NEW CONCEPTUALISATION OF SETTLEMENT FOR DEMOGRAPHY : BEYOND THE RURAL/URBAN DICHOTOMY

by
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INTRODUCTION

Space is important in demography. It has long been recognised that *where* people live and work can be a relevant factor in helping explain demographic behaviour. However, unlike many of the other independent variables we employ – socioeconomic status, class, role and status of women, economic wellbeing, labour force engagement etc. – our efforts to categorise location in censuses and surveys remains surprisingly crude. In most analyses, the urban/rural dichotomies officially adopted by particular nations are employed to differentiate types of location for demographic analysis. The measures of urban and rural employed by most nations were generally developed thirty or forty years ago and received only minor modification since. Indeed, they were strongly criticised at the time as being overly simplistic. However, this critical approach to the use of simple urban/rural dichotomies in censuses and surveys and to the criteria adopted to draw the distinction between them has faded with the years so that acceptance of them now is more non-critical at a time when development in the settlement system has undoubtedly made them less meaningful. It is the argument of this paper that firstly the type of settlement that people live in is a relevant demographic variable, secondly that settlement systems have increased in complexity since the 1960s in both less developed and more developed contexts, thirdly that existing rural/urban dichotomies classifications employed in national data collections are blunt instruments for examining the role of settlement in demographic processes and that the time has come for a rethink of how settlement should be differentiated in population data collection and analysis. It is also suggested that the contemporary technology and methodology makes it possible to analyse spatially referenced data in ways more sophisticated and rapid than could have been dreamt of in the era when settlement definition was last a major topic of scientific intervention by the IUSSP.

The IUSSP Scientific Committee on Urbanisation and Population Redistribution chaired by Professor Sidney Goldstein was established in 1971 and produced working

papers on Basic Data Needed for the Study of Urbanisation (Goldstein and Sly [eds.] 1974) and The Measurement of Urbanisation and Projection of Urban Population (Goldstein and Sly [eds.] 1975). This work, together with the efforts of the United Nations (e.g. UN 1967), basically set the framework for demographic data collection and analysis for the next three decades. The present paper begins by arguing that the urbanness/ruralness of a point or area on the earth's surface is only one of the spatial dimensions of human settlement which is of interest in the analysis and explanation of demographic processes. Following Coombes and Raybould (2001), it is suggested that there are at least two other aspects of human settlement systems which need to be considered by demographers. In addition to the urban/rural variable, it is at least necessary to consider population density and degree of accessibility/remoteness of locations since they both can exert an influence on demographic variables. The paper then examines each of these three dimensions of human settlement in turn and assesses how they can be better incorporated into demographic analysis. Particular attention is placed on the urban/rural differentiation. It is argued that the blurring of distinctions between urban and rural and the differentiation within urban and within rural calls for a more complex breakdown of urbanness/ruralness in locations. Some suggestions are briefly made about the possibilities of developing standard measures of population density and physical accessibility/remoteness for demographic analysis. Finally, it is argued that contemporary developments in the geocoding of census and survey data and in the technology and methodology of geographical information systems give us the toolbox to operationalise more sophisticated conceptualisations and measurement of human settlement systems. A decade ago such possibilities did not exist and it is important that demography and population studies are at the forefront of using these developments to arrive at classifications of location which are more likely to assist us in unravelling the causes of population change than simple urban/rural classifications. The present paper is not able to or meant to provide definitive solutions to the questions which it poses but it aims to contribute to, and hopefully ignite, debate among

demographers, statisticians, census takers and geographers about our standard geographical classification systems in population study.

FUNDAMENTAL DIMENSIONS OF SETTLEMENT SYSTEMS

The simple urban/rural dichotomy has long been recognised as an over simplification of the complexity of human settlement systems and the fact that these systems are constantly undergoing change. Indeed it was argued that the rural/urban dichotomy needed to be replaced with a rural/urban continuum as long ago as 1966 (Pahl 1966). Nevertheless, urban/rural distinctions have become a fundamental part of census systems across the world, with virtually all countries distinguishing between areas designated as urban and rural and the populations residing within them being classified as urban or rural. In most countries urban areas are identified using specific criteria and rules while rural areas are the residual 'non-urban' areas. Urban area definitions vary greatly between countries but usually involve the adoption of one or several of the following criteria:

- a population size threshold,
- population density,
- contiguity of built-up areas,
- political status,
- proportion of the population in non-agricultural occupations,
- presence of particular services or activities.

to designate building block areas such as census tracts or census collection districts as urban or rural. These building block areas are clustered together (usually on the basis of adjacency or being located within a minimum distance) to form urban places. Most nations adopt a minimum population size for a place to be designated as urban. The fundamental distinction between urban and rural places is in terms of population density, continuous built up areas and the economic and political functions carried out in those areas.

Living in designated urban or rural areas has been used widely to differentiate between populations since it has been assumed that there are important differences between urban and rural populations as is shown in Table 1.

Table 1: Some Widely Accepted Traditional Stereotypical Differences Drawn Between Urban and Rural Populations
Source: Hugo 1987

Dimension	Urban	Rural
1. Economy	Dominated by secondary and tertiary activities	Predominantly primary industry and activities supporting it
2. Occupational Structure	Manufacturing, construction, administration and service activities	Agriculture and other primary industry occupations
3. Education Levels and Provision	Higher than national averages	Lower than national averages
4. Accessibility to Services	High	Low
5. Accessibility to Information	High	Low
6. Demography	Low fertility and mortality	High fertility and mortality
7. Politics	Greater representation of liberal and radical elements	Conservative, resistance to change
8. Ethnicity	Varied	More homogeneous
9. Migration Levels	High and generally net in-migration	Low and generally net out-migration

However, it is clear that over time there has been a blurring of these differences between urban and rural populations. In 1966, Pahl pointed out that many of the changes occurring in rural Britain were urban in nature. Clearly, as transport and information technology have developed more freely mainly urban functions are locating in urban areas and more importantly, many people divide their lives between areas designated urban and rural. The extent of commuting, for example, between urban and rural areas has increased dramatically (Hugo *et al*. 1997). Hence the meaningfulness of the rural/urban distinction between populations has declined in the last four decades and the rural/urban differences in the variables listed in Table 1 have declined. Hence there has been greater blurring of urban and rural populations than

between urban and rural places. There has been a continuation of a distinctive difference between continuous built-up urban areas and more lightly settled rural areas.

