AGRICULTURAL AND FARM PLANNING[1] ON THE BASIS OF LAND CAPABILITY SURVEYS WITH PARTICULAR REFERENCE TO TRINIDAD AND TOBAGO

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In general, all text-books on planning procedures define planning as the comprehensive management of a nation's man-power and resources. An integral part is physical planning which provides an over-all picture concerning the best use of land, having regard to both economic and social criteria. The planning procedure involves several stages, but from the point of view of this paper, the following elements seem directly applicable : (1) the assembling and long-run assessment of all *land* resources to ensure that the plan can be put on a sound, practical basis (for example, for agricultural purposes); (2) the setting of objectives based on devising alternative plans and determining what each offers in terms of needs, land resources and disadvantages (e.g., industries and/or agriculture in Trinidad and Tobago) ; and (3) the taking of decisions and the formulation and implementation of the means by which to achieve the objectives in both the short and long run.

The degree of planning concentration of any country directed towards its various sectors and projects is dictated, very largely, internally by the economic and social situation, and externally by the economic circumstances mainly. Indeed, since World War II, the majority of the developing economies have been placing heavy emphasis on the planning of their agricultural sector. This trend has been occasioned, very definitely, by several economic, social and even political factors, notably of which are unstable export market conditions, greatly diminished external demands for their products of which only a few agricultural ones have predominated historically, declining world prices in the face of increasing internal costs of production, population pressures, and low industrial concentration with its consequential rather restricted employment opportunities.

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1 For purposes of this paper the terms "agricultural planning" and "farm planning" are not used synonymously. The former term is used for the planning of agriculture at the national level, while the latter refers to planning at the individual farm level. The reason for this differentiation will become apparent in the text.

The implication, of course, is the substitution of food imports, as much as possible, by expanding local production. This policy is regarded as desirable for these developing countries because money spent on food imports could be more effectively diverted to the importation of capital goods which are critical to their economic development and which could not be produced domestically as easily as food. Additionally, the relatively high labour-to-capital ratio with which these countries are endowed (and Trinidad and Tobago is no exception, more so as it is expected to be in the near future[2]), favour intensive labour using types of occupations, especially agriculture.

Aim of Paper

It is all well and good, and indeed imperative, to think in terms of self-sufficiency in food production as much as possible, the use of labour-using types of technologies, etc., etc., yet, what seems to be of vital importance to the country in the face of a rapidly growing population is *that* original and basic food-producing element, agricultural land, and its availability. It is common knowledge, for example, that Trinidad and Tobago cannot augment its physical land area. On the contrary, and from our agriculture's standpoint, are we not safe in saying that our good agricultural land supply curve is beginning to assume a backward-bending nature because of necessary urban, industrial, communication, and other encroachments.

This writer's main concern is the agricultural land supply problem in Trinidad and Tobago and the inclusion and analyses of *all* the necessary and available factors and techniques in the agricultural planning process. The objective of the paper is, therefore, to examine in only an exploratory manner, the role of land capability surveys in agricultural and farm planning. The sections to follow will discuss the nature of land capability surveys, and its extension, economic land classification, and their relevance to this country's farming industry at both the national and farm levels.

The Nature Of A Land Capability Survey

Land capability classification or survey is a scientific appraisal of the physical characteristics of the land, including

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2 This policy is certainly adopted by Trinidad and Tobago whose agricultural plans are focussed on a type of structural re-orientation compatible with expanded rates of growth particularly in its food crops and livestock sections. See Government of Trinidad and Tobago, **Draft Second Five-Year Plan, 1964-1968**, Government Printery, Trinidad, Trinidad and Tobago — 1965.

the inherent qualities of the soil. The technique was first developed by the U.S. Soil Conservation Service in 1939, and was designed to serve as a guide for general land-use planning, particularly management and usage of agricultural lands. It was, and still seems to be, the best known of many such interpretative groupings from the technical aspect of practical agriculture.[3]

In relation to the plant, or crops, the ability of the soil to perform its functions is dependent upon its physical characteristics which have much to do in determining moisture, air and temperature relationships. These physical resources of the soil, together with their properties, exert a controlling influence on chemical reactions and biological processes which bear on the nutrient status of the soil.[4]

The land capability survey combines the carefully analysed inherent soil features (briefly enumerated above) with such land factors as slope, degree of erosion, climate, vegetation, existing crop conditions, workability, stoniness, etc., to describe, assess, map and classify all lands of the territory. Whereas a soil survey is mainly pedological and genetical in outlook, the land capability survey is essentially *ecological* (crop ecology is the study of crops or plants in relation to their environment) and practical in scope and aim, and attempts to classify land according to its potentialities.

