Planning Techniques: Areal Data Collection Units and Migration in Malawi

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Introduction

The nature of the areal units for which data are collected has a particular significance for migration studies, since only by crossing a specified border is a migrant defined as such. The problems associated with the use of enumeration areas can be divided into three broad classes: (i) aggregation levels; (ii) the inappropriateness of areal boundaries, and (iii) the differences in the size and shape of areal units. Examples will be drawn from my studies of internal migration in Malawi.

Aggregation Levels

This problem is closely associated with that of size of collecting unit since lower-order units will be smaller than high-order units, but the main focus here is on the choice of order level for migration analysis. It is evident that the use of higher-order categories will generally produce smaller migration flows than lower-order categories. For instance, the migration rate for the Northern Region of Malawi in 1966 was 17.6 in-migrants per 1,000 population (from elsewhere in Malawi) and 62.2 out-migrants per 1,000 population, whereas for individual Districts within the Northern Region the rates varied from 29.7 to 172.6 in-migrants per 1,000 and from 63.7 to 162.7 out-migrants per 1,000. The volume of migration is clearly dependent to some extent upon the level of the enumeration unit chosen for analysis. The problem of aggregation is more than just a matter of volume, however. The way in which lower-order units are aggregated may have a considerable influence on the pattern of flows which subsequently emerges. Consider the situation shown in figure 1, where six enumeration areas each start with a population of 100 (figure 1a). Subsequent migration flows (figure 1b) result in a new population distribution (figure 1c). If the analysis of migration were to use units composed of two or three lower-order enumeration areas, the possible combinations of contiguous 'aggregate' units are shown in figures 1d to 1i. Each two-area unit (1d-1f) would have started with a population of 200, and each three-area unit (1g-1i) with a population of 300, and it becomes clear that the extent of change resulting from the migration flow reflects not only the level but also the organization of aggregation. If the whole block is divided into three two-area units the pattern will vary from no change (figure 1d) to minor adjustment (figure 1e) to marked change (figure 1f). If the block is divided into three-area units the values which appear are similar in each of the three examples (figures 1g, 1h and 1i) indicating a substantial adjustment in population levels as a result of migration, but the spatial pattern of gain and loss varies considerably. This is most marked in figures 1h and 1i where the difference between the aggregation patterns appears almost to reverse

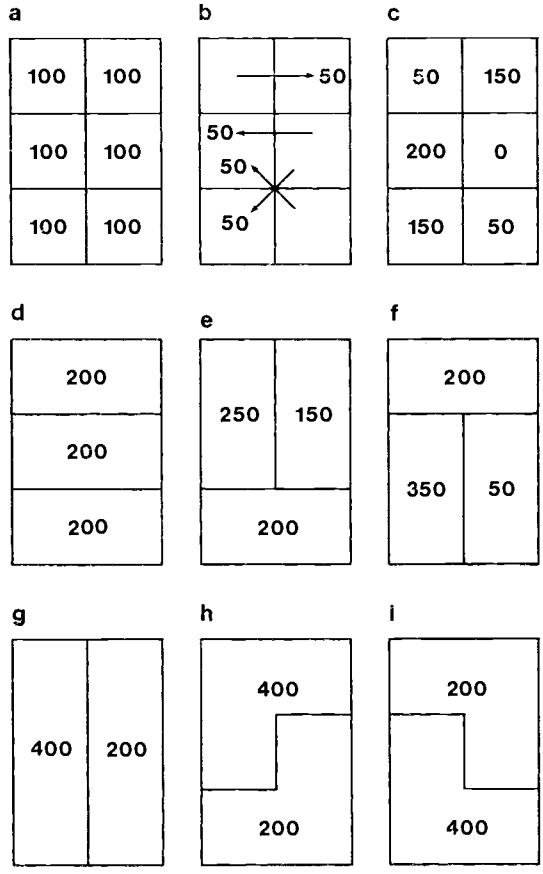

Figure 1. The Impact of Aggregation levels on a pattern of Migration flows

the migration flow. Thus the generalized pattern of movement shown which is made up of a collection of movements within smaller areal units (and, ultimately, of individual movements) will depend on the aggregation level chosen. Since the data are presented by the census in aggregate form, however, (figures 1g, 1h and 1i for instance) we may not be made aware of the smaller scale movements (figure 1b). Without this knowledge the selection of aggregation levels which, as we have seen, can radically alter the apparent migration flows, is arbitrary.

