edited by R.J. Chorley and P. Haggett) 1967. The interdependence farmer/crops/marketing systems is discussed in *Functional and Geographical Relationships in Agricultural Market Mechanisms*, J. Lundgren, the Geographical Survey, Vol. 1, April 1972, No.2.

<sup>3</sup> Similar situations with regard to dimensioning of bulk shipments and the varying ability of the ultimate receiver to accommodate certain shipment volumes can be seen in numerous transport situations, in international trade commodity handling, shipments to resort hotels, linkages between manufacturing firms, etc. For the Caribbean see especially supply-demand relationships between the agriculture-tourist industry sectors in Barbados, in *A Study of Barbados Tourist Industry*, G. Doxey, 1971. For bulk shipment systems on a different geographic scale see: *The World Market for Iron Ore*, United Nations, 1968.

<sup>4</sup> F. Dovring presents in *Land and Labour in Europe 1900-1956* an account of the changes of the farm operation in a wider socio-economic context. He emphasizes the role of extra-farm institutions (marketing and purchase organizations) on the orientation of agricultural development.

specialized production on consolidated farms these central marketing services deal only with two or three crops, separating them and arranging the marketing mechanics for each one of them. This pattern contrasts with the more diffused patterns that are likely to occur for the fragmented farm. The likelihood of a wider crop range, grown at different distances from the village, and the existence of a corresponding range of produce collection points, both in terms of distances and kinds of crops handled dispersed the output-displacement flows and the market destination flows. Often the proximity of a parcel to a produce collection point may strongly influence the choice of the crop for cultivation.

Thus the models indicate that certain advantages exist for the consolidated farm on the production level, as well as in the simplified marketing arrangements, whereas the fragmented farm may be more advantageous to operate in relation to input purchases. There is no question that convenient proximity to farm lands is a production advantage. In recent discussions of both West European and Caribbean agriculture the proximity or distance-decay factor has been stressed, most recently by B.C. Richardson in a study of rice cultivation in Guyana. Labour inputs and yields per acre decline almost 50 per cent when parcels lie one mile or further away from the farmer's dwelling and central holding. The distance-decay function with regard to yield per acre is very strong. Although Guyanese rice cultivation is distinctly different from Caribbean agriculture as a whole, similar distance-decay correlations can be anticipated in small scale fragmented farming in most parts of the world.

From the above we can state that farm consolidation may be preferred if one were to choose avenues toward increased yields on agricultural lands, but it must be stressed that this cannot be achieved by overcoming the physical aspects of farm fragmentation alone. One has also to consider the marketing and the supply systems simultaneously. The end product of farm consolidation is usually greater product specialization, which results in lowered self sufficiency for the individual farmer, and increased market dependence. *Therefore it is only in carefully integrated agricultural rationalization programs for larger regional and national development plans that a consolidation policy can be justified.*

### The Sample Farm

The previous section has stressed the importance of an effective marketing system paralleling the consolidation policy for fragmented farms. The effects of a consolidation program on a farm in terms of geographic market accessibility is a matter which has mostly been discussed only on macro-geographic levels in the Caribbean. An attempt to assess the geographic marketing differentials for individual farms has been made, at least tentatively on the basis of the data compiled by McGill University Caribbean Project.

The changes that occur with respect to actual as well as potential marketing outlets in the farm consolidation for a single farm are indicated schematically in Figures V and VI for the sample farm presented below; outlining the approximate points and distance relationships under which the farm functions.

The Smith farm in central Jamaica consists of two parcels, each of the same size but located five miles apart and under different physical conditions. Some 15-20 crops are recorded for the aggregate farm and they are sold primarily to three market destinations (Table 2). Mile Gulley, Xiana and Mandeville, giving a total *actual net marketing milage* of  $(1.5 + 8.3 + 10.0)$  *19.8 miles*, which should be compared with the potential net marketing mileage (= aggregate distance to nearest specialized and general marketing pick-up points, with no double counting whether used or not) of *28.8 miles*. The farmer, by his own choice, spends 32.3 per cent *less* in marketing mileage compared with the potential mileage. If the same calculation is made for the individual parcels one finds that the South Plot has a market accessibility which, in actual net mileage, lies 30.6 per cent below the value of the North Plot. Also for the potential net mileage the Southern Plot has an advantage of 34.9 per cent lower marketing mileage. From a consolidation policy point of view, if one considers agricultural marketing distances, it is therefore important to realize that a farmer is well established with certain marketing outlets, an amalgamation can result in substantial transport increases or savings depending on which plot the farmer's dwelling is located. In this case it would require greater capital outlays for a new house, farm buildings etc. If the marketing costs constituted

one-third of the total costs of production (= procurement costs + cultivation costs + distribution costs) the consolidation to either plot would be beneficial, and the costs saving would thus amount to around 30 per cent of the marketing cost factor. However, such a high percentage for the marketing costs is unrealistic and the savings would therefore be lower. It is a fact, though, that the consolidation affects transport costs at both ends, on the procurement side as well as on the marketing side. Thus, a substantial overall transport reduction would be realistic.