It is sometimes suggested that this is a phenomenon of more developed countries but it is clear that this increased fuzziness of distinction between urban and rural is also true of less developed countries (Hugo 1982). While there is an accelerated blurring between urban and rural *populations* there is a fairly clear distinction between urban and rural *areas*, although it is possible to argue that there are zones of transition around large urban centres where urban and rural functions are mixed.

It is important to point out, however, that the urban/rural distinction is not the only significant way in which people's settlement patterns can be differentiated, although in most analyses it is the only one used. Coombes and Raybould (2001, 224) have argued, however, that:

> In an increasingly complex pattern of settlement, linked with socio-economic polarisation, no single measure can represent all of the distinct aspects of settlement structure, which will be of interest to public policy.

They go on to suggest that there are at least three key dimensions to modern human settlement patterns which are quite distinct from each other and which are all important for policy makers to take into account when they are allocating resources or designing programs. These are:

- settlement size – ranging from metropolitan centres to hamlets,
- concentration or population density – ranging from dense to sparse,
- accessibility or degree of remoteness – ranging from central to remote.

The important point here is that there is a clear conceptual difference in these dimensions. Individual areas can be, for example, urban and remote at the same time. It is the strong argument of this paper that the conceptual difference between urban/rural on the one hand and accessibility/remoteness on the other needs to be maintained. Classifications can, of course, be derived which designate places

according to how they rate on two or all three of the variables as well as those based on only a single dimension of settlement.

THE SETTLEMENT SIZE DIMENSION

All nations differentiate demographic data on the basis of the urban or rural *residence* of the population and have done so for a long time (Shryock and Siegel *et al.* 1971, 151). However, unlike in most other areas of population it has also long been accepted that no uniform definition of urban or rural is possible. As the United Nations (1967) point out in their *Principles and Recommendations for Censuses*:

> Because of national differences in the characteristics which distinguish urban from rural areas, the distinction between urban and rural population is not yet amenable to a single definition which would be applicable to all countries. For this reason each country should decide for itself which areas are urban and which are rural.

There is little point in searching for a common definition of urban since what is perceived as an urban area does vary between nations so that the effort should be on individual nations arriving at definitions of urban which are most appropriate to them. The vastly different situations can be illustrated by contemporary Australia and Indonesia. Australia's definition of urban (ABS 1999) adopts a different methodology for delimiting urban centres with 20,000 inhabitants or more and urban centres with between 1,000 and 19,999 inhabitants. A lower limit of 1,000 residents is set for urban centres.

- To delimit places with 20,000 or more residents each census collection district (CCD) in Australia after each census are designated either urban or rural with the former having a population density of 200 or more persons per square km. There are a number of rules which mean that some CCDs with lower population density are designated urban on the basis of contiguity with urban CCDs and/or

landuse. These are the basic building blocks and adjoining[1] urban CCDs are aggregated to form urban centres.

- Each urban centre with between 1,000 and 19,999 is defined subjectively using aerial photographs and field inspection to delineate the built up urban area.

However, by applying the Australian density criterion of 200 or more persons per square km to the island of Java in Indonesia which had 122.6 million residents in 2000, the entire island would be classified urban since the island had an average population density of 929 persons per square mile. In fact, around two thirds of the island's population is classified as rural under Indonesia's urban definition.[2] In Indonesia a locality *(desa)* is categoried as urban if:

(a) It had a population density of more than 5,000 persons per km^2.

(b) The proportion of households engaged in agricultural production was less than 25 percent.

(c) At least 8 out of 15 designated 'urban' facilities had to be available in the *desa*. These include Primary School, Junior and Senior High School, Cinema, Hospital, Maternity Hospital, Clinic, Road negotiable by motorised four wheel drive vehicle, Post Office or Telephone, Shopping Centre, Bank, Factory, Restaurant, Public Electricity and Party Equipment Renting Service. Each *desa* was given a score as shown in Table 2 according to where it ranked among the three criteria.

Desa scoring 23 or above were classified as urban and those with 17 or less were rural. Those with scores between 18 and 22 were field checked to see if they should be classified as urban or rural. If they were close to an area classified as urban, or in the opinion of the checker had distinctly urban characteristics or had strong prospects of being enveloped by a nearby urban area they were classified as urban.

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1 And under certain conditions nearby.

2 One of the authors has worked in *desa* in Java with more than 10,000 people which can only be considered rural due to their lack of urban services and their residents working in agricultural occupations (Hugo 1978).

Table 2: Scores to be Given to *Desa* According to Three Criteria to Determine Whether They Should be Classified as Urban

Source: Biro Pusat Statistik 1979, 5

Score Given	Criteria		
	Population Density per km^2	Percentage of Households Engaged in Agricultural Production	Total Urban Facilities
1	Less than 500	more than 95 percent	0
2	500 - 999	91 - 95	0
3	1,000 – 1,499	86 - 90	1
4	1,500 – 1,999	76 - 85	2
5	2,000 – 2,499	66 - 75	3
6	2,500 – 2,999	56 - 65	4
7	3,000 – 3,499	46 - 55	5
8	3,500 – 3,999	36 - 45	6
9	4,000 – 4,999	26 - 35	6
10	5,000 or more	25 percent or less	8 or more

The point here is that criteria adopted for defining urban areas in one context are not necessarily going to be adequate in another context and this needs to be accepted. One important issue, however, relates to the spatial units used in deciding whether an area or group of people are urban or rural. As the United Nations has pointed out, it is best if they are as small as possible. With the availability of geographical information systems the use of small basic units is made more feasible than was previously the case.

One issue relates to the fact that most urban/rural classifications refer to areas yet as demographers we are interested in populations. Conventionally we have classified people as urban or rural according to whether their place of residence is an area designated as urban or rural on criteria such as those given above. However, with increasing levels of population mobility, although people's place of residence may be urban or rural, they can be spending significant parts of their lives in other areas as a result of commuting or circular migration of various kinds (Hugo 1982). The question

then becomes as to whether only place of residence should be used in classifying *populations* as urban or rural.

