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Hillary J. Shaw

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FOOD DESERTS: TOWARDS THE DEVELOPMENT OF A CLASSIFICATION

by
Hillary J. Shaw

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ABSTRACT. Many people in developed countries fail to consume a healthy diet. This phenomenon has been linked to the contested existence of 'food deserts' in the UK, and the occurrence of 'food insecurity' in the USA and elsewhere. 'Food deserts' remain contested theoretical territory at least partly because no firm definition has been proposed. This paper argues that the barriers to consumption of a healthy diet may be classified according to whether such barriers are financial, physical, or derive from the mental attitude and knowledge of the consumer. The perception of 'unsupportive food environments' by some consumers is contrasted with the geographical existence of multiple sources of fresh fruit and vegetables in certain locations. Using a total of 234 semi-structured interviews in various UK locations, qualitative evidence is gathered for the existence of at least ten different types of 'food desert'. The paper then goes on to show how such a three fold classification may be developed, using a modified ternary diagram, to assess the most appropriate initiatives to tackle 'food deserts' and to monitor progress in alleviating their effects.

Key words: food deserts, food security, diet, poverty, social exclusion, Leeds, Lincolnshire

Introduction: origin of the term 'food desert'

Numerous studies have shown that eating fruit and vegetables protects against cardiovascular disease, cancer and Type II diabetes. Conversely, consumption of processed foods, possibly containing high levels of fat, salt, or sugar, may cause obesity and lead to associated health problems (Donkin *et al.*, 1998). Therefore, consumption of fresh fruit and vegetables is recommended by dieticians, but not everyone can access these foods easily. Reporting on a deprived area of Birmingham, England, *The Economist* (2002) said: 90% of the households in the area were within 500 metres of shops that sold junk food and fizzy drinks. Less than 20% of the houses were within 500 metres of a shop selling fresh fruit and vegetables. Similarly, MSNBC News reported in 2004 on the food access problems suffered by some residents of New Hampshire, USA (http://msnbc.msn.com/id/5353901/, accessed 18 December, 2004). Here, 'the community's two convenience stores offer little fresh produce and plenty of high prices'. The MSNBC report continues: 'such is life in "food deserts", increasingly common rural – and sometimes urban – areas where supermarkets with healthy and affordable food are many miles away.'

The phrase 'food desert' was reputedly first used by 'a resident of a public-sector housing scheme in the west of Scotland in the early 1990s' (Cummins and MacIntyre, 2002a, p. 436). In 1996 the Low Income Project Team defined 'food deserts' as 'areas of relative exclusion where people experience physical and economic barriers to accessing healthy food' (Reisig and Hobbiss, 2000, p. 138). However, what a 'food desert' is remains largely undefined beyond this basic description. Wrigley (2002, p. 2032) wrote: 'Despite its rather imprecise definition the metaphor of the food desert was rapidly pressed into service in policy debate in the late 1990s and "food deserts" were simply assumed to exist despite a lack of systematic research documenting their prevalence and distribution.' Researchers have proposed many factors – economic, geographical, psychological and sociological – as to why some people fail to consume a healthy diet. These factors may interact to produce various types of 'food desert'. This paper seeks to examine whether a classification of food deserts may be derived from the factors that create barriers to accessing a healthy diet.

Why might 'food deserts' exist?

Accessing food requires several different types of resources. The consumer must be physically capable of travelling to a food retailer, or an allotment, and of transporting the food back home, unless consumed on restaurant-type premises. Travel, unless on foot, demands financial resources; this might also include 'virtual travel', ordering food electronically or via a home help. Consumers need know-

ledge of the food they intend to buy and of how to prepare it. Food is also relatively heavy; consumers can only carry so much, and some of their weight-carrying capacity is already spoken for by essential non-food items (e.g. household cleaning goods or pet food). 'Disposable weight-carrying capacity' may be as important as disposable income for some consumers. Food is also one of the more discretionary items on a poor family's budget once essential fixed outgoings such as rent and monthly debt repayments are deducted. As Darmon *et al.,* (2004) have shown, less healthy but more energy-dense, obesogenic, diets are cheaper than diets high in fresh fruit and vegetables. This tempts poor mothers in particular to reach for the biscuit barrel when hungry, even as they feed especially male members of their household a better diet (Harrison, 1997; Whelan, 2002). Perhaps 'food deserts' can exist as fractions of a household. Most food has a limited useful life-span; therefore adequate refrigerated storage space is needed. Without this the consumer may have to make frequent, perhaps costly, trips to a distant food retailer or minimize travel costs by purchasing less healthy food available closer to home. Individual household members also differ in food preferences, and in poor households the person buying food will avoid wasting money on purchasing food that will not be consumed, for example by the children (Jackson and Bussell, 2003).

Financial barriers to food access by the poor may be lessened by the presence of discount food stores, offering healthier foods at low prices (Cummins and MacIntyre, 2002b). Many inner city areas have cheap supermarkets, (e.g. Aldi, Lidl, Netto) (Cummins and MacIntyre, 2002b); there are also more ethnic food stores, many in deprived areas, than there were fifty years ago. However, geographical proximity to a food store does not necessarily mean that the consumer will find it attractive, wish to be seen using it (Wrigley *et al*., 2004), be financially able to shop there, or possess the expertise to cook and prepare the fruit and vegetables it offers. Williams and Hubbard (2001) reported that consumers might choose stores on factors such as whether help with packing was available, the anticipated length of queues, or how easily children could exert 'pester power' there. Micro-scale barriers, significant to the elderly and others of limited mobility, may impede access to food stores even a hundred metres away (Food Commission Report, 2005). Hence areas apparently well served by fresh food retailers could be 'food deserts' for some.

A brief review of food access research

Researchers in the UK began examining the phenomenon of rural consumers left bereft of access to grocery retailing from the 1970s onwards. Growing numbers of widowed women in rural areas had never learned to drive, and were finding themselves stranded as increasing car ownership led to a reduction in public transport services; simultaneously village grocery stores were closing. The Standing Conference of Rural Community Councils studied retail changes in seven counties in southwest England between 1972 and 1978 (reported in *English Village Services in the Eighties*, published in 1990). The University of East Anglia published a national study by Moseley and Packman (1983) about the availability of retailing in rural areas. More local studies were done in Northumberland, Lincolnshire and Gloucestershire, in collaboration between the county council and local community groups. Guy (1991) also researched the decline in rural facilities in Wales, and further rural food access research was done in the 1990s; for example, a survey by Norfolk Council of village shops in Norfolk, presented at the Norfolk Food Futures Conference on 13 July 2001.