### Conclusions to Above Model Analysis

The following conclusions may be drawn from the marketing mileage differences between fragmented farm holdings under one single farm management and the aggregate farm as such:-

1. Present levels of fragmentation may reflect quite different trends in agricultural structural change. Therefore it may be dangerous to generalize about the pros and cons of existing levels of geographic farm fragmentation.
2. A consolidation of a farm can shift certain costs of production from the individual farmer to outside interest groups which may strengthen or weaken the bargaining position of farmers *vis a vis* suppliers.
3. Consolidation policies always disrupt established trading and marketing links, which makes a consideration of overall marketing policy in the area necessary.
4. Although consolidation makes more efficient on-farm management possible, this can only be achieved through greater capital requirements. This indicates the need for a broad approach to the formulation of consolidation policies.
5. And in terms of marketing accessibility, consolidation policies may not be beneficial to all the farmers in the area.



TABLE 1. FRAGMENTATION IN THE CARIBBEAN (Approx. 1960)

Average number of parcels per size groups (acres)

Country	Total	0-1	1-4	5-9	10-24	25-49
Antigua	1.30	1.03	1.29	1.95	2.01	2.26
Barbados	1.22	1.10	1.63	2.23	2.43	1.10
Dominica	1.43	1.04	1.53	1.55	1.90	1.52
Grenada	1.61	1.16	1.83	2.76	2.69	2.26
St. Kitts/ Nevis/ Anguilla	1.33	1.05	1.43	1.83	2.26	1.63
St. Lucia	1.32	1.17	1.30	1.61	1.71	1.50
St. Vincent	1.25	1.06	1.33	1.54	1.92	1.44
Trinidad & Tobago	1.46	-	1.20	1.53	1.71	2.13
Jamaica	1.60	1.41			2.20	2.40

