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SOME OBSERVATIONS ON THE Von THUNEN METHOD OF ANALYSIS: WITH REFERENCE TO SOUTHERN ETHIOPIA

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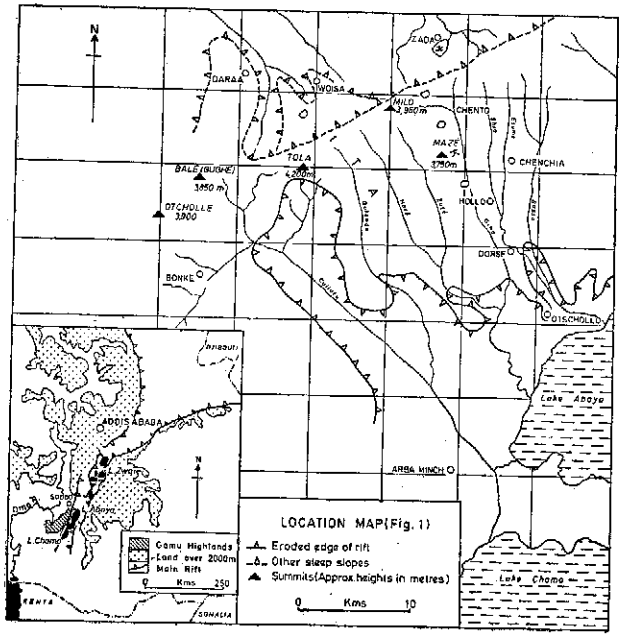
In the Doko area of the Gamu Highlands (Fig. 1) of Southern Ethiopia[1], there are two types of farmer: those who are rich enough to be involved in a cash economy and those whose poverty restricts their agricultural efforts to the production of sufficient food to keep themselves and their families alive. These two classes of farmer have different economic outlooks and they express these outlooks through their different land use management approaches. The richer in attempting to enlarge, if not maximise, profits, rationalise their land use according to certain economic constraints e.g. inputs in relation to expected outputs. The poorer are restricted both by the size of their holdings and by their lack of capital. The result, described in more detail below, of these dual sets of constraints is a pattern of land use and settlement for the whole community which masks two very different land use evaluations (Fig. 2).

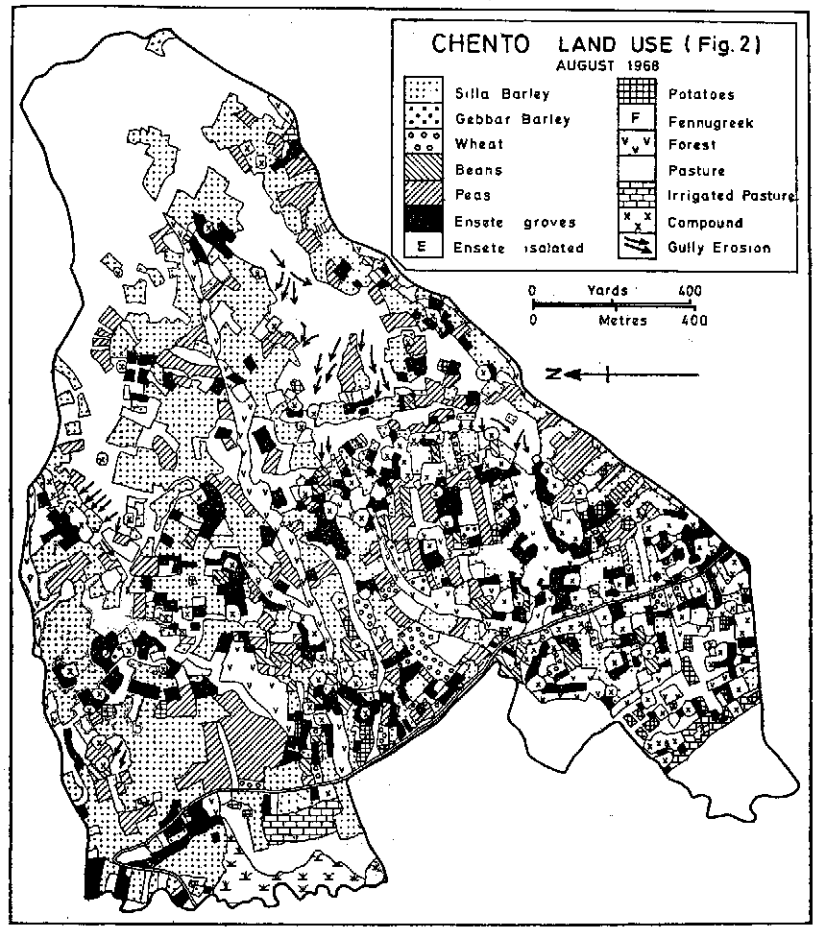
Both sets of farmers, it is important to note, work in an agricultural environment which is under considerable pressure from population. The physical environment is one of a cool and moist, basalt upland area, marked by rolling hills and valleys perched above the western edge of the south Ethiopian rift valley. The Gamu Highlands have long witnessed a continual series of immigration of peoples whose mainstay has been ensete (*ensete edulis*)[2] both as their staple food and their multiple-purpose domestic raw material. Ensete, in a small area, can produce large, if starchy, quantities of food, at a rate of approximately 4000 calories/square metre/year. It is these extremely high yields from ensete which have encouraged and sustained the high population density which exists in the region. Throughout the area within 20 miles of Chencha, population density is rarely less than 250 persons/sq. mile and in some areas is near to 1000. In the small area of Chento, a Doko village in which this detailed survey was carried out, the density approaches 600p./sq. mile.