What emerges is the uniqueness which a particular aggregation level confers on migration. Both the volume and pattern of migration depend upon the level of aggregation chosen for the analysis. Furthermore "it is apparent that conclusions derived from studies made at one scale should not be expected to apply to problems whose data are expressed at other scales. Every change in scale will bring about the statement of a new problem, and there is no basis for assuming that associations existing at one scale will also exist at another".[1]

The Inappropriateness of Areal Boundaries

In relation to data collection units in Britain, Lloyd and Dicken have noted that the most commonly chosen planning regions, namely local authority areas, enumeration districts, employment exchange areas are "invariably arbitrary administrative constructs bearing little, if any, relation to the 'spatial facts of life' ".[2] In more general terms, Duncan, Cuzzort and Duncan have noted that "it is the rule rather than the exception that the set of areal units was devised for purposes other than the specific ones of the investigation. Areal units are therefore likely to differ not only in the characteristic whose variation is the focus of study but also in characteristics which may constitute 'disturbing' factors of one sort or another".[3] African international boundaries have long been notorious for the extent to which they divide ethnic groups arbitrarily, and those of Malawi are no exception.[4] The internal divisions in Malawi appear to have been no less arbitrary: the present District boundaries are an historical development of those laid down in colonial times and frequently they correspond with identifiable physical features rather than with ethnic or other socio-economic features. In a 1957 examination of 17 villages around Blantyre City[5] one of the sample villages chosen was in Chiradzulu, not the Blantyre District. In 1966 the population density of Chiradzulu District was 185 per square kilometre—by far the highest in Malawi and more than four times the national average. Estimates for about the same period suggest that there was an average of only about one hectare of clear field pattern per family in the District.[6] a figure which is less than basic subsistence requirements in Malawi,[7] and it would therefore seem that some of the economic life of the District revolved around the urban centre of

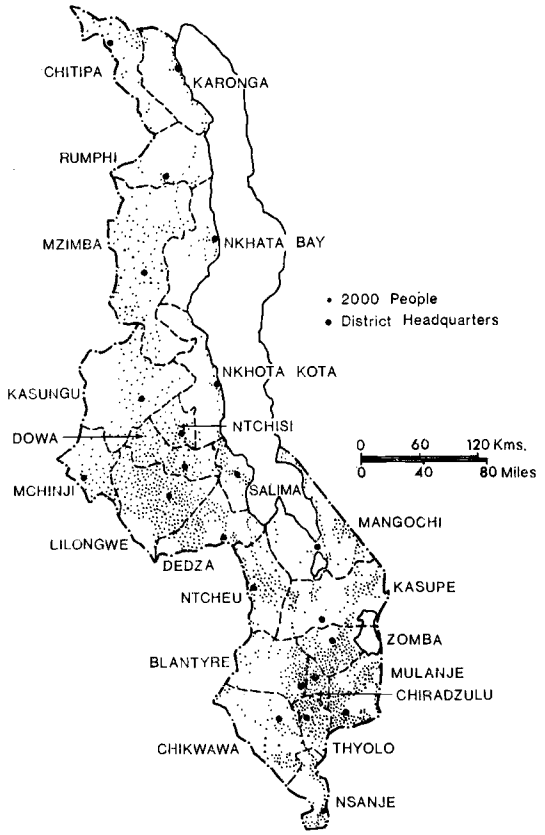

Figure 2. Malawi : Population Distribution 1966
Based on a map by G.M. Stubbs in S. Agnew and G.M. Stubbs (Eds.) Malawi in Maps, London, 1972, pp. 57.