The election of New Labour in Britain in 1997 brought an increased emphasis upon urban food access, after the Social Exclusion Unit was set up within the Home Office (Wrigley, 2002). Since then, 'food deserts' have been researched in Leeds, Newcastle upon Tyne, Cardiff, Coventry, Glasgow, London and Manchester, and in smaller settlements such as Guildford and Portsmouth. The focus of these studies has varied widely. Some, such as the Leeds 2002 study (Clarke *et al*., 2004) have examined the impact of an intervention such as a new supermarket on food access in Seacroft (Fig. 2. square P-11), an area with a hitherto unsupportive local food environment. There have also been longitudinal studies of retail change in Cardiff and Portsmouth, and research of an entire city, Newcastle upon Tyne, by the Food Standards Agency (White *et al*., 2004). The Newcastle study, one of the largest UK studies to date, found that attitude to, and knowledge of, foods was the main determinant of whether or not a healthy diet was consumed.

Of particular relevance to this paper were dietary studies focusing on non-geographical barriers to healthy eating. Donkin *et al*. (1998) discovered that single men were less likely than women or men with a female companion to eat five portions of fruit and vegetables a day. Reasons for this included the

greater expense per person of living alone, less male involvement in cooking activities, and the preference by single men for food that is quick and easy to prepare. Girois *et al*. (2001 in a study of adults in Switzerland and the USA found that awareness of what constituted a healthy diet was positively correlated with being educated and being female. Bogue and Sorenson (2001) reported similarly in a study based in Eire on attitudes to healthy food. In the Netherlands Brug *et al*. (1995) found that self-motivation and the influence of close companions were a major influence on whether or not a healthy diet was consumed. Darmon *et al*. (2004) showed how, in the Val de Marne region of France, energy-dense but nutrient-poor diets were cheaper than healthy diets, making these diets more attractive to the poor.

In anglophone countries, notably Canada, the USA and Australia, much research has focused on the concept of 'food security'. Food security is defined by the Wisconsin Food Security Project (website accessed 2005) as 'the assured access of all people to enough food for an active healthy life; households are food insecure if they have uncertain or limited access to food through normal channels'. Food insecurity was said to affect 33 million Americans, over 10% of US households, in 2000, with single women particularly vulnerable (Olson and Holben, 2002). Similarly, Kaufman (1999) showed that rural poverty combined with poor physical access to large supermarkets in the rural lower Mississippi Valley produced a reduction in quality of diet for less well off households. Zenk *et al*. (2005a), in a study of Detroit, USA, noted a racial dimension to poor food access, stating that for poor neighbourhoods, areas where African Americans resided were significantly further from supermarkets selling good-quality fruit and vegetables than were poor neighbourhoods where white Americans lived; for wealthier areas there was little racial-based distance difference. Zenk and colleagues (2005b) also found an indirect link between income and fruit and vegetable consumption because higher-income shoppers tended to shop at well-stocked supermarkets where fruit and vegetable availability was better than at smaller local shops. Morland *et al*. (2002a) posited a more direct link between race, poverty and food access, with the lower income areas in this study of four US states having lower car ownership, fewer large supermarkets, more small convenience stores and alcoholic beverage stores, and a higher proportion of African-Americans than the high-income areas. Equally, Morland (2002b) found that providing an additional supermarket in a US census tract could raise fruit and vegetable consumption by 32% for blacks and 11% for whites.

In Australia the Eat Well South Australia report (1999) noted that unemployment, low pay, living in poor areas (urban and remote rural) with few healthy food retailers, and low self-esteem due to low socio-economic status, as well as possessing few cooking skills, were all inter related factors contributing to an unhealthy diet. However, Turrell *et al*. (2004) found, in Brisbane, Australia, that the socio-economic status of area of residence had only a small correlation with quality of diet. Rather, the personal characteristics of the consumer, including their own wealth, food preferences and other social attributes, were more important in determining whether a healthy diet was consumed. Reidpath's research (2002) correlated with Darmon's Val de Marne findings, concluding that people in poorer areas had greater access to calorie-rich fast food than did residents of wealthier areas, and this contributed to greater obesity amongst the poor in Australia.

Research into food access demonstrates two factors relevant to any attempt to classify 'food deserts'. First, that, in Europe and the anglophone countries, as well as in the UK, the factors debarring access to a healthy diet are multiple and extend well beyond strictly spatial or geographical aspects. Second, that these factors appear to operate in broadly similar ways in many developed nations besides the UK, albeit mediated by factors such as international differences in racial composition and geographical segregation, the degree of social inequality, and spatial differences in the food retail infrastructure. Therefore a typology of food deserts based on UK data may be applicable at least in part to other countries also. This paper uses qualitative interview-based data from a range of consumers and agencies to, first attempt to create a list of possible 'food deserts', and second to classify these 'deserts' in terms of causes and attributes.

Methodology of this research

Interviews and research setting

A total of 234 semi-structured interviews were carried out during 2001 and 2002, with shoppers, shopkeepers and relevant agencies in the Leeds and North Lincolnshire areas, supplemented by qualitative data provided by the Norfolk NHS Trust and other food- and poverty-related agen-

Fig. 1. UK research locations, 2001/2002.

cies in Norfolk, particularly in the Great Yarmouth area. The 234 interviewees comprised fifty-six individual shoppers, fifty-eight shop workers or managers, and 120 agency representatives. Agencies made up over half of the total respondents due to the broad range of agencies approached, and because community group agencies could often give a broad overview of shopping obstacles faced by their members. In some cases focus group interviews were arranged, comprising the agency representative plus several individual group members.

Shoppers were selected by door-to-door calling, starting at a random street name, and supplemented by some 'snowball' calls as recommended by respondents. This gave the face-to-face element required for qualitative data collection, without the respondent having to stand in the street. Once an interview was gained a further random street was taken for starting calls again. Shops were selected by purposive sampling, so as to give a range of different food shop types, large and small, (e.g. convenience stores, butchers, greengrocers, supermarkets). Agencies were also selected purposively to represent, for example, ethnic communities, poverty and pensioner support groups; also supply-side agents. All interview information was recorded on tape and also in shorthand note form, guarding against loss of data due to unsuitable recording environments and also speeding up the transcription process.