Barley is grown in Chento as a major supplementary crop; for food, *araki* (a spirit), *talla* (a beer) and tax payments by the poorer peasant, and for food and cash by the richer. Other crops include wheat (for *borde*, a beer) potatoes, beans and peas (for oil), and a faster maturing form of ensete locally called *chero*. Cattle and sheep are grazed on upland pastures, but the pressure on these has resulted in many of the poorer people feeding their stock on hedgerow grazing or ensete leaves (the root and lower stem only is used for human consumption). Most of the livestock, especially the sheep, are owned by the richer peasant, but almost everyone, save the very poor, possesses a cow. The chief function of cattle seems to be the provision of manure. Milk yields are extremely low — less than one litre a day during lactation — and few beasts are slaughtered for meat, even by the richest, except at *Maskal* (the main Ethiopian holiday and religious festival in late September).



Sources of income outside agriculture are few. Some Doko men emigrate to Addis Ababa to take up weaving but little domestic weaving is practised within Doko. Dorse, only ten miles away, is famous for its weavers throughout Ethiopia. According to our sample survey of the Dorse village of Hollo, half the male population, outside Maskal, are absent from the village weaving. Nevertheless, here the population density at the time of the survey was over 900 per sq. mile. Some Doko men, especially landless sons, hire out their labour in gangs to the richer farmers or to the weavers of Dorse. Some Doko women act as market porters for Chencha merchants but most of these have moved permanently to the town.

It will be appreciated that there exists, despite high yielding ensete, considerable pressure on the land. To overcome such problems several steps have been taken: terracing[3] to reclaim higher slopes (thus, unfortunately, reducing the availability of pasture and hence of manure); manuring; the cultivation of bamboo and eucalyptus[4] which avoids the use of valuable manure as fuel, and, in addition provides wood ash as a manure supplement; systems of rotation which reduce manure requirements by 50%; the tethering of cattle; the stalling of cattle and the hand collection of fodder; the construction of limited areas of irrigated/drained land for grass cultivation etc. Nevertheless that the land is not producing sufficient given present agricultural techniques is made clear by the following calculation:



Manure availability

Assumptions (a) The highest, and inadequate, rate of manuring noted was 2 kg. of stable litter per sq. metre. Assume a deficient minimum of 1 kg.

(b) Doko cattle produce no more than 8 kg. of stable litter per day.

(c) Cattle density per acre of pasture in Doko is a little over 1 — not taking into account sheep (4 per acre). This is high to the point of being dangerously near overgrazing.

(d) Pasture occupies 35% of Chento, about 210 acres. Calculation : then, 210 cattle will produce 210 x 8 x 365 = 613200 kg. which will supply 613200 square metres or about 110 acres. Allow for rotation $\frac{110 \times 100}{50} = 220$ acres.