In most countries the fundamental definition of urban (and rural as a residual) dates back to the 1960s. The world has changed massively since then and in the present context it is the huge changes in personal mobility and in transport and communication which are relevant since they have operated to break down these differences between urban and rural populations listed in Table 1. The fact that there has been a convergence between urban and rural populations in their characteristics and attitudes raises the question as to whether a distinction should be drawn between urban and rural at all. As far back as 1979, Uzell called for a discontinuation of the use of the concepts of urban and rural in MDCs since, he contends, they do not distinguish cultural and social differences in society. However, the weight of opinion is that there is still a meaningful distinction to be made in MDCs between urban and rural populations and areas. Despite the emergence of a dominant urban society and modernisation of rural areas there are still enough important distinctions between urban and rural areas and populations to maintain their separate classification (Willits, Bealer and Crider 1982; Lang 1986). Most would agree, however, that the rural/urban dichotomy has little applicability and that (Lang 1986, 120) rural and urban:

> ..... denote opposite ends of the conceptual continuum with real people and communities falling somewhere between the two hypothetical extremes. Any specific instance in the real world, therefore, can be viewed as demonstrating relative degrees of rurality and its opposite, urbanity, falling somewhere along the continuum between the two extremes.

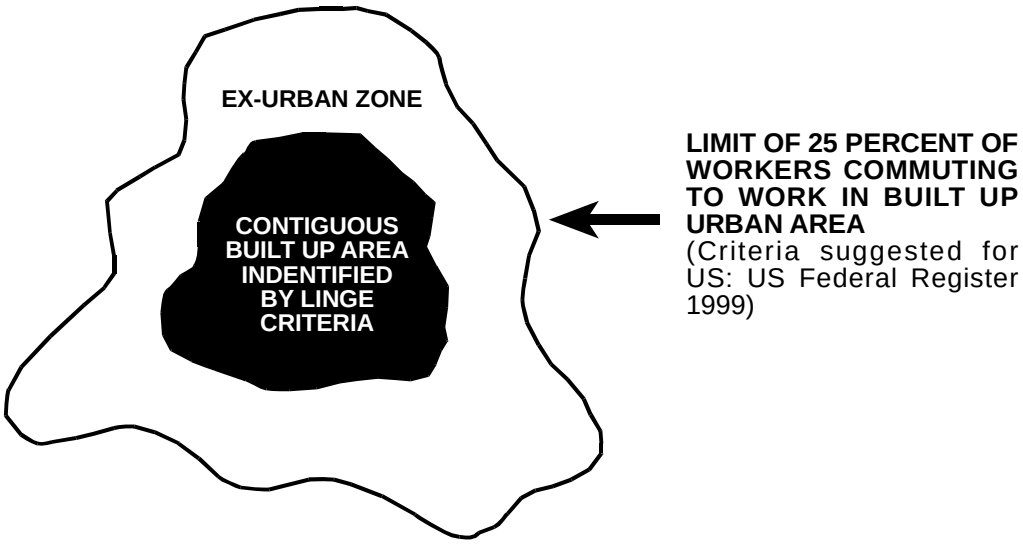
The argument here then is that, while there has been convergence between the characteristics and attitudes of urban and rural populations and that it is difficult to sustain a rural/urban dichotomy argument, there are still enough significant distinctions to maintain a separate rural and urban classification. However, there is a need to

recognise the changed situation with new ways of classifying urban and rural areas which take full account of the new complexities of the present reality. One way of approaching this is to explicitly recognise that there is a continuum between definitively urban and definitively rural communities and rather than seek to produce a dichotomous classification across nations develop a number of types of settlement categories reflecting different degrees or types of 'rurality' and 'urbanity'. One such category which is of particular significance is the ex-urban fringe areas around major cities. There has long been a recognition of a distinctive zone around large cities, especially in MDCs (although it increasingly applies also to those in LDCs), which is distinctly rural or non-metropolitan in appearance but contains many functions which are strongly associated with the nearby metropolis and whose residents maintain strong regular (often daily) contacts with the metropolitan area (Spectorsky 1958, Friedmann and Miller 1965, Pahl 1965). This zone is distinctive in function and population composition but also is seen as being transitional between metropolitan and non-metropolitan areas by some and by others is best considered to be part of the metropolitan region focused on the major city because of the strong functional linkages maintained with the city proper. This region has been referred to as Ex-Urban (Davis 1990, McKenzie 1996), Peri-Metropolitan (Burnley and Murphy 1995), Technoburbs (Fishman 1990) and Exurbia (Nelson and Dueker 1990). Burnley and Murphy (1995, p. 245) have described these areas as comprising urban centres set in a matrix of rural land where the traditional agricultural and associated service functions have been invaded by uses associated with the nearby metropolitan area including the development of low density residential areas for commuters to metropolitan areas and retirees. In the United States this has been recognised as a new settlement form housing some 60 million people or a quarter of the total population (Nelson and Dueker 1990). In the US the term rural-residential has been used to describe new developments of housing of various densities of people predominantly commuting to the metropolitan area (but not necessarily the CBD or inner city) with some having

hobby farms and others residential allotments only. Hence it is a distinctive landscape with particular landuse and planning issues and problems often arising from clashes of urban and rural functions and values.

This has given rise to the concept of 'Functional Metropolitan Regions' which include not only the built-up metropolitan area but also the ex-urban area around it which is functionally strongly linked to the urban centre. The schematic representation of the proposed system is depicted in Figure 1.

Figure 1: Schematic Representation of Suggested Functional Metropolitan Region



The question arises as to how the outer boundary of the ex-urban area should be defined. In effect this boils down to a problem of establishing the spatial extent of the housing and labour markets of the urban and metropolitan centres. The overwhelming choice of data to operationally define the outer boundary of the ex-urban zone is the journey-to-work (JTW) information collected in the national census. In the United Kingdom there have been attempts to use financial-banking data to define the city regions based on metropolitan areas (Coombes, 2000), while in the United States

context Berry (1995) has suggested the use of media hinterlands, especially the areas served by television stations based in the urban centres. However, the weight of experience and opinion is that journey-to-work data present the most reliable, valid and operational option for establishing the outer limits of the ex-urban zone. It undoubtedly reflects the extent to which sub areas outside the built-up metropolitan area are linked to the major urban areas. In the United States, for example, the JTW data were used successfully to delineate commuting zones and labour market areas for the 1980 Census (Tolbert and Killian 1987; Killian and Tolbert 1993) and the 1990 Census (Tolbert and Sizer 1996).