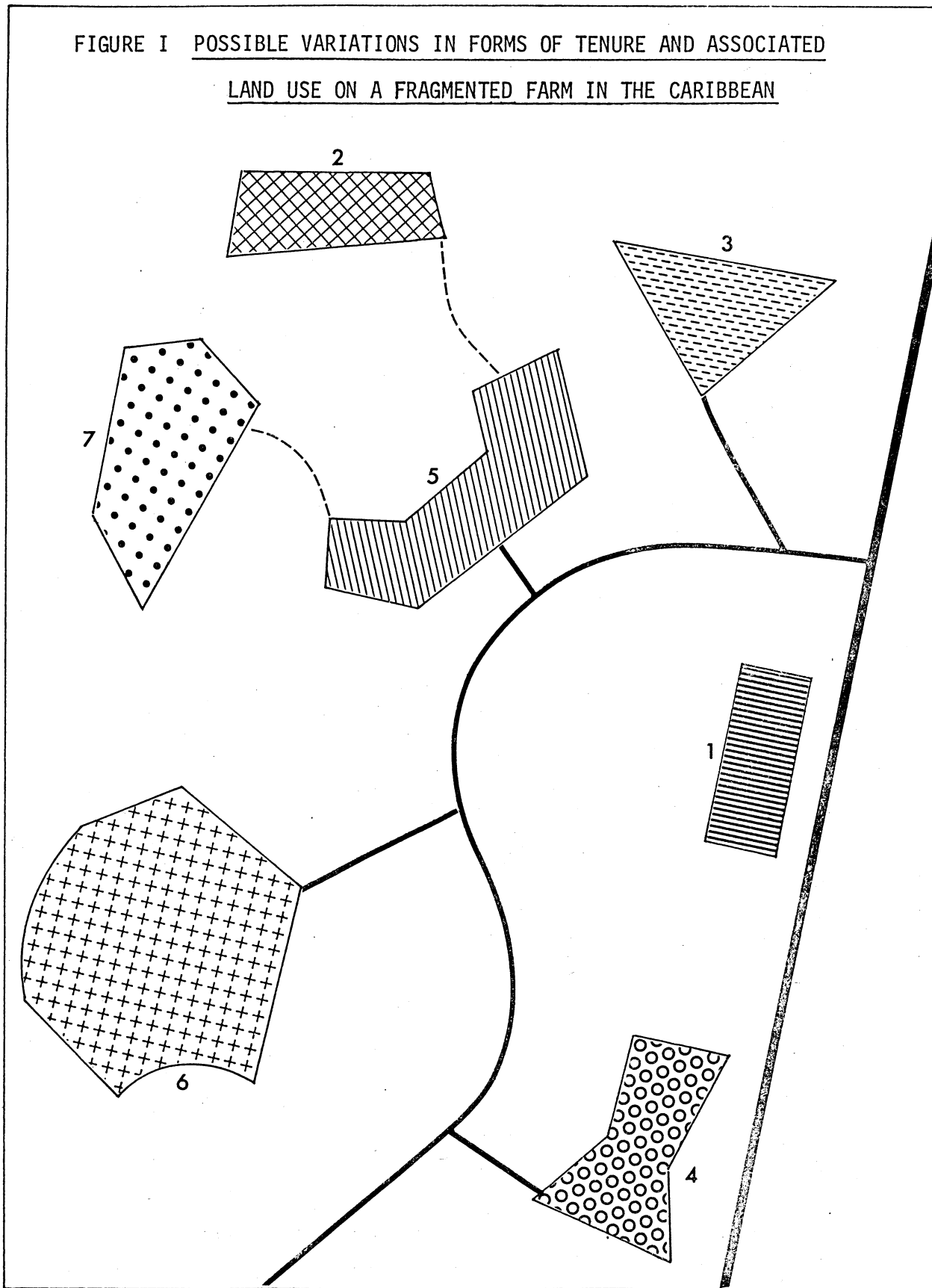
TABLE 2. MARKETING DISTANCES, SAMPLE FARM: CENTRAL JAMAICA

1		2		3		4	
Number of		Market Outlets		Net Mark.Mileage		Mileage Differentials	
plots	crops	A	B	A	B	Absolute	Relative
		actual	available	actual	potential	3A/3B	3A/3B
(1) 2	17	3	9	19.8	28.8	-9.0	-32.3%
(2) N. Plot		3	9	28.8	38.4	-9.6	-25%
(3) S. Plot		3	9	20.0	25.0	-5.0	-20%
(4) Diff. N/S Plots		0	0	-8.8	-13.4	4.6	5%

Note: (1) Read differentials *between* actual and potential marketing distances *horizontally*.

(2) Differentials caused by fragmentation should be read *vertically*.

FIGURE I POSSIBLE VARIATIONS IN FORMS OF TENURE AND ASSOCIATED  
LAND USE ON A FRAGMENTED FARM IN THE CARIBBEAN



Notes: (Figure I. Fragmentation, Tenure, Land Use)

1. *Owned* - (a) residence, (b) perennial crops, (c) crops for home consumption, (d) crops more vulnerable to praedial larceny, (e) enterprises - crops and livestock - that need more frequent care, (f) enterprises that wife and rest of family could handle.

Owned non-residential parcels may be utilised in the same way except for (c), (d), (e), and (f).

2. *Leased (unconditional)* - (a) seldom residential, (b) limited variety of perennial crops (depending on duration of lease).

Where stipulations are made (e.g. Bauxite lands in Jamaica) land use will be within these.

3. *Rented with no stipulations* - (a) seldom residential except where no parcel is owned, (b) perennial crops in exceptional cases only (e.g. Redemption Sharp farmers in St. Vincent).

Rented with land use stipulations - enterprises in accordance with these.

4. *Tenant-at-will (or "Manager")* - where a relative or friend who has migrated (generally) permits the farmer to use the land. Use to which this parcel is put depends upon the ultimate purpose for which it is intended (building, farming, etc.).

5. *Share cropped* - (a) where the land owner and sharer jointly make decisions, (b) where the land owner makes the decisions, (c) where the land sharer makes the decisions.

Land use may differ in each case.

6. *Community Property* - Such parcels are found in parts of St. Lucia and Dominica. As a general rule rights of usufruct in these cases have a negative effect, and such parcels are, at best, usually only slightly utilised.

7. *Squatted* - In many cases, such plots are not residential and enterprises short term because of the general state of uncertainty associated with this form of tenure. However, in some cases (e.g. Fancy in St. Vincent) homes have been established and agricultural enterprises may be of a more lasting nature than would be expected.