Cultivated land in Doko = 350 acres. Therefore average manure application can only be $\frac{220}{350}$ or 0.6 kg./sq. metre.

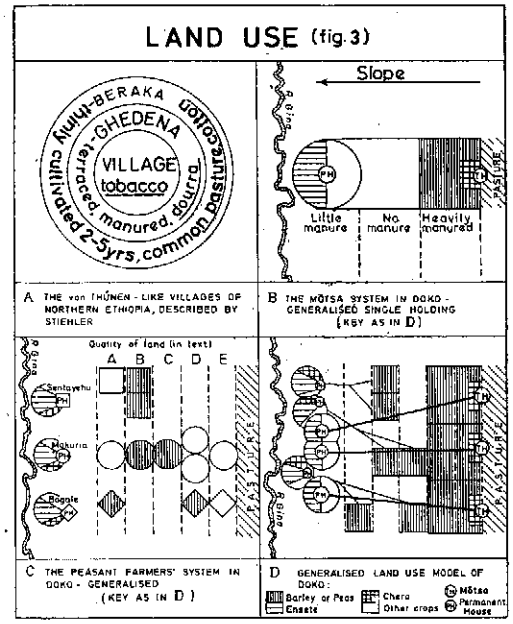
The average supply of stable litter from cattle falls short of even the deficient minimum assumed. Unless new techniques of cultivation are adopted then it is possible to foresee a situation where arable land has extended to consume all the pasture land to make up for these deficencies.

More generally, land pressure has resulted in the crystallization of rough bands of land use. Pasture, except for irrigated grazing, has been largely excluded from lower slopes and is restricted to the hills and their summits. Cereal and ensete growing is carried out on the hill slopes, and the floodplain is utilised for irrigated pasture and grazing for mules belonging to the richer peasants who may use them for riding or goods transport. Ensete is, in all its forms expect chero, clustered down-slope of the houses for ease of manuring.

It is now appropriate to discuss the reactions to this general environment of the two strata of peasants distinguished above; first *the poorer peasant*. He possesses on average three or four blocks of land totalling rather less than 1 acre. One block will be around his house where ensete will be grown and which will be fertilised by cows' urine running directly from the cattle stall to the ensete grove. Evidence from less densely populated areas of the Highlands suggests that at one time dung was similarly drained downslope direct to the ensete. With the need for the dunging of their land increasing as population pressure grew resulted in shorter and shorter fallows, the form if not the function of the association lingered on. The use of ensete leaves as a cattle folder, the impossibility of finding a place in a rotation for a plant requiring nine years growth, and the innumerable household uses of the plant may have helped retain the close spatial ties between ensete grove and dwelling.[5]

The peasant's other two or three fields will be scattered at some distance from his dwelling, partly as a result of the original tribal land distribution, partly as a result of divided inheritance. (Fig. 3C). Usually, the furthest field will be an hour or ninety minutes walk away. Of his crops, the only ones which *must* be manured are barley and chero. Wheat, beans, and peas need not be. The source of manure is the cattle stall in the compound.

The von Thünen method on analysis[6] would strongly suggest that of the two or three fields at his disposal the one, or possibly two, nearest his house would be



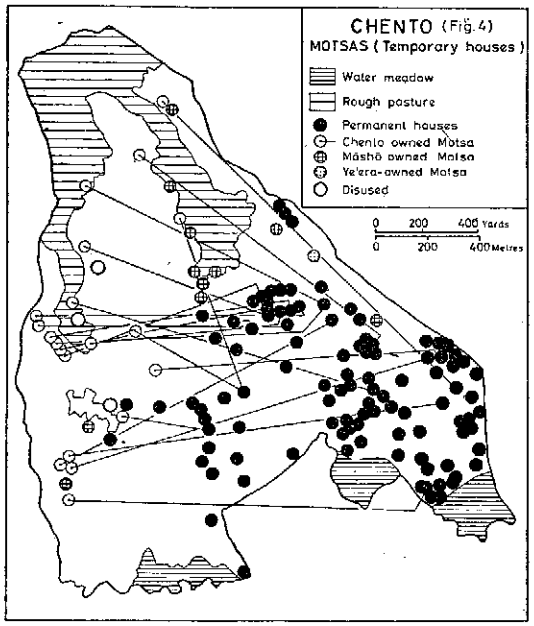
the ones on which barley/chero would be grown (see, for example, fig 3A). After all, this nearest field is half an hour's walk away. Even if it is only 1200 sq. metres in extent then a broad-shouldered wife carrying 30 kgs. a journey would have to make 32 return trips to lay, say 0.8 kg./sq. metre. In fact, the peasant will grow barley/chero on that piece of land, irrespective of distance and convenience, which in his opinion is naturally best suited to that crop. Thus it may be that his wife makes 32 trips of three hours, not one, to fulfil the same requirements, and he will similarly spend far greater time supervising his wife and handspreading the manure.