Leeds and North Lincolnshire together presented a wide variety of neighbourhood types and ethnic groups, (e.g. Afro-Caribbean, Bangladeshi, Chinese, Indian, Jewish, Pakistani, Polish and Vietnamese). The research area contained people from many different socio-economic groups, and presented a range of settlement sizes from Leeds itself (population 700 000) through to the medium-sized town of Scunthorpe (population 75 000) and the smaller market towns of Brigg and Kirton Lindsey, with fewer than 10 000 inhabitants each. Scunthorpe presented a fairly self-contained market area for food, being some 40 kilometres distant from any comparable-sized town. There were also many smaller villages, both with and without grocery shops, in the more rural areas studied. Where possible, when a socio-economic or ethnic group was interviewed in Leeds, a similar group was also interviewed in the more rural setting of Lincolnshire. Within these areas, therefore, a wide range of food access situations was examined (Fig. 1.).

Each respondent was asked a short series of open questions, (between eight and eleven questions overall), which allowed for a considerable amount of personal comment to be made during the interview. The precise questions asked varied according to the respondent. Respondents representing consumers were asked what, if any, problems they or their group members had in accessing grocery shops, how they felt these problems could best be tackled and by whom, and their opinions of the local grocery retailing situation, both current and regarding any changes they were aware of in recent years. Respondents representing the supply side, such as commercial property agents or wholesalers, were asked what problems, if any, they perceived in the supply of groceries, and again how such problems might be alleviated, as well as how they felt the supply situation had changed in recent times. Representatives of 'third party' bodies such as the police or transport companies were asked how retailing affairs affected their organization and what changes, if any, they would like to see in the retailing sector and why.

Agencies interviewed included:
- chambers of trade;
- community groups representing pensioners, the poor, the disabled and ethnic minority groups,
- government agents, local and national;
- health providers and dieticians;
- housing agencies – house builders, estate agents, housing associations, and council (public) housing providers;
- planning agencies;
- police;
- public transport agencies – council transport planners and corporate public transport providers;
- retail property agents;
- wholesalers.

Retailers interviewed covered the full range of shop sizes, from local independent corner shop proprietors through local supermarket managers to superstore managers.

Mapping the level of grocery retail provision

Retail grocery provision was mapped across the study areas. Urban areas were divided into 250 × 250 metre squares (rural areas were mapped at 500 metre resolution), derived from Ordnance Survey gridlines. Squares were ranked as to whether they:

1. contained a shop selling ten or more kinds of fresh fruit and vegetable;
2. contained a grocery store but no shop selling ten or more kinds of fresh fruit and vegetable;
3. contained a residential area but no grocery shop;
4. were non-residential.

Residential and non-residential areas were distinguished because the absence of shops in areas such as industrial estates deprives almost no one of access to groceries. The threshold of ten kinds of fruit and vegetable served to distinguish shops selling a few carrots, onions, or other hard, less-perishable vegetables, from those retailers offering a fuller range of green vegetables and fruits. No single 'list of ten kinds' was applied to all shops, because the range of fruits and vegetables in south Asian-oriented shops often differed markedly from those in more European-oriented shops.

The results of this mapping, and the uses, limitations and possible development of the maps, are discussed below.

Research results

Retail grocery access maps

Maps of the geographical prevalence of grocery shops do not always coincide with the perceptions of retail access by consumers. Some areas with many grocery shops are perceived as shop-poor by some residents. The more affluent northern suburbs of Leeds, with few shops, are not normally associated with 'food deserts', yet some consumers lack easy means of travel to distant supermarkets. The maps are shown with a letter-number-based grid system, to identify locations referred to in the text below (Figs 2 and 3).

Uses and limitations of the grocery retailing access maps

The maps do not show the total numbers of grocery shops in any one square. This would be important if considering the vulnerability of an area to loss of its retailing facilities; if only one shop is present, its closure will totally remove such facilities from that square, and stand-alone shops or shops in smaller parades may be more vulnerable to closure than those in larger clusters where footfall is greater. However, when considering access at one point in time, the consumer is presented with a similar choice of groceries whether there is one shop or several. What the maps show is which residential areas are geographically close to at least one retail source of fresh fruit and vegetables.

The maps contain two kinds of elements to which further information may be added. There are 'edge' elements, the square boundaries, and 'area' elements, the 250 × 250 metre area represented within each square. Edge elements represent boundaries whose permeability to shoppers varies. Crossing an 'edge' to access the retail contents of a square may involve crossing a major road, or ascending a hill laden with shopping. Other linear features could be plotted along square edges, such as bus routes, or socio-demographic area boundaries, wards or census areas. Area elements could be used to map socio-economic data such as income or car ownership. The grocery retail maps could also be used to plot changes over time in access to grocery retail shopping.

Interview results

Food access problems in inner city areas. In many 'inner city' areas, high residential density is ac-