From the above method of assessment usually seven or eight broad *classes* are recognised (in Tobago and Jamaica, 7; U.S.A., 8) and considered adequate in determining a country's available arable acreage and in specifying land-use and management recommendations. In general, the classes range from very good agricultural land to good, moderately good, fairly good and lands which are not at all recommended for agricultural usage.[5]

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3 See **Land Classification in the United States** by the National Resources Planning Board (U.S.A.) March, 1941.

4 Apart from falling within the sphere of the soil scientist, plant physiologist and others, the scope of this paper is not to present a detailed account of the soil-plant relationship, nor to consider the multitudinous chemical and physical factors which are interrelated and react with each other to produce the extremely complex system, the soil, which provides the basic medium for plant growth and reproduction.

5 For a detailed description see (a) Brown et al, **Land Capability Survey of Trinidad and Tobago**, No. 1 Tobago Caribbean Printers Ltd., Trinidad 1965, and (b) Steele et al (1954), **A Capability grouping of the soils of Jamaica**: Trans. Vth International Congress of Soil Science. Vol. III, pp. 402-406.

These broad classes, however, are distinguished by the over-all degree of limitation in long-time use rather than by specific *soil* characteristics that affect the kind of limitation. Thus, each broad class can be further sub-divided into *sub classes* which are defined in accordance with the dominant kind of limitation of which four are normally counted significant — slope and risk of erosion, excess water within or on the soil for at least part of the year, shallow soil or some other soil features such as low moisture-holding capacity, and climate.[6]

Broad classes, and sub-classes to a lesser extent, are considered too general for many purposes. This means a still further break-down into what are known as *land capability units,* each of which is regarded as consisting of, for practical purposes, one kind of land from the viewpoint of the use and treatment the land should receive if it is to be held in maximum continuous production.

However, many predictions of responses, particularly those involving the selection and management of specific crops, must be made by referring to the exact soil type, slope phase, and degree of erosion as indicated on the *soil survey maps* themselves.

It was mentioned earlier that details of a land capability survey and classification could be found in works, references to which have been cited. However, it should be noted that Class I lands have virtually no permanent limitations or hazards to land maintenance and can be freely cultivated with little risk. Thus, this Class is not sub-classified ; the others, II-VII are. In general, the capability units suited to cultivation in any considerable degree fall into Classes I-IV. Class V is suited to forest, tree crops (cocoa, citrus, etc.) grazing or building depending on the slope ; Class VI, while some of its soils can support pasture, should be left under permanent indigenous growth or forest ; and Class VII, considered the worst soil, are totally unsuitable for agriculture due to the extremely steep nature of the lands, or to the presence of toxic qualities of a given chemical, e.g. salt.

Economic Land Use Classification

Before attempting to consider the relevance of a land capability survey to agricultural and farm planning, let us briefly,

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6 The Land Capability Survey of Trinidad and Tobago has 3 sub-classes and not 4 as in Jamaica. Climate is not regarded as an important sub-classification limitation in Trinidad and Tobago, which emphasises the fact that the system of land capability classification must be adapted to the particular country.

look into the economic aspects of the capability survey. After all, the national community, and moreso the farmer, must realise that income is *the* goal of all farming activities and by which means primarily, the farmer tries to satisfy all his wants. With a certain amount of exaggeration we might say that, were it not for costs, all crops would be possible everywhere ; but since this is impossible the applicability of a method, new or old—be it fertilisation, tillage, weed and pest control, rotation, cropping system, or soil conservation, etc.—depends on economc considerations. Incidentally, this writer feels, very strongly, that the exercise to immediately follow the completion of the land capability survey of Trinidad and Tobago should be the one to appraise the economic use of all agricultural lands as determined by the capability survey.

Economic land-use classification determines and maps the "local" variations in the capacity of land to produce income in response to productive expenditures. This type of classification actually predicts and reveals the comparative economic, productive capacity of the land during the easily forseeable future. In making the class maps, both physical (as determined by the land capability survey) and economic information (i.e. factors which influence the success of farmers in earning an income and accumulating capital on their farms — in other words, farm management studies) are used to derive a classification that measures and shows the significant and economic differences between land classes, and which, to mention only one use, could furnish a basis for advising farmers in each land class on how to make the best economic use of their own land resources.[7]

Relevant Planning Facts

The facts and information emerging from a land capability survey, and also, from an economic land classification, which are directly related and relevant to, and necessary for, agricultural and farm development in the context of a food self-sufficing economy whose population growth rate is high, are as follows:

(a) *Capability Survey* : (1) a break-down of the total land acreage that could be utilised for the various agricultural systems and the specification of where, in the territory, each capability class is located and its acreage, (2) the areas of actual and potential agricultural lands requiring a programme of soil conser-

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7 For further details on the comprehensive treatment and procedural method of this subject, see "Land Classification for Agricultural Development", FAO Development Paper No. 18, AGRICULTURE, November 1952, (pp. 22-30).

vation measures for effective production, (3) recommendations on alternative and/or combination of kinds of crops, on a non-priority basis, that could be successfully cultivated, (4) the areas and acreages of those lands which should not be farmed, and (5) areas needing irrigation and drainage works.

(b) *Economic Land Survey* : in general, this reveals (1) the type of project and method of implementation on a priority basis and guided by the needs of the economy, (2) the type of agricultural extension programme for the various farming systems and enterprises, (3) the agricultural credit needs of farmers, and (4) agricultural marketing requirements.

Agricultural Planning : Trinidad and Tobago

In welcoming delegates to the Root Crops Symposium two Sundays aback, our Minister of Agriculture remarked in part that ".....this is a critical period for West Indian agriculture...." and that ".....our scientists, technicans, and administrators should meet and exchange ideas, and plan for the future direction in the field of agricultural development." These remarks could never be considered more timely and appropriate by this conference when it learns of certain grave agricultural economic situations that Trinidad and Tobago could head towards, and which must disturb our agricultural planners. The problems are in the context of population pressures, local food supplies, and agricultural land availability, all of which are directly related to the subject matter of this paper. I refer to the projected figures of Appendix Table 1. Admittedly, the acreages projected assume the constancy of several factors, quite a few of which may appear unrealistic. Nevertheless, to my mind this table presents the basic problems of our country's agriculture if it is examined against the background of our historic methods of farming and land-use in general.

The table shows that, in 1960, when the population was 828,000, our domestic total agricultural output was produced on about 640,000 acres, all of which were considered agricultural lands whether in or out of cultivation.[8] Assuming (a) that the 1960 agricultural acreage continues to be treated and utilised in the same 1960 manner, and (b) that no more agricultural lands are forthcoming, then, on an agricultural-acreage-per-capita basis, our population for the year 2,000, which I project to be nearly 2½ million, would require an agricultural acreage about 1½ times the physical size of Trinidad and Tobago to produce the 1960 per capita output.

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8 See appendix 2, note (b)

Let us now examine the situation with food import substitution, again using 1960 as the base year. In 1960 this country imported about $27 million worth of foods that could be produced locally — items such as tomatoes, sweet potatoes, yams, pulses, pumpkins, milk, beef and veal, etc. This 27 million dollars, incidentally, was not even half the total food import bill. In terms of acreage, we would have required in 1960, over 350,000 acres to produce this proportion of the then total food import bill. This means that by the year 2,000, we would have to search for an additional one million acres of land (computed as done in the para. above and with the same assumptions).[9] The grand total agricultural area required by the year 2,000 would then be about 3 million acres or roughly two and one third times the size of Trinidad & Tobago.

Quite apart from the extremely pessimistic, and, perhaps, highly hypothetical nature of the foregoing discussion, the point to be made is that, if Trinidad and Tobago is to be self-sufficient in food production to any significant degree, she will, sooner or later, encounter the serious limitation of agricultural land-supply unless concrete action is attempted at ameliorating the problems which the above mentioned assumptions of agricultural land-use and treatment, and the non-availability of additional cultivable lands, contain. The most important factor implied in these assumptions is technology, quite obviously.

Before analysing these assumptions in the context of a land capability survey, let me remark that government has already embarked, and the indications are that it will continue to do so, on agricultural programmes designed to ease our agricultural land-supply problem. Further, as explicity stated in its Draft 1964–1968 Second Five-Year Plan, government does realise the need for a proper land classification and the importance of continued research in soil science in order to make possible the most economic usage of the land. This should imply that it hopes to make full use of the results of our land capability survey in the planning process.

Appendix Table 2 shows the manner in which our total land area was utilised in 1956 and 1957 (incidentally, this paper assumes the same situation existed in 1960). Among other things it indicates the amounts of unused, forested, and cultivated lands. What the appendix does not and cannot reveal and which is not known to date (except for Tobago whose land capability surveys was recently completed), is how many acres of our total land area

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9 Appendix 3 provides a list of the 1960 food items considered here and, also, indicates how quantities were converted to acres.

are available for, and which could be brought under agricultural cultivation of one sort or another. From the discussions of the nature of land capability surveys, this is the sort of information that will be forthcoming and which, together with other related types of information such as soil-types, erodibility, etc., could provide a sound and objective basis for planning our agriculture in the context of increasing food supplies from local sources.