With alternative opportunities for employing his labour virtually non-existent he can 'afford' to do this. Thus with opportunity cost in the region of nil the poorer peasant does not take a von Thünen point of view. To the several and offstated assumptions of the model viz :

1. central location of the activity/market,
2. increasing transport costs outwards from this centre,
3. 'profit' maximisation,

we can add 4. opportunity cost, unspecified, but greater than nil. Assumptions 2 and 3, already shaky in a non-cash economy, are undermined by 4.

The richer peasant moves more in the realms of assumptions made by the von Thünen model. Profits are in terms of cash rather than of crude yield. Since the richer farmer pays for labour and sells much of his produce, opportunity costs are certainly greater than nil, whilst expenses are increased by the distances over which the prime input (manure) has to be transported. It is important here to note that in this case, the costs of transporting inputs are far greater than the costs of transporting output (grain) since the yields per acre of barley in Doko nowhere exceed 12 cwt./acre — about 0.15 kg./sq. metre compared with the imputed input of 0.63 kg.



In respect of these assumptions, then, the richer peasant is susceptible to von Thünen analysis. However, on the fourth assumption the Doko farmer transgresses; as land use has extended to meet the needs created by increasing population pressure so a system of dual — or triple — centred farm operations has come into play. As with his poorer neighbours, the richer farmer's land is scattered in several blocks; usually he owns from 10 to 20 blocks totalling 5 to 10 acres. Some blocks will be at a distance of several hours' return journey from the original house. Further, the development of broad zones of land use mentioned above leads to a separation of pasture and arable land. This means that the farmer's cattle (5 to 20 head) and

sheep (40 to 100 head) must be walked daily several miles up and downslope to their pastures. Lastly, the richer farmer's main concern is with cash production. He and his family are not able to provide the necessary labour requirements of his herd and land,[7] and labour must be hired. In order to save time and money, therefore, *motsas* or secondary residences are constructed at the junction of pasture and arable land (Fig. 4). A herd boy, or second wife, will be installed here, and cattle will be stalled, close by their daytime pasture, each night.

A further saving accrues on the cultivation of arable hand. The thinner soils of the upper valley sides are considered more suitable for barley cultivation. Since this is also the land abutting the pasture and the motsa, manure collected beneath the slatted floor of the cattle shed can be spread with a minimum of labour in the semicircle of land immediately downslope of the motsa. On the land nearer the original house (which will still form the permanent residence of the farmer) crops requiring little manure will be grown. One or two cattle may also be kept in the permanent house fed on hedgerow pasture and ensete leaves like those of the poorer peasant.

In general, then, the land use pattern of the richer farmer is a curious version of the classic von Thünen model: land nearest the primary house has small inputs, land downslope of the secondary house has large inputs, and land upslope of the motsa is devoted to pasture (Fig. 3B).

Conclusion.

The above empirical observations were arrived at by utilising the von Thünen *method of analysis*. In one case, the patterns of activity bore little resemblance to the classic model derived from the method. In this case, it is suggested that the assumptions of profit maximisation and increasing transport costs are inoperative in the absence of alternative employment opportunities. In the second case, most of the assumptions of the method are held to be observable; the sophistication of one assumption, brought about by the peculiar circumstances of population pressure's effect on land use, results in a variation of the usual model. It is important to stress that the observations do not 'disprove' or 'invalidate' the von Thünen method.[8] This indeed is capable of far more sophistication than the simple adjustment suggested here. It may however be held to be least useful in agricultural economies where subsistence rather than cash cropping is dominant.