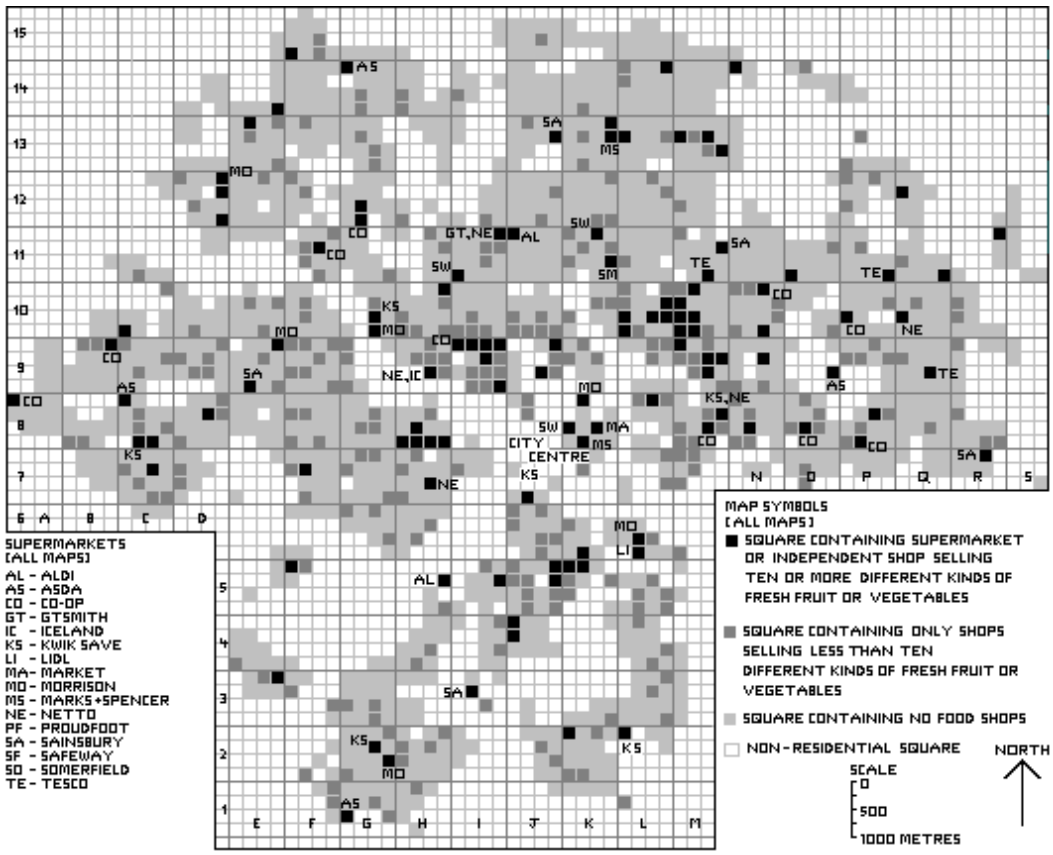

Fig. 2. Map of Leeds grocery retailing access 2002

companied by a dense network of grocery/convenience stores, but this does not always mean easy access from houses to shops. The East Park area of Leeds, a deprived inner city area just east of the city centre, typified many of the problems faced by elderly, poor or disabled people, or by mothers with children, in accessing grocery shops. East Park (Fig. 2, squares L-8 to M-7) is close to both the main food market in Leeds (K-8) and two supermarkets across the busy York Road. There is also a local Co-op (M-8), but this store did not stock fresh fruit and vegetables during the research period. However, a poverty support group in East Park said

> There aren't any shops here, just two or three local shops. The supermarkets won't come, as this is a poor postcode. Many here are on Benefits. The unemployed can't afford to get a taxi to the supermarket, but need one if they have a lot of kids. We have a very frail lady, 80 years old, who walks 100 yards to the corner shop but it takes her half an hour to get there. They have to pay high prices at local shops, double the supermarket price. Carrying shopping back is difficult, I get a bus there and a taxi back. It depends on the weather and if you are trailing kids, or elderly or frail. Crossing the A64 [York Road] is difficult as they have filled in the underpass as too many muggings [happened] in there. So now there are three sets of lights for pedestrians to cross, with kids, and they are synchronized against pedestrians because if they stopped the traffic on all three lights at once, long enough for someone to cross, there would be long tailbacks of cars'.

Although East Park is geographically close to Leeds city centre and suburban supermarkets, obstacles such as major roads and hilly topography

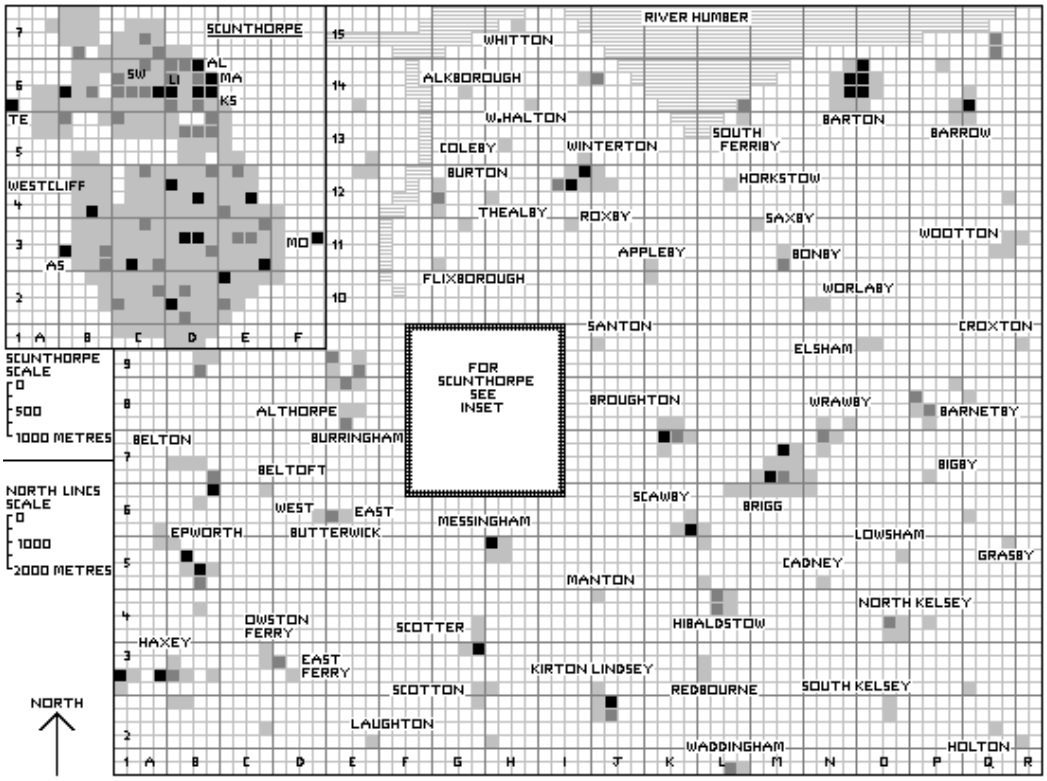

Fig. 3. Map of North Lincolnshire grocery retailing access 2002

create barriers to stores situated within a few hundred metres of peoples' homes. Williams and Hubbard (2001) noted similar problems with pedestrian access to stores that involved using subways, particularly for women. The 'hypsographical' problem of shop access, something that often does not show up well on two-dimensional maps of shop location, was noted by Wilson *et al*. (2004) in Guildford. Other non-spatial problems of food access affecting pedestrians alluded to here include ill-health, fear of crime, weight and price of shopping, and road crossings that may be more of a barrier than an access point for pedestrians.