In the United States there is a longer history of delineating Metropolitan Regions to encompass nearby, linked, non-metropolitan areas. In 1983 the US Bureau of Census introduced the concept of an MSA (Metropolitan Statistical Area) which consisted of a county or counties which contained:

(a) a city of 50,000 or more population (using legal boundaries to define the city); or

(b) an urbanised area (UA) of 50,000 or more population and the total metro population should exceed 100,000.

It set up a set of specific thresholds of commuting, population density, percentage urban and similar quantifiable measures to determine whether or not outlying counties qualified as parts of metropolitan statistical areas. The official (US Bureau of Census 1984, 7) explanation of their rationale was as follows:

> The general concept underlying these definitions is that of a geographic area consisting of a large population nucleus together with adjacent communities having a high degree of economic and social integration with that nucleus. In effect, the definitions specify a boundary around each large city that includes most or all suburbs in addition to the city itself. Most definitions also include smaller satellite communities and some open country, since entire counties generally form the MSA

building blocks. Some areas are defined around two, three or more central cities.

The MSA concept represented an attempt to recognise that the areas adjoining cities include large numbers of residents who have much in common with residents of the central city although they do not live in a central city landscape. Under the US scheme it is possible to use a conventional urban/rural breakdown of population characteristics. However, it is also possible to use an MSA/non MSA classification and an MSA Urban, MSA Rural, non-MSA urban and non-MSA rural classification.

During the 1980s and 1990s there was increasing dissatisfaction with the metropolitan and non-metropolitan definitions used in the United States (Lang 1986; Dahmann and Fitzsimmons 1995). It was argued that the pattern of settlement and human behaviour has changed such that the older established urban/rural, metropolitan/non-metropolitan and centre/suburb distinctions have been rendered obsolete. Accordingly the US Bureau of Census commissioned four prominent geographers to address a series of questions on new approaches to defining metropolitan and non- metropolitan areas leading up to the year 2000 (Adams 1995; Berry 1995; Frey and Speare 1995, Morrill 1995). Their views are summarised in Table 3 and most suggest that urbanised areas need to be defined using some landuse and/or population density criteria and a wider metropolitan area being defined using commuting data or, in the case of Berry, media hinterlands. Non-metropolitan areas were obtained as a residual, although several of the authors make suggestions about how the non-metropolitan area should be divided. For example, Frey and Speare suggest dividing the non-metropolitan area into Functional Community Areas, mostly on the basis of commuting data. It will be noticed in Table 3 that most commentators suggest that countries be the basic spatial building blocks in delimiting metropolitan areas. The final recommendations (US Federal Register 1999, 56634) raised a 15 percent commuting limit to 25 percent for counties to be included in Metropolitan Areas.

Table 3: Approaches Taken to Redefining Metropolitan and Non-Metropolitan Areas by Five Prominent United States Geographers

Source: Dahmann and Fitzsimmons 1995

Author	Spatial Building Blocks	Criteria Used to Identify Metropolitan/ Non-Metropolitan Areas
Adams	Counties	Population Density
Berry	Zip Code Areas	Communication Regions and Population Density-Based Cores
Frey and Speare	Counties	Commuting Patterns Used to Define Functional Community Areas
Morrill	Counties	Spatial Extent of Urbanised Area Derived from Commuting Data

It is not just in MDCs that the idea has arisen of recognising functional urban regions and the areas with mixed urban/rural characteristics surrounding metropolitan and urban centres as separate settlement categories. It is apparent that the same thing is occurring around cities in LDCs. In the Asian context, among others, McGee (1991) has recognised this phenomenon around major metropolitan centres and he has coined the term *(desakota*[3]*)* to describe the mix of urban and rural functions in these areas. One of the features of Asian megacities[4] is their poly nuclear nature. They are a series of cities linked by urban development along major transport routes and separated by the type of *desakota* development mentioned earlier.

Champion (2001, 27) has argued in the European context 'that the urban region is evolving away from its traditional monocentric form … a variety of polycentric configurations seem to be emerging'. He examines the interrelationship between

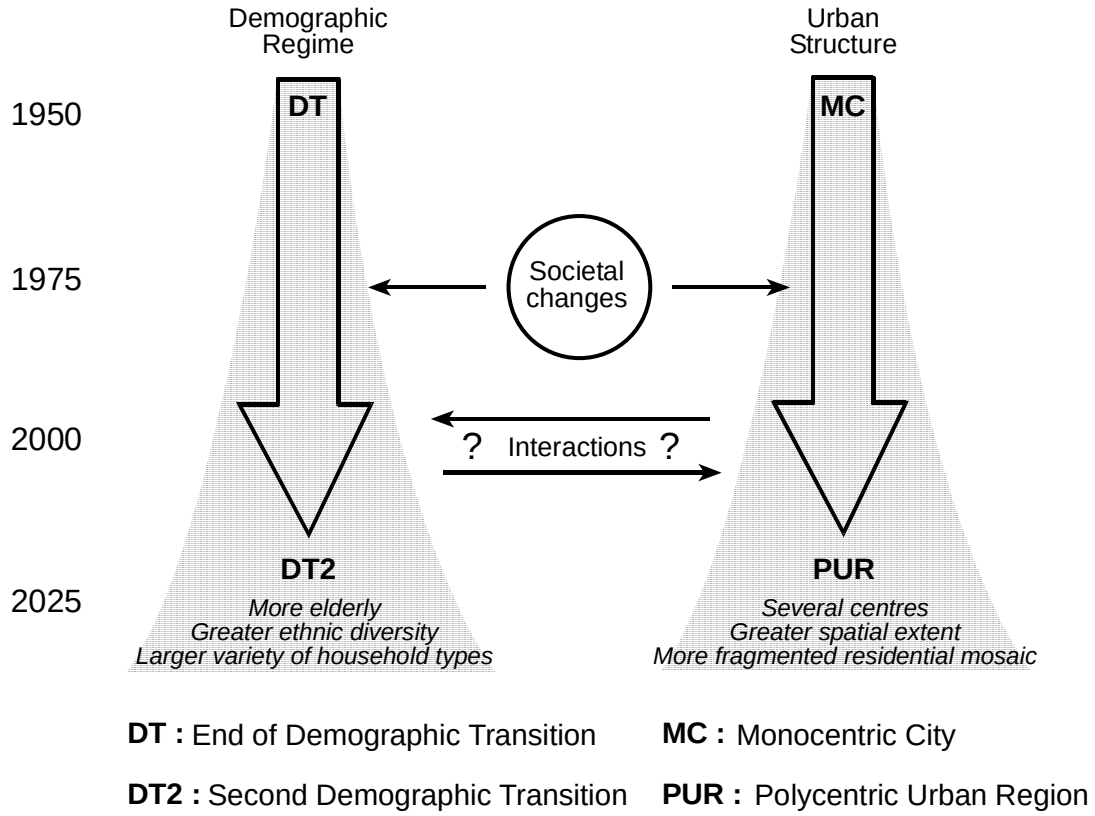
[3] *Kota* is the Indonesian word for city and *desa* the Indonesian word for village.