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5. STIEHLER W. 1948 Studien zur Land wirtschafts — und Siedlungsgeographie Athiopiens, *Erdkunde* II

6. CHISHOLM M. 1962 *Land use and Rural settlement, London*

7. A farmer possessing 10 cattle and 7½ acres of land was amongst those sampled his cattle were producing approximately 29,000 kgs. of litter a year. Allowing for rotation, 3¾ acres of land were being manured in any one year. The average length of journey from his *primary* house to his manured land was one hour each way. Assuming he possessed no secondary house (he had two) that his wife, daughter, and daughter-in law could carry 30 kgs./journey each, then the total time spent on carrying manure would have been nearly 650 hours/person! Note also that the richer farmer tends to have more cattle proportionate to his arable area than the poorer and that thus his average rate of application of manure was about 1.9 kgs./sq. metre.

8. CHISHOLM M. 1969 Letter to the Editor, *Ann. Ass. Am. Geog.*

Acknowledgements for the article on P. 47

The basic data for this paper arose out of fieldwork completed by the second year students of the department of Geography in 1968 under the supervision of Dr. I. W. Hanna. We are very grateful for the co-operation received from Mehta Co. Ltd. both at the time of the field course and since, and I would like to thank Mr. Issac of that company for all his assistance. Makerere University College Grants Committee provided financial assistance for the use of the computer and towards the cost of publication. I would also like to thank Professor B.W. Langlands for reading the draft of this paper and I am especially indebted to Dr. K.J. Tinkler for his assistance with the computer programme. Mr. J. Sebunnya drew the maps.

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THE PRODUCTION OF SUGAR CANE BY OUTGROWERS IN EAST MENGO — UGANDA

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Introduction

The majority of sugar produced in Uganda is from private estates of which the largest are the Mehta Group estate at Lugazi in East Mengo district and the Madhvani Group at Kakira near Jinja in Busoga district. Both concerns have a large estate and a factory for refining sugar. Whilst there are other estates on a smaller scale, Lugazi and Kakira are unique in the development of a large number of outgrowers associated with the factory. Farmers around the estate have seen the advantage of sugar as a cash crop or have been encouraged to grow sugar[1], which they have transported and sold at the factory gate. Outgrowing of this nature is not confined to sugar as it is very common in the production of tea in western Uganda. In addition, the Government plans to introduce the system in northern Uganda with a project to grow 24,000 acres of sugar at Kinyala in Bunyoro district, of which 11,000 acres will be produced by outgrowers.

Despite the large numbers of outgrowers involved and the contribution they make towards the production of cash crops, very little information on the system exists. In the case of sugar outgrowing, this is for the large part due to the indiscriminate way in which the outgrowing of sugar has increased. This situation was unsatisfactory to the buyers at Lugazi and Kakira as they wanted a fairly accurate estimate of the sugar that could be expected at the factory gate, and therefore they undertook to register all outgrowers of sugar by collecting basic information when the farmer came to the factory for any purpose (usually to buy cane cuttings or to sell the harvested cane). Since the buyers gave preference to the registered outgrowers, it was in the interests of the farmer to ensure his own registration. For the Lugazi factory records consist of the name and tribe of outgrower; the number of acres under sugar (subdivided into plant, first ratoon and second ratoon[2] crops); the variety of crop; and location by village name and distance by motorable road from Lugazi. This data from Lugazi, supplemented by interviews conducted by students, forms the basis of this paper.

The outgrowing system

One of the outstanding features of the study of the Lugazi area is the contrast in scale between the estate and the outgrowers. The Mehta Group at Lugazi has an estate of 21,000 acres which, although fragmented to a certain extent, is in close proximity to the factory (Fig. 1). By contrast the factory had registered in September, 1968, 733 outgrowers who had 4,277.5 acres between them. Consequently the outgrowers are of minor concern to the Lugazi factory since they contribute a small part of the sugar processed. The system is important however since it provides a large number of people with their major form of cash income