Non-car owners faced a poor local bus service. The same poverty support group quoted above said

> The buses here are bad because of all the traffic-calming measures to stop joy riders. A lot of buses have been withdrawn from here or don't run after 6 p.m. People from here can't afford the bus fare into town, it's a pound there and a pound back. The pensioners still pay 20p but only get this between 9.30 a.m. and 3 p.m. A lot of pensioners are frightened to carry their shopping back in case they get knocked over for it, it is half a mile to walk but steep uphill, carrying heavy shopping. We are close to the city centre but it could be a million miles as it's too far for the pensioners to walk. The bus service, though we're close to the centre, is appalling, in frequency and reliability, we only have one every half an hour, not always on time'.

Again, non-spatial factors such as fear of crime and the unreliability of the bus service militate against its use to access grocery shops. Therefore an area apparently well served by local supermarkets and city centre retailing in fact presented major obstacles for the less mobile in reaching these shops.

Food access problems in more affluent suburbs. Food access problems for the elderly, less mobile, and other disadvantaged groups may also exist in more affluent areas. Guy noted how areas of 'low food provision' existed in areas of 'high relative af-

fluence' in Cardiff, although 'the vast majority of residents are untroubled' by this (Guy *et al*., 2004), having access to a private car. But not all have access to a car, and even affluent households may lose such access at least temporarily, through accident, theft, disqualification, or failing health. Birkin *et al*. (2002) shows that Cookridge and Alwoodley (Fig. 2, squares J-14 to L-14), on the more affluent side of Leeds, nevertheless have 6.3% of the population unemployed or in low wage work and 26% of residents do not own a car. Pensioners, who make up 30% of the population of Cookridge and Alwoodley, may have physical problems in getting to the shops; Townsend (2003) says that 11% of those aged 65 to 84 and 45% of those aged 85 and over are unable to shop on their own. However, in these wealthier suburbs, shopping seems largely predicated on a weekly car trip to a distant supermarket; local parades of shops contain few shops selling fresh fruit and vegetables. Pensioners with no car may have to carry shopping some considerable distance home on foot. A Leeds councillor said of Adel (Fig. 2, square K-14):

> *Apart from Sainsbury, there is nowhere to buy fresh food. There are loads of little shopping parades but no butchers, no greengrocers, no fishmongers. Some pensioners will walk a half or three-quarters of a mile* [1 kilometre] *to Sainsbury but then you will restrict your shopping to two carrier bags. You will buy one apple, one onion, you have to get essentials like tuna fish, cat food, milk, so you don't get fresh vegetables. So people's eating habits have deteriorated because we haven't got lots of fresh food shops*'.

As mentioned above, limited personal carrying capacity, lack of a car, poverty and distance to shops interplay to create what may be an unsupportive local food environment for some households, whereas interspersed with these are many other households for whom accessing healthy food is no more problematical than driving to a supermarket.

Attitudinally- and demographically-based grocery access problems. Close proximity of food shops to a residential area does not imply that the entire local population will *perceive* that they are near to useful grocery shops. There may be one large section of the population towards whom most of the retailing is oriented, leaving other sections with different tastes relatively unserved. This research found two such populations, namely students in Headingley (Fig. 2, square I–10 and south Asians in Beeston Hill (J-6). A Leeds city councillor stated: 'In 1992 Woodhouse Carr [the part of Headingley where most students live] was 80% families and 20% students, now [2002] it is 90% students'. The effect on local grocery retailing was described by a local shopkeeper: 'We do less traditional foods, more exotic foods. We sell more crisps, sweets, cigarettes, alcohol, we sell less to pensioners which was our traditional market. Eighty-year-old ladies don't want a pizza or off-licence, all the shops they like, such as the chemist, are closing.' The level of grocery provision in student areas may become highly variable, and therefore be seasonal (Ravetz, 1996). During the thirty weeks or so that students are at the university, a house with six adults creates more demand for food than if the same house were still in family occupation; however, demand plummets during holiday times. This may militate against the provision of perishable groceries such as fresh fruit and vegetables, especially in the hotter summer holiday period, and the permanent residents of Headingley may find themselves in a seasonal 'food desert' for some twenty-two weeks a year.

Southwest Headingley, along with Beeston, has a large south Asian population, affecting local food retailing in a similar way to the students of Leeds universities. Butchers serving the white pensioner population are closing contemporaneously with new Halal butchers opening. In the Burley Road area (Fig. 2, square I–9) of Headingley, a 'white' butcher complained that cars belonging to worshippers at a local mosque reduced his trade because his customers could not park nearby; a Halal butcher a few doors away welcomed the same cars because they meant extra trade for him after the service. The effect on older, less mobile white pensioners who have through poverty retired *in situ* in areas such as Beeston Hill was described by a poverty support group: 'Many white working-class pensioners want potatoes, they don't like seeing "exotic" fruit and vegetables.' Jackson and Bussell (2003) noted the effect of this on older white people. When shopping in an area which had many Asian greengrocers, white pensioners may perceive a rather limited choice of acceptable foods available. White pensioners in Beeston Hill were therefore likely to perceive a very different 'foodscape' from the geographical one of many independent Asian-run grocery stores. Many of these pensioners walked for up to a kilometre to two discount supermarkets

on Dewsbury Road (Fig. 2, square K-5), and then faced an uphill walk home with the shopping. Attitudinal constraints, namely of being unwilling to use easily accessible food shops, are not only based on taste and preferences. A Bangladeshi community group, based in Crosby (Fig. 3, square C-6) commented: 'Some Bangladeshi women lack confidence, and there is a problem with muggings by youths; few have cars as earnings are low. The most the women will walk to the shops is to the corner shop, or maybe five or ten minutes walk.' This Bangladeshi community lived in an area served by a Safeway, Aldi, Lidl and Kwik Save, all within 1.5 kilometres of most Crosby homes. However, fear of crime, and cultural traditions of the community, greatly increased the psychological distance of these supermarkets to certain Bangladeshi women.