FIGURE II FARM FRAGMENTATION AND DISTANCE

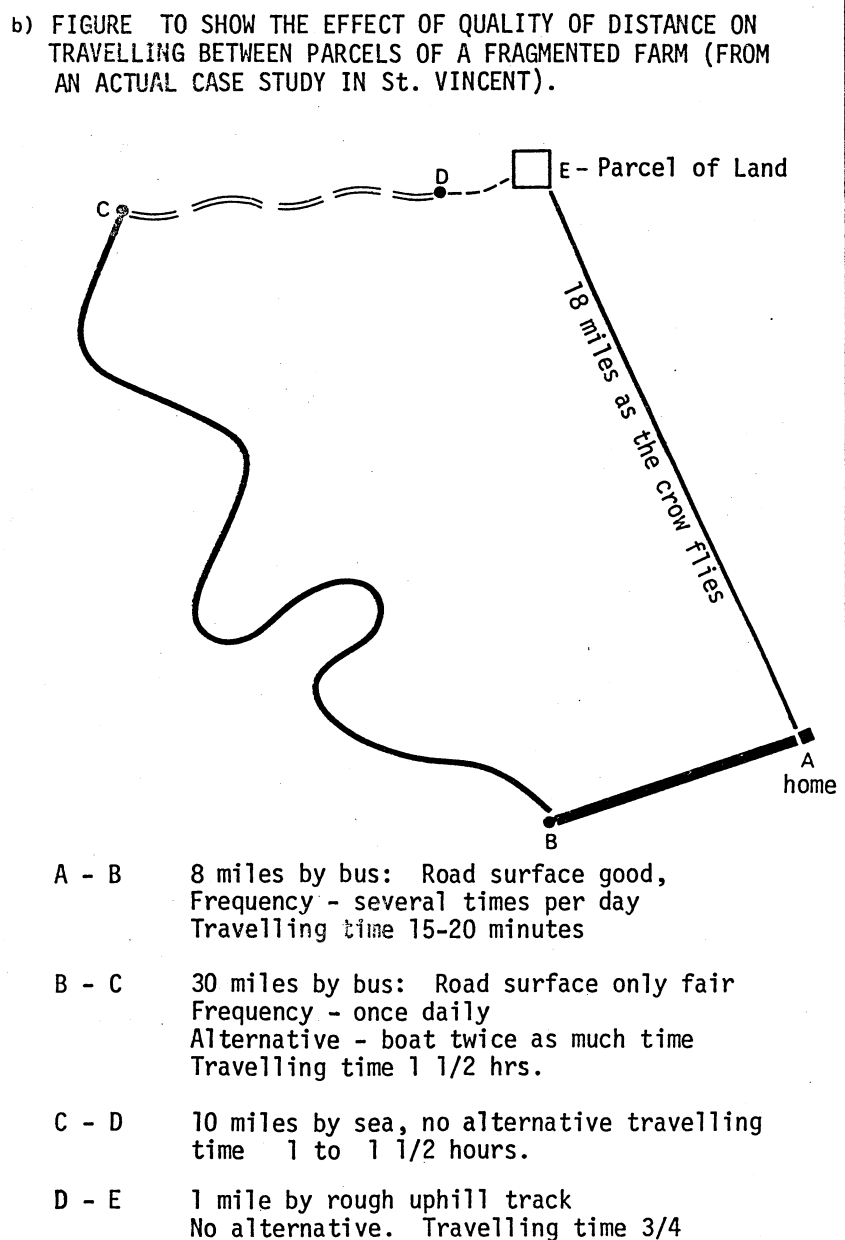