[4] i.e. those with 10 million or more inhabitants.

demographic developers and urban structure and investigates causal links between them as is depicted in Figure 2.

Figure 2: Links Between Evolution of Demographic Regime and Settlement Structure

Source: Champion 2001



In discussing the difficulty of identifying Polycentric Urban Regions (PURs) Champion (2001) identifies three versions of polycentric configuration:

(a) On the scale of the individual metropolitan area encompassing city, suburbs and community hinterland. In these areas a number of centres subsidiary to the major city can be identified (Berry and Kim 1993).

(b) A region containing a number of cities, one of which is dominant, referred to by Dieleman and Faludi (1998, 365) as the 'polynucleated metropolitan region' exemplified by the Randstadt in the Netherlands.

(c) The ‘polynucleated urban field’ (Dieleman and Faludi 1998, 374) incorporating several polynucleated metropolitan regions such as the megalopolis identified on the northeastern seaboard of the US by Gottmann (1961).

This presents some major challenges in terms of identifying and delimiting PURs which Champion (2001) suggests relate to scale, degree of interaction between centres and the variety of origins under which PURs may emerge.

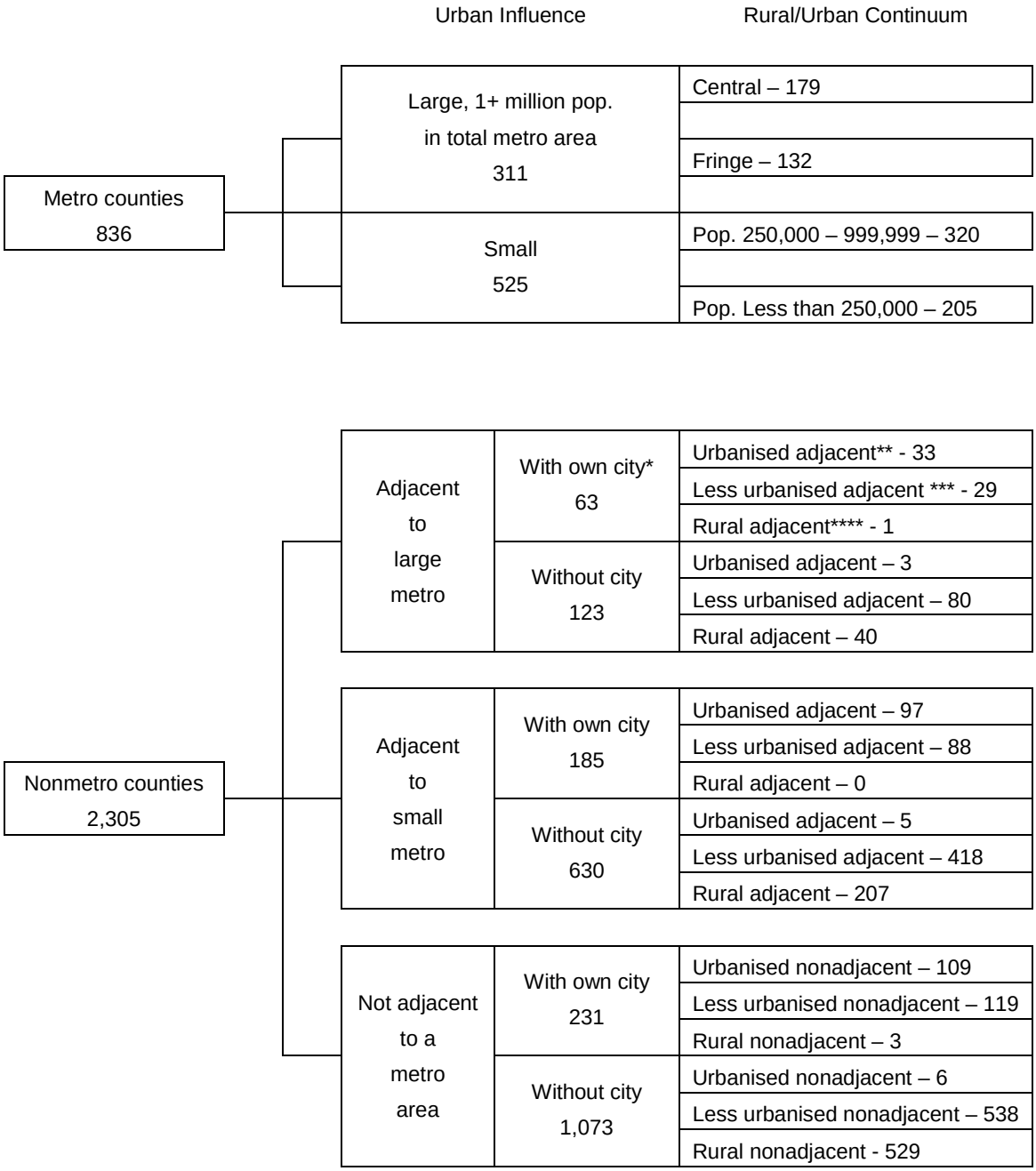
Some interesting attempts have been made in the United States to go beyond a simple urban/rural dichotomy. A study by Ghelfi and Parker (1995) classifies the 3,141 counties and independent cities in the US into a number of categories according to the degree of urban influence. In this classification eight separate categories are recognised and these are presented in Figure 3. Two types of metropolitan areas are identified – those with more than 1 million inhabitants and those with less. Non-metropolitan counties are classified into three groups according to their degree of adjacency to metropolitan areas. The non-metropolitan groups are further broken down according to whether the counties contained a city with 10,000 residents or more.