By no means should I be interpreted as saying that a land capability survey, and, also, an economic land classification to re-emphasise, is an end in itself to our land-supply problem, rather, it is an extremely invaluable modern technique and means which, if carefully interpreted and applied, will point up the specific problem areas in agriculture. And who will doubt that the identification of the problems, directly or indirectly, is not the most important pre requisite to solving the problems contained in the assumptions of land-use and treatment and land availability within the framework of our stated agricultural philosophy.

Finally, and in the form of questions, I present the main problems, all of which will directly or indirectly have the effect of augmenting the food supply from our local sources.

(a) Should we not intensify our research methods and techniques with greater rapidity towards evolving higher yielding strains and varieties of crops and livestock in accordance with our needs and stated objectives ?

(b) Should we not embark upon an intensive soil conservation programme in the areas deemed agriculturally suitable but which are subject to erosion hazards ?

(c) Should we not be provided with, as much as is possible researchwise, more information on the soil requirements of the crops that could be grown locally ?

(d) How far can we go with our "food import substitution" philosophy, and in what direction ?

(e) Should we not adhere, as much as possible, to the land capability recommendations regarding land-use ? Maybe this is an important factor adversely affecting our agricultural land productivity.

(f) How much more of our *good* agricultural lands can we afford for our internal infra-structural developments (a hint perhaps to our physical planners) ?

(g) Should we continue to permit the disposal of so many hundreds of acres of beautiful agricultural lands, particularly sugar cane lands, for speculative and non-farming ventures, or should there not be some sort of legalised zoning and/or rural land taxation device to discourage this, and also the practice of holding enormous, uncultivated and under-utilised acreages, also retained for speculative purposes ? and

(h) Should we not commence thinking in terms of an economic land-use classification to determine the types of agricultural development programme in respect of agricultural extension, agricultural credit, marketing, etc. ?

Farm Planning : Trinidad and Tobago

In our type of economy, there is no guarantee that government's agricultural plans and policies, hopes and aspirations, would be followed and fulfilled because of dependence, to a significant extent, on so many "independent" farmers whose attitudes, motives and objectives might tend to conflict with government's. Of course, government can enforce control measures, if these are to the national interest, e.g., a soil conservation, or irrigation, scheme, but there is a limit as to how far these can be instituted. This was my main reason for distinguishing between "agricultural planning" and "farm planning."

In an effort to see that its peoples are adequately fed as much as possible from local sources, our government emphasises increased production per unit of land which, though a necessary condition, is not a sufficient one to ensure maximum income which is the primary objective of the farmer. Of course, this is an over-simplification of government's objective because it, too, does not ignore the private individual farmer's income motive.

In an attempt to maximise his income the farmer, consciously or unconsciously, uses (or should use) that combination of land, labour and capital resources in producing a given product on which he incurs the least expenditure and which will produce the maximum physical yield. If, however, he wants to know which one(s) of several kinds of crops to produce, and in what quantities, then, in addition to the above principle, he must know the market prices of each crop.

Without delving into further details of all the economic principles involved in the production and income maximisation process, let us now consider only one factor, land resource, from

the viewpoint of a land capability survey. The farmer must be interested in the productivity of his land ; but we know fully well that soils vary not only from region to region or from farm to farm, but also within a single farm or field. This, the farmer must be able to determine with a certain degree of accuracy if he is to assess the production capacity of his land. · Upon obtaining this knowledge, he can then apply the recommended soil improvement techniques, which will then allow him the opportunity of selecting the crop or crops to produce, or the system of farming to adopt. Of course, in so doing, he again makes use of the above economic principles in order to maximise his income. What the farmer really wants to know of his land in technical terms, is the nature of the production function, and possibilities of improving it, for each soil type.

Without repeating the nature and kind of a capability survey, we now see its applicability at the individual farm level also. The farmer would know in what class(es) his land falls, and would obtain a fair indication of what type(s) of crops he should grow. However, selection and management of specific crops should be carried out by referring to the soil survey map itself. One limitation that faces our average farmer, however, is the fact that it is not very practical to carry out a survey on each farm, mainly because of the size. In the U.S. where farms cover hundreds of acres a capability survey is carried out at the request of the farmer.