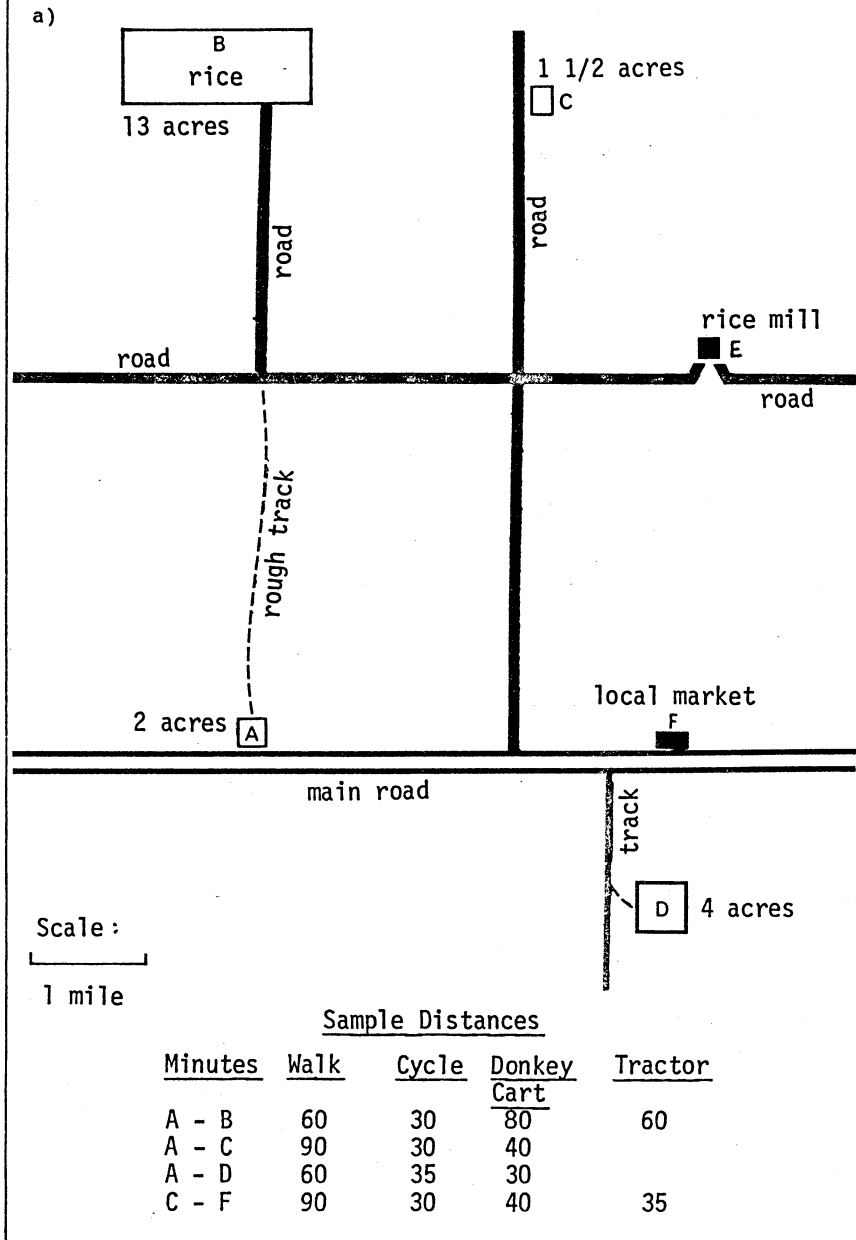