An alternative approach has been to actually attempt to operationalise the rural/urban continuum. Butler and Beale (1994) divided up US counties into 10 categories – 4 metropolitan and 6 non-metropolitan according to the size and nature of their urban population and degree of adjacency to metropolitan areas. The categories are presented in Table 4.

Cromartie and Swanson (1996, 5) point out that both of the schemes considered above form a settlement continuum based on population size, population density, levels of urbanisation, commuting patterns and adjacency. They created an abridged composite five level version of the rural/urban settlement continuum classifying centres which they apply at the sub-county level, arguing that the county is not an appropriate spatial unit for this purpose because of its heterogeneity. Their classification is presented in Table 5. It should also be noted that the United States have since 1920 divided the rural population into rural farm and rural non-farm components.

Figure 3: Counties by Urban Influence and Rural/Urban Continuum Codes, 1993

Source: Ghelfi and Parker 1995



* Own city means the county contains all or part of a city containing at least 10,000 residents.

** Urbanised means the county contains at least 20,000 urban residents.

*** Less urbanised means the county contains 2,500-19,999 urban residents.

**** Rural means the county contains 0-2,499 urban residents.

Table 4: Country Identification Codes Created by the Economic Research Service, USDA

Source: Butler and Beale 1994

Rural/Urban Continuum Code	
Metro counties:	
0	Central counties of metro areas of 1 million+
1	Fringe counties of metro areas of 1 million+
2	Counties in metro areas of 250,000 - 1 million population
3	Counties in metro areas of fewer than 250,000 population
Non-metro counties:	
4	Urban population of 20,000+, adjacent to metro area
5	Urban population of 20,000+, not adjacent to metro area
6	Urban population of 2,500 - 19,999, adjacent to metro area
7	Urban population of 2,500 - 19,999, not adjacent to metro area
8	Less than 2,500 urban population, adjacent to metro area
9	Less than 2,500 urban population, not adjacent to metro area

Table 5: United States Rural/urban Settlement Continuum According to Cromartie and Swanson.

Source: Cromartie and Swanson 1996, 5-6

1. Metro Core	Begins with an 'urbanised area' i.e. extent and distribution of the built-up area. If 50 percent of the spatial unit's population is contained in the urbanised area it is indicated as part of the metro core.
2. Metro Outlying	Areas linked to core by commuting and exhibiting metropolitan character (as measured by population density, percent urban and recent population growth).
3. Non-Metro Adjacent	Physically adjacent to a metropolitan area with at least 2 percent of employed labour force commuting to urban core.
4. Non-Metro Non-Adjacent with City	Areas not adjacent to Metro Areas but contain all or part of a city of 10,000 or more residents.
5. Non-Metro Non-Adjacent without City	Access not adjacent to Metro Areas and without a city of 10,000 or more inhabitants.

The rural population comprises all people living outside places of less than 2,500 inhabitants. Farm and non-Farm are differentiated on the basis of the proportion of household income derived from primary production (Lang 1986, 124).

A minor issue relating to urban classification relates to whether it is possible to develop guidelines to identify standard areas within urban centres such as clustering sub-areas into areas such as:

- CBD
- inner
- middle
- outer
- fringe

This clustering should utilise the following variables:

- distance from the CBD
- population per km^2
- housing units per km^2
- proportion of population living in detached dwellings
- rate of population change
- average age of the population

It also might be appropriate to adopt some standard classification of urban centres according to population size such as:

- 10 million+
- 1 - 9.9 million
- 250,000 to 999,999
- 100,000 to 249,999
- 50,000 to 99,999
- 20,000 to 49,999
- 10,000 to 19,999
- 5,000 to 9,999

- 1,000 to 4,999

The key issue, however, remains that settlement systems in more and less developed countries have undergone substantial changes since the concepts currently used in censuses and surveys to capture the settlement dimension were developed more than three decades ago. Even in the early 1970s, the IUSSP Committee on Urbanisation made the following conclusion (Goldstein and Sly 1974, 13):

> In many countries of the world the conventional urban/rural dichotomy appears to be outdated. Thus, it is recommended that three- or four-fold classification systems be considered for adoption.

Yet, three decades later we are still using the urban/rural dichotomy in demographic data collection and analysis. Moreover, the settlement system has changed dramatically since then. It is suggested here that the following issues need to be placed on the agenda for urgent consideration:

- Can we develop operational definitions of Functional Urban Regions which can be used in a wide range of nations?
- Can we develop operational definitions of Polynucleated Urban Regions for use in a wide range of nations?
- Can we develop operational definitions of ex-urban areas which are transitional between quintessentially urban and quintessentially rural areas?
- Should we develop standard settlement classifications which are more complex than urban and rural?
- Do we have to be confined to place of residence based settlement classifications assigned to people?

ACCESSIBILITY

A key dimension of where people live is their level of accessibility to basic goods and services. This can be an influential element in shaping demographic processes. Of course, accessibility is a complex variable incorporating not only

physical elements but also socio-economic differences in access to transport, cultural and other factors. However, it is argued here that if a standard approach to measuring accessibility is to be considered it is preferable to measure only physical accessibility. For particular purposes, though, it may be possible (indeed desirable) to include other relevant dimensions of accessibility.

An example of an index of accessibility is presented below. This was developed by the National Key Centre for Social Applications of Geographical Information Systems to indicate accessibility in the non-metropolitan part of Australia (Bamford *et al.* 1999). The Accessibility/Remoteness Index of Australia (ARIA) is based on 11,338 population localities identified on the 1:250,000 topographic map series. The distance between each of these 11,338 populated localities and the 201 service centres (populated localities with a population greater than 5,000) in Australia was calculated. Service centres were categorised into four levels of functional complexity:

- Level A More than 250,000 persons
- Level B 48,000 to 249,999 persons
- Level C 18,000 to 47,999 persons
- Level D 5,000 to 17,999 persons

To calculate the *road distance* between each of the 11,338 populated localities in Australia and their *nearest* Level A, Level B, Level C and Level D service centre the Key Centre used:

- GIS technology;
- up to the minute databases and technical data supplied by the Australian Land Information Group (AUSLIG); and
- powerful computers in the High Speed Computer Centre at the University of Adelaide.

This process calculated four minimum distances for each of the 11,338 populated localities.