Food access in rural areas. In small rural towns, geographical food access problems may exist analogous to those in Richmond Hill, Leeds. Towns such as Brigg (Fig. 3, square M-7) appear to be well served by food retailers, having several supermarkets and a number of independent shops in the town centre. However, parts of Brigg are over 1000 metres from any shop, and, bus services into town are infrequent. This affects both the less mobile and any carers they may employ. A representative of a pensioner support group said: 'Even in Brigg where you'd think there's good access to shops there are problems for some carers on the outskirts of Brigg. To walk into town is difficult and there's not a regular bus route from the edge of Brigg.' In the North Lincolnshire villages, the shift from local farm-based work to urban-located services jobs has removed much employment. A local politician said: 'We have virtually nobody employed in agriculture [in the North Lincolnshire villages] now.' Similarly, a rural preservation respondent said of Brigg itself: 'Brigg has lost the cattle market, so the farmers don't come and buy machinery, so the local engineering companies are in trouble'. The shops then suffer as local footfall declines; the local police commented: 'Brigg had five or six butchers ten years ago but now [2002] we're down to three'. Many villages in Lincolnshire might be regarded as little more than dormitories for commuters; what in the USA are called 'exurbs' – settlements located in the countryside but socio-demographically more like suburbs detached from the nearest town. Left behind are the elderly and other non-commuters such as spouses and children. As one pensioner respondent put it: 'At 9 o'clock there's a mass exodus, off to school and off to work, all the young people get in their cars and drive to Lincoln. People say, "don't do away with the village shop, the post office", but in the end they don't support them'. The shift from local employment to car-based commuting is likely to precipitate a reduction or withdrawal of the village bus service. Initially the village shop may see an increase in trade as villagers without cars are forced to shop there more, but this shop cannot serve all their shopping needs. In the longer term those without cars cope by arranging transport to a nearby town, or perhaps even move out of the village altogether, and the village shop may close, unless saved by some local citizens' initiative such as a buy-out.

Time-based constraints on access to healthy food. Pensioners needing a carer to access the shops are constrained by the need to pay the carer, who must find time for this task, time that must come out of other important tasks the carer may perform such as cleaning. Time constraints may produce another situation where access to healthy food is compromised, among the unlikely setting of wealthy professionals living in upmarket city centre flat developments. Rathje (1996) described how such professionals buy the fresh fruit and vegetables they know they should eat, but also microwave ready meals as a back-up because they are cash-rich but time-poor. Often the ready meals are preferentially consumed and the fresh produce has gone bad before it can be eaten. A Leeds councillor said: 'Professional people are living off really expensive packaged stuff because TV pressurizes people into a certain lifestyle, and that'll kill your local shops off.' Leeds has a high-status city centre residential area, The Calls (Fig. 2, square, K-7) where these professionals are likely to live. The Calls is within one kilometre of three supermarkets plus the City Market, but if time and lifestyle constraints do not permit the use of these shops, or the consumption of fresh fruit and vegetables bought from them, then nutritionally they are inaccessible.

Lack of cooking skills. Some people can cook but fail to find time for this activity; others lack cooking skills altogether. These are often the poorer households; lack of nutritional knowledge and limited cooking skills may be linked to low socio-economic status (White *et al*., 2004). A Scunthorpe dietician said 'We have outreach projects like "healthy living" in Crosby. We promote allotment use, and teach adults how to cook what they've grown. We

have a "sure-start" programme for mums with children aged 0-5. Put fruit in school tuck-shops. There is a lack of education on how to buy food wisely as well as how to cook it.' However, cooking skills may be lost amongst the wealthier as well. A female from an affluent village near Leeds, earning an above-average wage, said, 'meat is nicer in plastic than in the butchers [she disliked the smell of meat at the butchers] but the knowledge and skills of butchers are being lost, we have "noddy recipes", they tell you how to cook food now.' Once households are deskilled in cooking expertise, their food purchasing may shift from fresh fruit, meat, and vegetables towards pre-packed ready meals, which will tend to be offered within a greater range and at a lower cost in a large supermarket than in a local grocery store. A vicious circle may ensue with the closure of local retailers precipitating further cookery deskilling and continued shift of trade to distant supermarkets, leaving behind altogether those of limited mobility and means.

Wealth-based constraints on healthy eating. Poorer households may be denied access to healthy food not through geography or attitude but cost. A dietician in Scunthorpe said, 'The Asian diet in Crosby may have too much fat and too few vegetables. Asian vegetables are very expensive here in the UK, and they may not be aware of English alternatives, so although the home diet is good, it has too much fat here in the UK.' Many Asian families may have below-average income due to discrimination, poor English, or lack of recognition of non-UK qualifications. Combined with this is the possibly higher cost of Asian foods due to limited economies of scale and the import route of these foods through agencies located in cities such as Manchester, for historical reasons. The black community may also suffer a poor diet due to cost constraints. A black community group in Chapeltown (Fig. 2, K-10 to L-10), commented: 'We have Afro-Caribbean shops here [Chapeltown]. They sell yams, green bananas, sweet potatoes, mangoes, star fruits. Yams and green bananas are carbohydrate foods, quite starchy, they are bulk foods that fill you up. It's proteins and the various meats we don't seem to get because they're quite expensive. We eat a lot of goatfish and monkfish, which are more expensive.' This phenomenon of the poorest paying more for their food mirrors the situation on poor white estates where the less mobile, poorer, families pay more at local grocery shops than those who have access to supermarkets by car.

In some cases the cost of food may be the overriding factor as to which shops are used, rather than shop location or type of shop. In order to keep the food bill 'manageable', consumers may choose more calorific, cheaper, but less healthy food (Jackson and Bussell, 2003), or avoid taking themselves (or their children) to stores where they anticipate a temptation to buy unaffordable food. A Leeds housing worker said, regarding Lincoln Green, a poor part of Leeds (Fig. 2, N-9, square), 'I don't think most of our tenants can afford groceries, as in vegetables, stuff like that. I think they eat more junk food, convenience food, because they're on limited funds. They only get about £50 each a week [unemployment benefits] if they're single.' To access a fresh fruit and vegetable retailer may require a bus journey, yet return bus fares may be around £2 out of this £50 for a single person. For unemployed people this may be a strong incentive to shop locally and consume fewer healthy foods. In North Lincolnshire an elderly support group spokesman said: 'In a steel town such as Scunthorpe money is tight. The majority of people in this town have a miserly pension, and elderly people are going to try to get to [the cheaper supermarkets] and bypass corner shops to do so'. This implies that the less-well-off elderly who cannot access these 'cheaper supermarkets' may be pushed into consuming a less-healthy, more calorific, but possibly more expensive, diet based on what is available at small local shops.