FIGURE III CONSOLIDATED FARM IN DISPERSED SETTLEMENT SITUATION

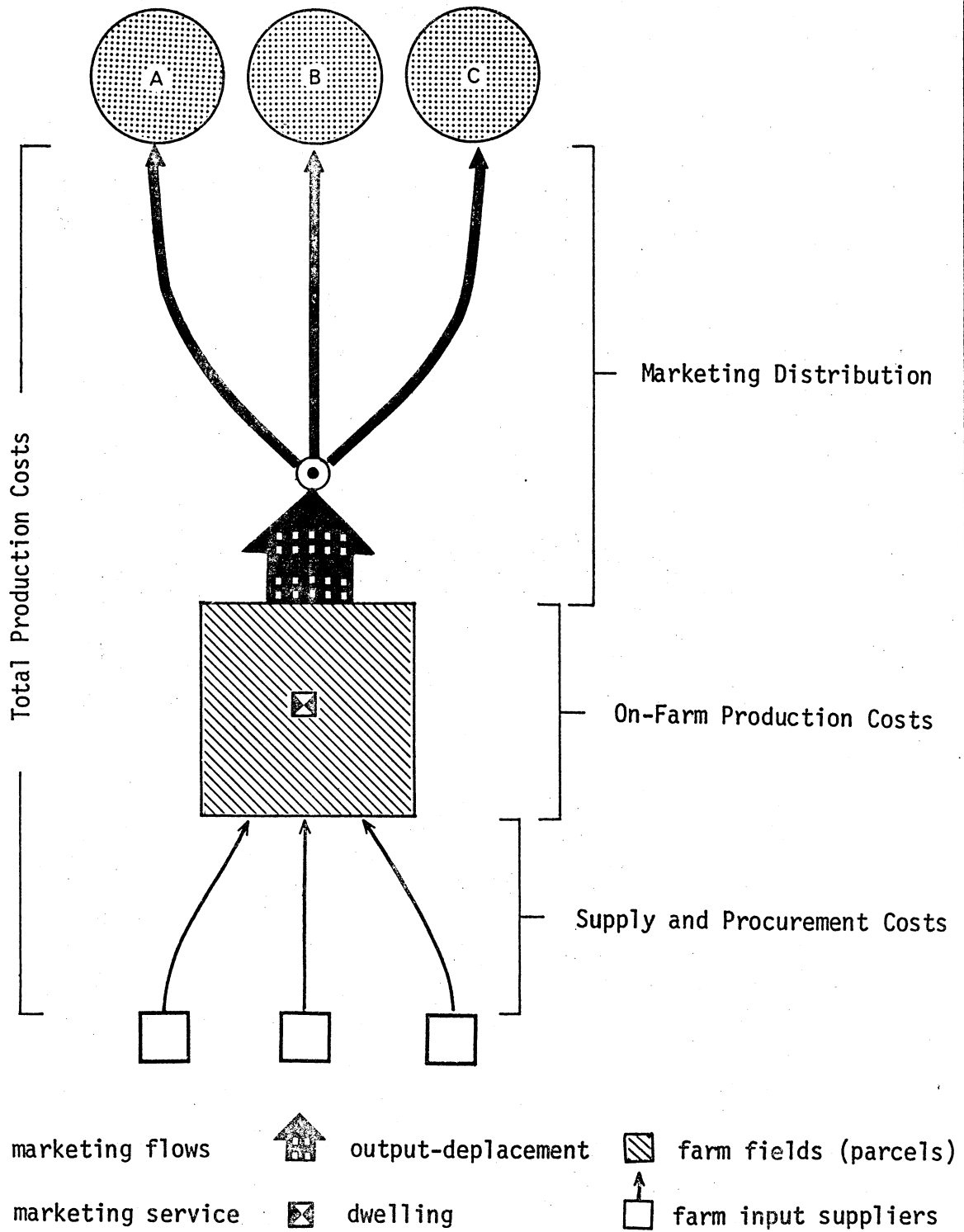


FIGURE IV FRAGMENTED FARM IN NUCLEATED SETTLEMENT – VILLAGE SITE