Summary

What I have endeavoured to indicate, very broadly, in this paper, is that our land supply problem. from the point of view of local food production as much as possible, would become acute if the necessary steps are not immediately instituted. Particularly, I have stressed the necessity for a land capability clasification in the planning of our agriculture at both levels, national and farm. Our plans must be both short and long term ones but flexible enough to accommodate newer and more modern techniques and tools in order to approach our agriculture along more rational lines. In this connection, not only do I firmly believe in the use of the results of a land capability survey, but also, strongly advocate the carrying out of an economic land clasification using the land capability survey as its basis.

APPENDIX TABLE 1

Year, Population ; Used, Unused and Potential Agricultural Acreage Trinidad and Tobago, 1960, 1970, 1980, 1990, 2000.

(1) Year	(2) Population	(3) Used, unused and Potential Agric. Acreage without 1960 imported quantities.		(4) Additional Agric. Land requirement — in terms of 1960 imported quantities — $12m. worth		(3) + (4)	
		Total ('000 ac.)	Per Capita (acres)	Total ('000) (ac)	Per Capita (acres)	Total ('000 ac.)	Per Capita (acres)
1960	828	641	0.77	350	0.42	991	1.20
1970	1,091	771		460		1,231	
1980	1,438	1,030		608		1,688	
1990	1,896	1,465		802		2,267	
2000	2,499	1,927		1,057		2,984	

Population growth rate — 2.8% per annum.

Sources: (a) **Draft Second Five-Year Plan, Trinidad and Tobago,**
(b) **Land Utilization, Agricultural Production, 1956,** C.S.O., Government of Trinidad and Tobago.
(c) **Annual Trade Report,** C.S.O., Trinidad and Tobago, 1960.

APPENDIX TABLE 2

Land Use, Trinidad and Tobago, 1956 and 1957

Land Use			Acres
1. Under Cultivation			
(a) Crops and Pastures			373,800
(b) Government Lands			28,560
of which : Sugar Cane	—	47,500 ac.	
Cocoa	—	48,300 ''	
Coffee	—	3,200 ''	
Citrus	—	8,200 ''	
Coconuts	—	29,500 ''	
Rubber	—	600 ''	
Total		137,100 ac	
2. Unused but reported to be potentially suitable for agriculture			20,100
3. Private forests and secondary growths			118,600
4. Government lands available for development pending agricultural potential survey			100,000
5. Government land in forest, teak, secondary suited to agriculture			442,640
6. Unused but reported unsuitable for agriculture			74,200
7. Built on and swamp areas			109,400
Total Land Area, Trinidad and Tobago			1,267,300

Sources (a) **Draft Second Five-Year Plan**, T & T., op. cit (p. 52)

(b) **Land Utilization, Agricultural Production**, 1956, C.S.C., Government of Trinidad and Tobago.
C.S.C., Gov't of T'dad & T'go.
(Land Utilization series of the 1963 agricultural Census not available).

Note : (a) Break-down into above categories done by the writer :

(b) Total of items 1 — 4 — about 641,000 ac. considered under cultivation and potentially cultivable.

and (c) Though these are 1956 and 1957 data, they are treated as data for 1960 in the text.

APPENDIX TABLE 3

Food Items Imported, Trinidad and Tobago, 1960

Imported Item	Quantity ('000 lb)	Acres
Tomatoes	680	30
"Irish" Potatoes	23,134	3,200
Root crops	5,667	400
Pulses (Peas & Beans)	13,312	1,500
Pumpkins	359	180
Cereals (Corn & Rice)	71,285	40,000
Fruits	6,207	500
Milk	138,000	300,000
Meat (Beef & Veal)	18,222	10,000
Total	—	355,810

Source : **Annual Trade Report,** C.S.O. Trinidad and Tobago, 1960.

Note : (a) Quantities were converted into acres by using average yield data from the writer's 1955 Farm Management Notes e.g., Tomatoes 20,000 lb/ac ; Irish potatoes 3 tons/ac ; Yams and Tannia 10 tons/ac ; Sweet potatoes 6 tons/ac ; pumpkins 2,000 lb/ac ; Corn and hulled rice 1,800 lb/ac ; Plantains 12,000 lb/ac ; Apples in terms of grafted mangoes 15,000 lb/ac ; Pineapple (P. Rico) 9 tons/ac ; Milk 3,500 lb/lactation ; Meat (Beef & Veal) 700 dressed/animal, Pulses (in terms of pigeon peas — shelled) 900 lb/ac.

(b) All above food items are considered locally cultivable as indeed nearly all are even though in limited quantities.

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