Other constraints on a healthy diet. In other towns, cost constraints came in the form of limited accommodation, sometimes combined with cultural attitudes that deterred some men from attempting to cook and prepare healthy foods. A dietician in Norwich said

> asylum seekers in Great Yarmouth in bed and breakfast have no cooking facilities, or they have to queue for hours to get on the cooker, over four hours in one bedsit. Or they have to leave the bed and breakfast for seven hours during the day, so nowhere to cook, so they have crisps and fizzy drinks. Bosnian men, in their culture, don't cook, also North Sea oilmen. The poor here, have no space for a freezer to bulk buy food, but that would make food cheaper.

These populations are analogous to the poorer households in the affluent northern suburbs of

Leeds. They may be concealed within a larger population which has good food access, but none the less constitute a significant section of the community experiencing adverse access to healthy food. The disabled comprise another 'hidden' group facing dietary constraints based on what food they can access once in the home. An arthritis support agency in Scunthorpe commented: 'A lot of arthritis sufferers don't eat fresh fruit and vegetables because they can't afford to. A lot can't peel carrots or potatoes. They can't prepare them or cook them at home. They can't lift pans on to the cooker'. In addition, many local convenience stores, which may be the only ones accessible to a disabled person with no car, are too cramped to have room for anyone using a wheelchair or even a Zimmer frame. Many inner city convenience stores were originally built as houses with steps up to the shop door, a major obstacle to the disabled. Legislation is supposed to ensure disabled access to such premises but, if enforcement is lax, or funds for conversion are unavailable, many disabled will continue to face significant barriers to accessing local shops.

As with previous research, hitherto geographically invisible barriers to food access have emerged from the interview data. This paper now seeks to pull these together into a coherent classification that may be applied consistently across diverse national settings.

Towards a classification of food deserts

The Low Income Project Team defined food deserts as 'areas of relative exclusion where people experience physical and economic barriers to accessing healthy food' (Reisig and Hobbiss, 2000). This research has shown that 'physical' barriers may originate at many levels, from the physical ability of the consumer to the nature of the landscape they have to traverse to access food. What is a major obstacle for one household may be a scarcely noticed impediment for the next; often it is not the obstacle itself but the individual's ability to overcome it that is crucial to accessing healthy food. Similarly, economic or financial barriers may take many forms, from expensive bus fares to high prices in local shops to being unable to afford accommodation with food preparation facilities. There are also various psychological and knowledge barriers that deter some consumers from purchasing healthy foods that are physically and financially within their reach, ranging from a lack of cooking skills to preferences for and against certain foods, to the adoption of a time-poor but cash-rich lifestyle that allows insufficient time for preparation of healthy meals. The prevailing mental attitude of the consumer becomes the dominant influence over their food purchases rather than what foods that household might physically be able to access. In some households, individual household members, such as children, may have different opinions on what constitutes 'acceptable' foods from those held by the food purchaser, and in less well-off households, avoiding food wastage is more important than buying 'healthy' foods that will go to waste.

A threefold classification of 'ability', 'assets', and 'attitude'

This paper proposes that the concept of 'access' may be broken down into three contributory factors to access problems: 'ability', 'assets', and 'attitude'. These three factors are expanded upon below:

1. *'**Ability'** problems may be defined as anything that physically prevents access to food which a consumer otherwise has the financial resources to purchase and the mental desire to buy.* This factor would include personal physical disability, and also the physical lack of space in small local shops for disabled people. Also included are the physical problems some persons have with accessing food within the home; for example, difficulties with opening food packaging experienced by many consumers with arthritis. Some shoppers may experience 'ability' problems if the local geography, (e.g. road crossings), is inimical to their accessing shops, or if local hypsography renders shops inaccessible that could be reached if the landscape were flatter. Ability problems may also be increased by the weight of food to be carried home as well as the terrain it has to be carried across.

2. *'**Asset'** problems may be defined as lack of any financially valorisable asset that prevents consumption of food the consumer can otherwise physically access and has the desire to consume*. Such assets may be the money to pay for a bus fare or other travel to shops, or to pay for the computer or allotment needed to access food by electronic means or to grow it oneself; or to pay for the delivery charge levied by many internet-based food suppliers. Assets that are not directly in monetary form include the refriger-

ated storage space and access to cooking facilities lacking, for example, in the case of some refugees in Great Yarmouth.

3. '***Attitude'*** *problems may be defined as any state of mind that prevents the consumer from accessing foods they can otherwise physically bring into their home and have the necessary assets to procure*. This research has shown that such states of mind may include culturally based prejudices against certain foods, lack of knowledge as to how to prepare and cook some foods, or unwillingness to find time in a time-poor but cash-rich lifestyle to cook fresh vegetables. States of mind that debar food access may also occur when the consumer is reluctant to venture to physically accessible affordable shops due to fear of crime or cultural constraints on venturing out alone.

Uses of an 'ability / assets / attitude' differentiation of food access problems to differentiate various food deserts

This research has described a number of possible 'food deserts', including some where fruit and vegetable shops are present in abundance. The relative importance of ability, assets and attitude-based factors in creating these 'food deserts' may be categorized as 'high', 'medium' or 'low', according to the interview data supplied by these groups.

- '***High'*** *means the factor is the dominant cause of the food access problems suffered by that group, or at least co-equal with another factor.*
- *'**Medium'** means the factor is important, but not dominant in creating food access barriers.*
- *'**Low'** means the factor may be present, but is not a major influence in debarring access to fresh fruit and vegetables.*

These three categories have not, been quantified, in this research, but possible methods of doing this are discussed below.

The different food deserts described in Table 1 have been arranged in approximately geographical order, starting outward from the city centre. This order would probably apply to most UK cities, although there would be differences were this to be attempted for a North American or continental European city. In some USA cities, racial, ethnic and poverty-related factors are more prominent than in British inner city areas. Alternatively, in some European cities, particularly in France, city centre areas constitute high-class residential districts; poor and ethnic minority communities are often banished to the urban fringe. However, albeit in a different geographical order, similar food deserts might be expected in these cities too.

Using an ability/assets/attitude – based classification, Table 1 shows the food deserts that may be distinguished in Leeds and North Lincolnshire.

Contested food desert types

Evidence for some of these food desert types is stronger than for others. While most researchers would agree that Seacroft was a food desert, certainly before the arrival of the new Tesco supermarket, the inclusion of affluent 'docklands' executive flats is more debatable. However, if the inaccessibility of healthy food for the Beeston Hill white pensioners may be said to constitute an 'attitude'-based food desert, it could be argued that 'docklands' areas may also comprise an albeit unusual 'food desert' situation. The concept of south Asians living in areas with many independent grocers and yet failing to consume a healthy diet may also seem strange to some, but this problem was confirmed by several dieticians working in ethnic minority areas of Leeds and Scunthorpe.