1 H. H. McCarty *et al.*, *The Measurement of Association in Industrial Geography*, Department of Geography, University of Iowa, 1956.
2 P. E. Lloyd and P. Dicken, 'The Data Bank in Regional Studies of Industry,' *Town Planning Review*, 88, 1968.
3 O. D. Duncan, R. P. Cuzzort and B. Duncan, *Statistical Geography*, New York, 1961.
4 A. Chilivumbo, 'Social Research in Malawi: A Review of Some Methodological Problems Encountered in the Field,' *East African Journal of Rural Development*, 3, 1971.
5 D. G. Bettison, *'The Demographic Structure of Seventeen Villages in the Peri-Urban Area of Blantyre-Limbe Nyasaland,' Communication no. 11*, Rhodes-Livingstone Institute, Lusaka, 1958.
6 This estimate is derived from E. T. Wilmot and A. W. Lovatt, *Malawi Crop Potentials, 1965-1985*, Zomba, 1966.
7 P. F. M. McLoughlin, 'Land Reorganization in Malawi 1950-60,' in S. P. Schatz (ed), *South of the Sahara: Development in African Economies*, Macmillan, London, 1972.

Blantyre. Thus the inward movement to Chiradzulu District might well reflect conditions which more properly relate to Blantyre.

The appropriateness or otherwise of the Malawian District boundaries in the context of internal migration analysis is difficult to judge, but the map of population distribution in 1966 (figure 2) may provide some guidance. Other things being equal, we might expect less movement across boundaries as the population of the District is concentrated in the middle of the unit, and more as the population tends to be concentrated close to the boundaries. The Malawian population distribution, however, shows considerable diversity in this respect. Three of the lakeshore Districts show strong concentrations of their (sparse) populations along the shoreline, and their migration interactions with neighbouring inland Districts are therefore likely to be weaker than otherwise. The population of Blantyre District is clustered around Blantyre City in the eastern half of the District. Thyolo, Mulanje, Chiradzulu and Zomba Districts have somewhat less biased distributions, but there is a clear tendency in Thyolo, Mulanje and Zomba towards a greater concentration near their respective borders with Blantyre and Chiradzulu, and this area might be expected to record a high level of inter-District migratory movement.

The population of Dedza District shows a distinct distribution bias towards the Lilongwe boundary and the dense, but relatively even, pattern of population in Lilongwe, Dowa and Ntchisi Districts might be associated with a high volume of recorded movement. In contrast, the sparsely settled Districts with populations concentrated towards the centre of the unit (such as Kasungu) or concentrated near an international boundary (such as Chitipa) might be expected to record few migrants.

From the material available there is little guidance as to the impact which the boundaries might have on migration patterns and, since the migration data are given for the District level, there is little to guide us to a more appropriate set of boundaries. Moreover, a single set of areal collecting units which is meaningful for one distributional pattern may not be equally meaningful for others. This is particularly awkward when a large number of independent variables are used in an attempt to explain migration, for these will reflect, each in a different way, the impact of the boundary grid. It may, indeed, be that any areal-unit definition of migration itself is unsatisfactory and "in analysing statistics on internal migration the choice of the territorial unit is equivalent to selecting the kinds of migrants to be studied and the definition of migration to be used."[8]

Size and Shape of Areal Units

The problems associated with the various levels of aggregation and the inappropriateness of areal boundaries are exacerbated by variations in the size and shape of data collecting units. On size, Duncan, Cuzzort and Duncan have noted that "clearly, other things being equal, the rate of outmigrations will be greater for small areal units than for large areal units."[9] This is illustrated in figure 3 where it is assumed that each unit within