These distances were converted to ratios by dividing by the mean distance between all of the populated localities and each class of service centre. A threshold of 3.0 for each ratio was applied and the ratios summed to produce a continuous variable from 0 (*high accessibility*) to 12 (*high remoteness*). However, to facilitate interpretation, ARIA values have been aggregated into five categories of remoteness:

a. Highly Accessible - Locations with relatively unrestricted accessibility to a wide range of goods and services and opportunities for social interaction.

b. Accessible - Locations with some restrictions to accessibility of some goods, services and opportunities for social interaction.

c. Moderately Accessible - Locations with significantly restricted accessibility of goods, services and opportunities for social interaction.

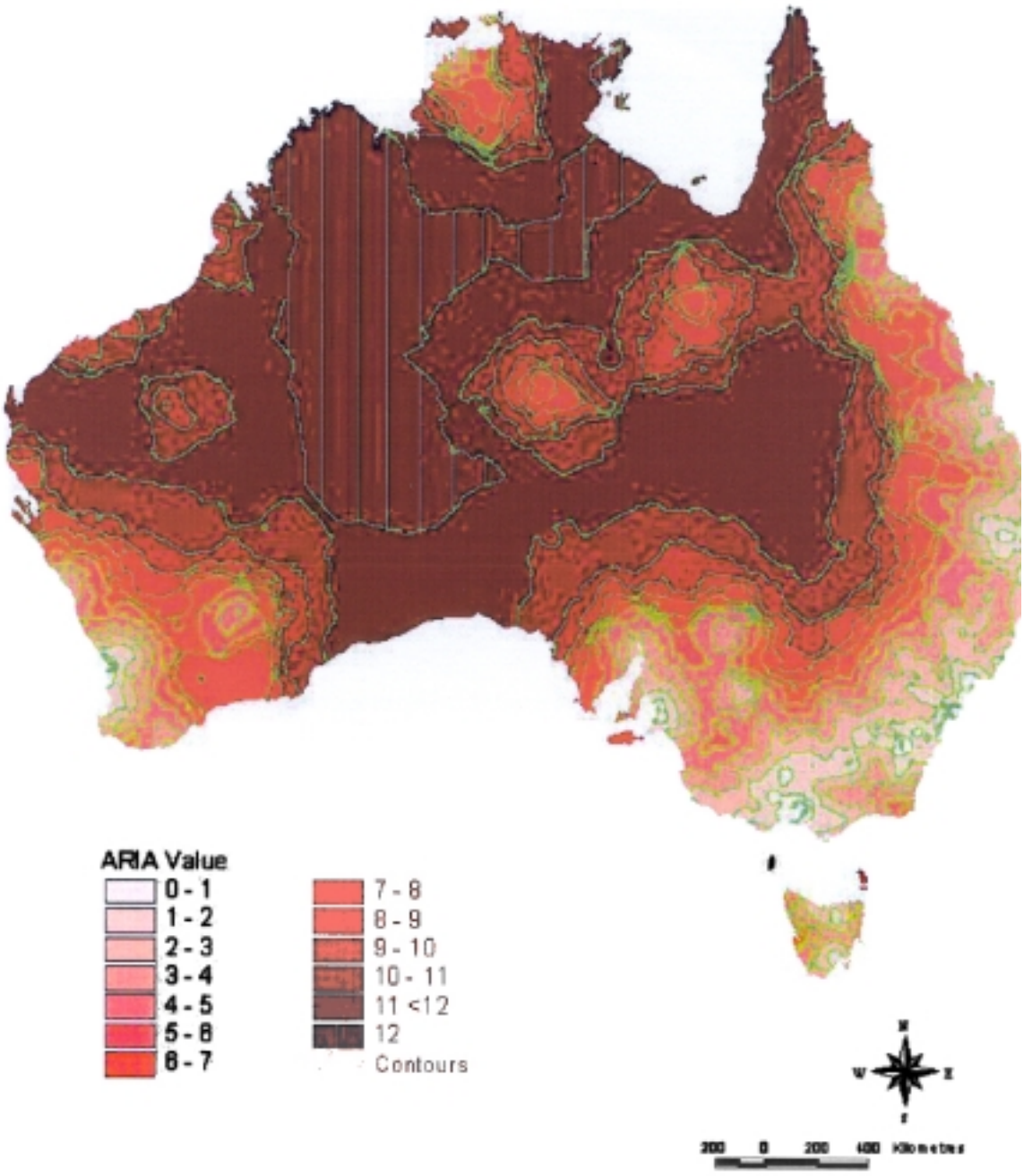
d. Remote - Locations with very restricted accessibility of goods, services and opportunities for social interaction.

e. Very Remote - Locationally disadvantaged - very little accessibility of goods, services and opportunities for social interaction.

Identifying the degree of remoteness for the 11,338 populated centres did not, however, embrace the whole of Australia. To embrace all inhabitants a ‘grid cell’ approach was employed by interpolating the remoteness measure for each of the populated localities onto a 1 km grid superimposed over the country. The 1 km square grid representation of remoteness can be used to produce remoteness contours for Australia and the resulting distribution of remoteness is shown in Figure 4. The cells can be aggregated into higher level geographic units including:

- collectors districts;
- postcode areas;
- Local Government Areas (Councils, Shires, etc.); or
- administrative units used by government and semi-government agencies.

Figure 4: ARIA Values Interpolated to 1 km Grid, with Contours



What has been described here produces a generic measure of remoteness/accessibility which can be applied across non-metropolitan Australia. The ARIA methodology and data base, however, can be employed to measure degree of

remoteness from any single type of service or group of services by inputting information about the service instead of size of urban areas into the calculations.

Table 6: Australia: Total Fertility Rate, Infant Mortality Rate and Standardised Mortality Rates for Males and Females Aged 15-64; 1992-95

Source: Glover, Harris and Tennant 1999, 135, 140, 144, 182

Accessibility/Remoteness Index	TFR	IMR	SMR Males 15-64	SMR Females 15-64
Very accessible	1.79	5.8	96	97
Accessible	2.15	7.1	118	102
Moderately accessible	2.30	6.3	116	106
Remote	2.43	8.0	128	126
Very remote	2.51	13.4	201	258

Table 7: Australia: Total Fertility Rate, Infant Mortality Rate and Standardised Mortality Rates for Males and Females Aged 15-64; 1992-95

Source: Glover, Harris and Tennant 1999, 136, 140, 144, 182

Urban/Rural Classification	TFR	IMR	SMR Males 15-64	SMR Females 15-64
Capital City	1.75	5.8	94	95
Other Major Urban Centres	1.84	6.2	102	105
Rest	2.16	6.8	110	109
Total	1.86	6.2	100	100

To give an indication of how this can be of importance in demographic study, Table 6 shows how there is a clear relationship between fertility and mortality levels on the one hand, and accessibility on the other. Of course, there is also a difference in fertility and mortality according to the extent of urbanness and where people live. Table 7 shows that fertility and mortality both tend to increase from large cities through provincial cities to rural areas.