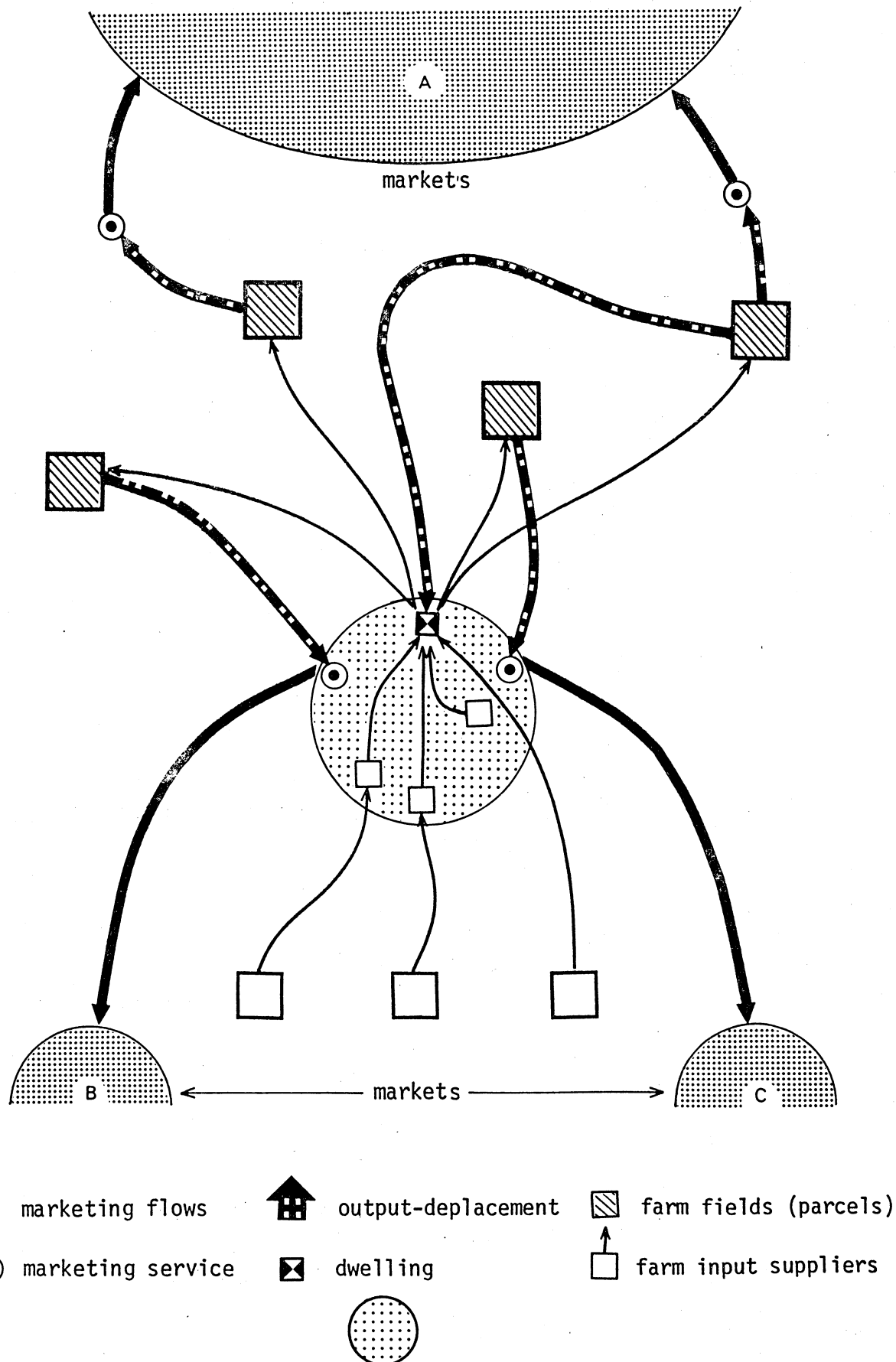


FIGURE V PRE-CONSOLIDATION MARKETING PATTERNS

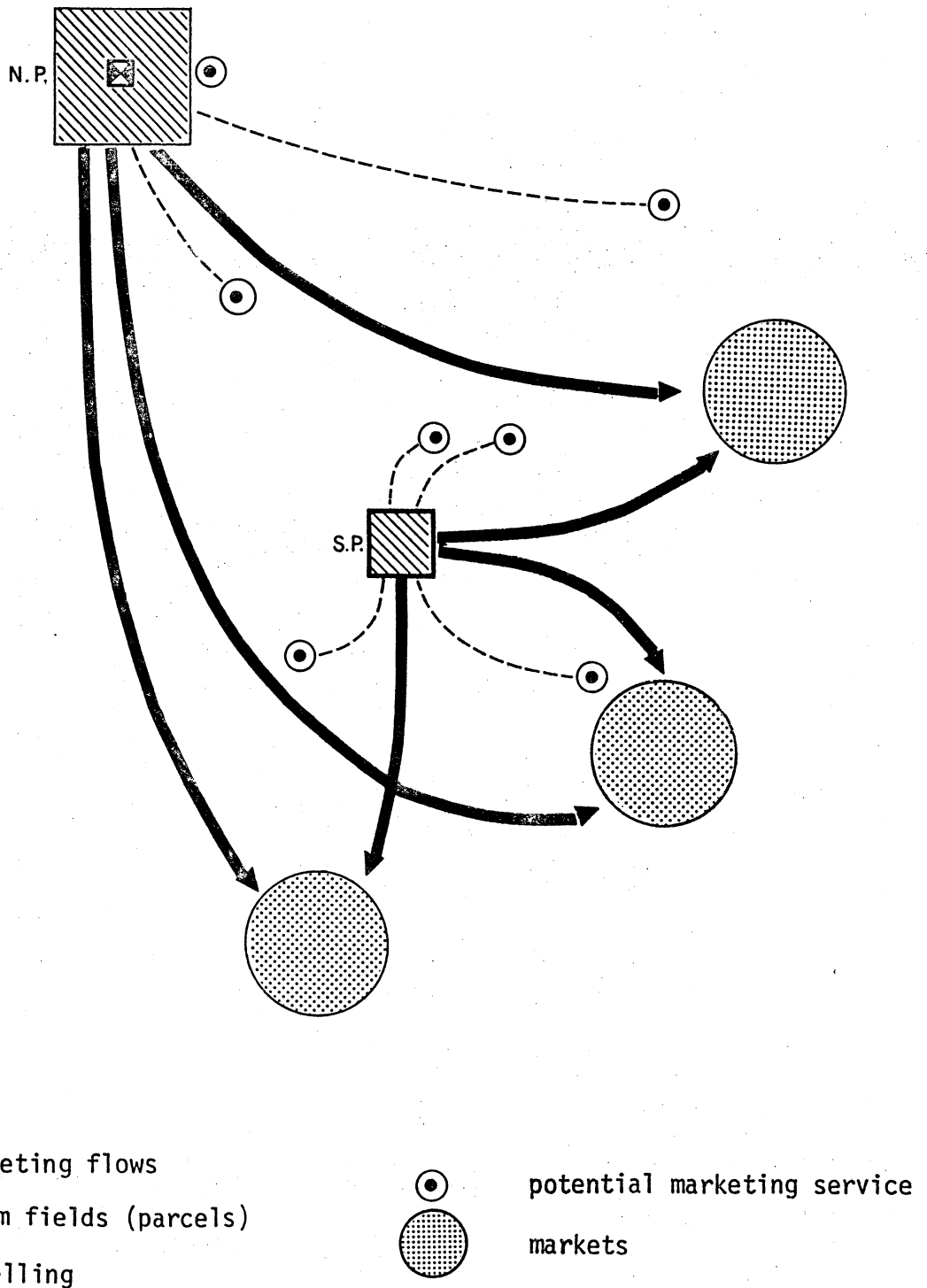
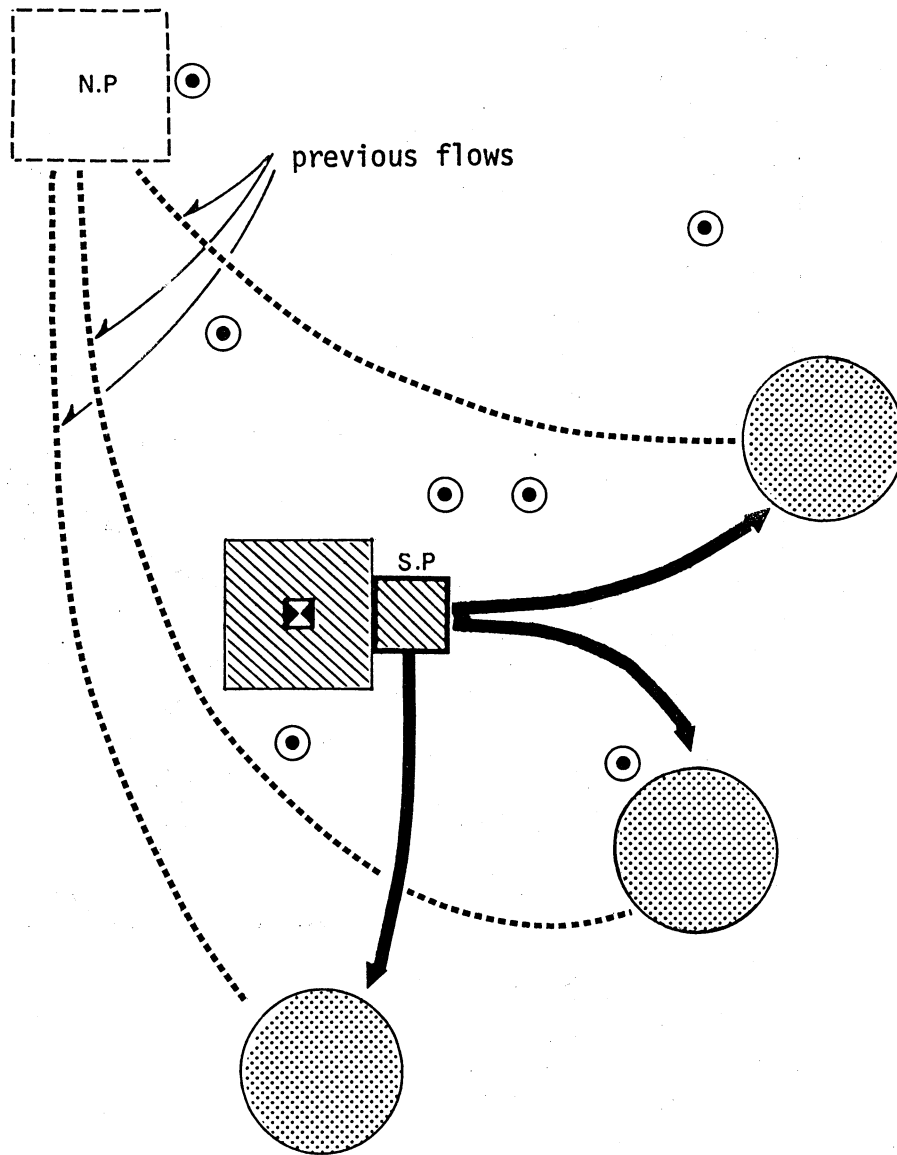


FIGURE VI MARKETING PATTERNS AFTER CONSOLIDATION TO SOUTH PLOT



marketing flows



farm fields (parcels)



dwelling



potential marketing service



markets