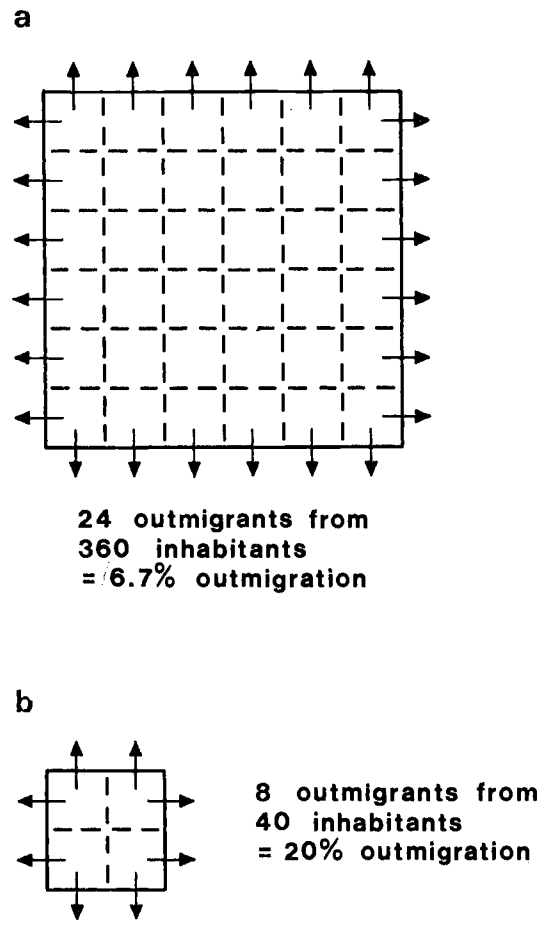

Figure 3. Size of Areal Unit and Rate of Outmigration

8 K. G. Willis, *Problems in Migration Analysis*, Saxon House, London, 1974.
9 Duncan, Cuzzort and Duncan, *op. cit.*, pp. 34.

the block contains ten people and generates four out-migrants, one in each main direction, who move only into adjoining units. For the large block (figure 3a) the rate of out-migration is 6.7 per cent whereas the smaller block (figure 3b) with a similar population density and per-unit propen-

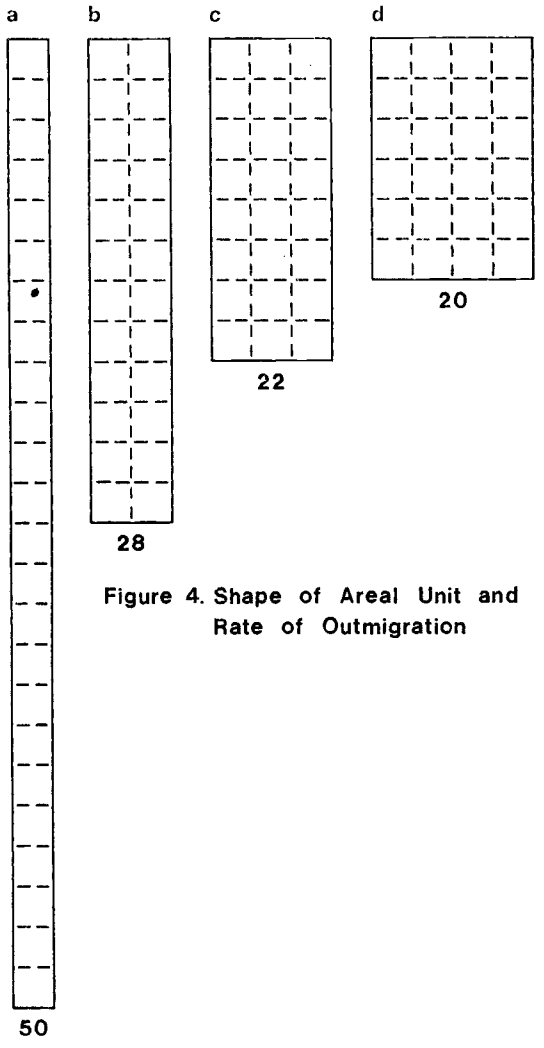

Figure 4. Shape of Areal Unit and Rate of Outmigration

sity to migrate, has a rate of 20 per cent. Duncan, Cuzzort and Duncan also note that "the problem is further complicated by the fact that for areas of the same size out-migration rates would be higher for a long and narrow areal unit than for a circular one".[10] This is illustrated in figure 4 which shows the different organizations of 24 units. Assuming once again that each unit generates four migrants, one in each main direction, who move only into adjoining units, the total numbers of out-migrants from each block varies from 50 for the long, narrow block (figure 4a) to only 20 for the more compact block (figure 4d).