THE POPULATION DENSITY DIMENSION

The relationship between population density and demographic processes is quite unclear because there has been a dearth of research in the area. Nevertheless, the degree of population concentration is an important dimension of the settlement structure. Most of the work in this area tends to have been done in non-metropolitan areas. Smailes (1996), for example, shows how population growth or decline in non-metropolitan South Australia over a period is better predicted by rural population density at the outset of the period than by absolute population size at the outset. Some have argued that because population density is a continuous variable, it better encapsulates variation in the settlement structure than does a simple urban/rural dichotomy. As Parr (1986, 329) points out:

> As a characterisation of regional spatial structure, the density function provides a structural link between the metropolitan and non-metropolitan parts of a region and is able to consider both elements without subordinating one to the other … (it) … provides a more general framework within which the analysis can be placed'.

THE ROLE OF SPATIAL INFORMATION SYSTEMS

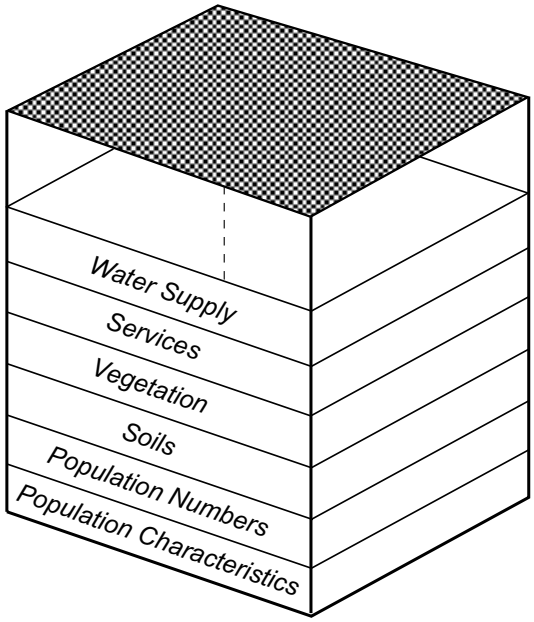
Earlier in this paper we argued that the settlement system has changed substantially since the concepts of urban and rural currently in use were developed more than three decades ago and this constituted a rationale for taking stock and reassessing the types of settlement classification we should adopt in censuses and surveys. It also can be argued that there has been a parametric change in our ability to capture, store and analyse data relating to settlement systems. This has been predominantly through the development of spatial information systems (SIS).

Spatial information systems (SIS) is the branch of information technology which adopts rapidly developing computer based technologies and methodologies to collect, store, interrogate, analyse, model, interpret and visualise spatially referenced

data. Spatially referenced data are pieces of information which each have a specific location on the earth's surface, a latitude and a longitude. What this means is that in such systems we not only have information about the unit which we are studying (person, household, farm, factory, health service, shop, etc.) but importantly we can consider:

- the specific characteristics of its location and the immediate vicinity;
- we can consider its location in relation to other units, e.g. household locations in relation to the nearest medical facility; and
- other pieces of information about the unit of study in that location.

Figure 5: A Simplified Model of a Geographical Information System



A spatial information system can be conceptualised as a series of layers of information with each observation in each layer tied to specific points and areas on the earth's surface via a specific latitude and longitude (Figure 5). Importantly, these layers of information can not only relate to different characteristics (e.g. population numbers,

soil type, slope, health services) but can be quantitative or qualitative and the data can be measured for different spatial units if it is not point data. SIS involves analysis which cuts vertically through the layers and analyses the relationships between them. Provided the data are spatially referenced (i.e. have a latitude and longitude) or relate to a specific spatial unit they can be included in the analysis. The methodology and technology of SIS allows these spatial patterns to be visualised in many and varied ways. However, its capacity goes far beyond mapping to include detailed spatial analysis, modelling, projection, policy evaluation and an array of options for interrogating the data as well as efficiently storing and maintaining it.

From the perspective of the present paper the capacity of SIS to act as an integrator of large, vastly different and complex spatially referenced data sets is of major relevance. The suggestions made earlier for more complex urban/rural classifications would create substantially greater demands for spatially referenced data of various kinds if sub-areas are to be placed in categories. GIS allows information derived from aerial photography and other imagery to be analysed together with population information, landuse information, commuting information, accessibility information etc.

Overlaying two or more relevant coverages or several individual map layers allows all the dimensions of the concepts to be captured in a single new coverage. This is a new base file made up of areas resulting from the superimposition of areas on the original maps using user-defined rules of union and interaction (Conning 1993, 171). SIS also has the ability:

> to make operational certain specific locational concepts and techniques: these concepts include the systematic analysis of proximity, accessibility, connectivity and density. In addition, GIS can also perform traditional locational analysis. The effective integration of all these functions and facilities would be very difficult to achieve, if not

> impossible, using traditional (i.e. non-GIS) methods (Scholten and Van der Vlugt 1990, 23).

The facility of GIS to *make sophisticated measures of accessibility* is especially important as has already been demonstrated in the Australian case study.

Of course, for GIS to be used most effectively, spatially referenced information needs to be available. Many countries are now looking at the possibility of georeferencing their population census and other data collections. Others are collecting information for smaller and smaller areal units so they can be subject to GIS analysis. Clearly, a potential for developing more sophisticated classifications of areas has been greatly enhanced by the availability of GIS and this needs to be taken advantage of.

CONCLUSION

Where people live and work has important implications for demographic processes. We need to include consideration of context in our analysis of causes and implications of demographic processes. Settlement systems have changed dramatically in both the less developed and more developed nations of the world but the classifications of settlement structure which we use in demography have changed little. We need to rethink these, especially in the light of the fact that we now have available to us the technology and methodology to undertake classification which involves large amounts of data of differing kinds.

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