Illustrated in this way, the size/shape problem is similar to that of aggregation, but our main focus here is on variations in the size and shape of a given aggregation category. In his examination of the influence of spatial structure on migration in North-East England Willis concluded that "within the same type of units or areas (local authorities, counties, regions) the shape and size of areas did not have a significant effect on composite gross in- and out-migration rates (but) when migration flows from a specific local authority area to other specific neighbouring areas were considered, the structure of space was found to be a function of the shape of the two areas, measured by the degree of compactness around respective centres of gravity, and also the size and length of boundaries of the areas". [11]

Since much migration analysis is concerned with the matrix of flows between areas, rather than with gross in- or out-migration rates, the factors of size and shape assume some importance.

Table 1

Size, Shape and Population Density of Malawian Districts 1966

District	Size (sq. km)	Shape Index	Population Density (persons per sq. km)
Chitipa ..	4,296	0·38	13·8
Karonga ..	3,358	0·43	23·1
Nkhata Bay	4,096	0·59	20·5
Rumphi ..	4,774	0·76	9·8
Mzimba ..	10,443	0·58	22·0
Kasungu ..	7,893	0·91	12·4
Nkhota Kota	4,265	0·49	14·8
Ntchisi	1,658	0·94	40·3
Dowa	3,249	0·59	56·0
Salima	1,993	0·68	43·4
Lilongwe ..	6,167	0·85	80·8
Mchinji ..	3,360	0·84	25·4
Dedza	3,628	0·68	63·6
Ntcheu	3,428	0·58	48·0
Mangochi ..	6,282	0·66	37·0
Kasupe ..	5,972	0·46	37·9
Zombe	2,583	0·74	109·3
Chiradzulu ..	767	0·89	185·4
Blantyre ..	4,190	0·91	66·6
Thyolo	1,674	0·90	146·8
Mulanje ..	3,454	0·80	115·5
Chikwawa ..	4,922	0·73	32·1
Nsanje	1,960	0·56	51·6

10 *Ibid.*
11 K. G. Willis, *op. cit.*

At the District level in Malawi there are very large variations in both size and shape (Table 1). Mzimba, the largest District, has an area of 10,443 square kilometres compared with 767 square kilometres for Chiradzulu, the smallest District. Shape is more difficult to quantify, but using a variant of the Blair-Biss index[12] developed by Whittington, Beavon and Mabin[13] (which provides for shape values ranging from 0 (noncompact) to 1 (compact), with scores of 0.83 for triangles, 0.95 for squares and 0.99 for hexagons, shape values for Malawian Districts varied from 0.38 for Chipita to 0.94 for Ntchisi.

This diversity of size and shape means that any bias in these regards introduced in the migration data is selective. The extent of this bias is difficult to judge, however, especially when for a single District the shape and size indices point in different directions. We have already seen that, other things being equal, the larger and more compact the unit the less will be the out-migration. Thus we might expect that a District such as Kasungu, which scores high on both indices, would have less out-migration than otherwise, while Nsanje, which scores low on both indices, would have more out-migration than otherwise. The picture becomes more complex for Districts such as Ntchisi, which scores high on shape but low on size, and Mzimba, which is high on size but low on shape. It is also clear that the assumption 'other things being equal' is inappropriate, since the impact of the shape of a unit will depend in part on the pattern of population distribution within the unit while the size of the unit is clearly related to the overall population density.

12 D. J. Blair and T. H. Biss, "The Measurement of Shape in Geography,' *Bulletin of Quantitative Data for Geographers*, no. 11, Department of Geography, University of Nottingham, 1967.

13 G. Whittington, K. S. O. Beavon and A. S. Mabin, 'Compactness of Shape: Review, Theory and Application,' Occasional Paper no. 7, Department of Geography and Environmental Studies, University of Witwatersrand, 1972.