Food deserts in affluent outer suburbs, although alluded to by Guy *et al*. (2004), may also be debatable. It may be pertinent to suggest that some people living in a wealthy area, distant from any grocery shops, could use the internet. Older residents, who are most likely to experience difficulties accessing remote shops, may also be in the best position to receive internet-based food deliveries, being at home during much of the day. However, pensioners are also less likely to have the technical expertise to order groceries via the internet or even to own a computer; physical problems such as poor eyesight may also militate against use of the internet, and the social interaction that physically visiting shops may provide is especially valued by some older persons. There may be financial issues concerning the affordability of a computer, or of paying delivery charges, often levied on the smaller orders pensioners are likely to place; one cannot assume that all pensioner households are as affluent as the average for a wealthy area, or indeed that all households in such an area are themselves affluent.

Overall, use of the internet for grocery shopping appeared to be low in Leeds, and was not mentioned by any of the respondents interviewed in

Table 1. Possible 'food deserts' in Leeds and North Lincolnshire

Type of area	Examples mentioned in text	Who may be affected	Relative importance of ability, assets, attitude
(1) City centre 'Docklands' flats	The Calls, Leeds	Young, single, cash-rich, time-poor executives	Ability – low Assets – low Attitude – high
(2) Inner-urban poor	East Park, Leeds	Elderly, disabled, mothers with children	Ability – high Assets – high Attitude – low
(3) Inner-city area with ethnic minority	Beeston Hill, Leeds Crosby, Scunthorpe	Ethnic minority community	Ability – low Assets – high Attitude – medium
(4) Inner city area with ethnic minority (as (3))	Beeston Hill, Leeds	Poor white pensioners retired *in situ*	Ability – medium Assets – high Attitude – high
(5) Student residential area	Headingley, Leeds	Pensioners	Ability – high Assets – medium Attitude – medium
(6) Peripheral suburb, local government rented housing ('conventional' food desert)	Seacroft, Leeds	The poor, those without access to cars, elderly, women in single-car households	Ability – high Assets – high Attitude – high
(7) Affluent outer suburbs	Cookridge and Alwoodley (Leeds)	Car-less households, no car due to age, disability, disqualification, accident, etc.	Ability – high Assets – low Attitude – low
(8) Poorer minorities in market towns	Great Yarmouth	Refugees, itinerant workers (e.g. North Sea oil workers)	Ability – low Assets – high Attitude – medium
(9) Periphery of small/medium-sized market towns	Brigg, Kirton Lindsey (North Lincolnshire)	Elderly, mothers, those without cars	Ability – high Assets – low Attitude – low
(10) Villages	Elsham, Barnetby, Bonby (Lincolnshire)	Elderly, others without cars, or in single-car households	Ability – high Assets – low Attitude – low

2002 as a means of grocery shopping. Using home delivery to purchase food may be socially divisive on access grounds. One shopper commented: 'We can't afford to order groceries on the internet because of the £5 delivery charge. We could use a taxi together but then we have to lug the shopping up all the stairs to the flats, because it's less than four floors they don't have to provide a lift. But if we could use the net then the delivery man would bring it upstairs for us'. The problem of an inverse relationship between needs of access and ease of access recurs here, with those able to afford internet delivery charges being also most likely not to live in deck access flats with no lifts, or in areas where crime makes walking to the shops more hazardous.

Various 'coping strategies' were employed by households to access food by less conventional means. One of these concerns a deprived area of east Leeds, Halton Moor (Fig. 2, squares N-7, O-7), in which an informal car boot sale of fruit and vegetables was held weekly by those who drove to a wholesale grocery market 3 kilometres away. 'Coping strategies' can greatly modify the access problems faced by consumers in a 'food desert' attempting to consume a healthy diet. However, the issue of coping strategies falls beyond the scope of this arti-

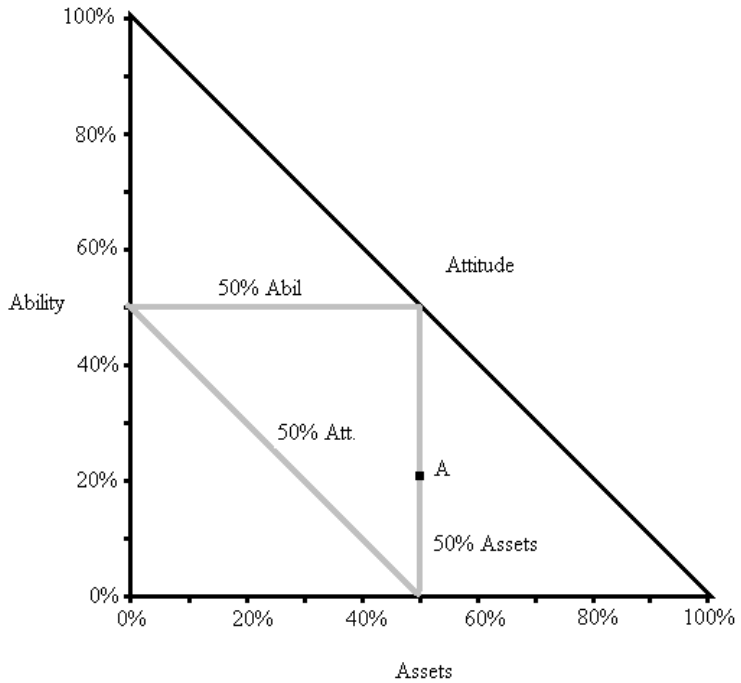

Fig. 4. Ingram-type ternary diagram with hypothetical 'food desert' plot; contributory factors, assets = 50%, attitude = 30%, ability = 20%

cle. Overall, the list of possible 'food deserts' proposed in this paper should be taken as exploratory rather than definitive, as is further covered below.

Limitations and possible further developments of the proposed classification of food deserts

Although Leeds has provided a useful representative sample of the neighbourhood types and socioeconomic groups found in most British cities, resource limitations precluded a comprehensive survey of rural food access situations beyond North Lincolnshire. Lincolnshire villages are predominantly travel-to-work areas for the larger settlements of Doncaster, Grimsby, Lincoln and Scunthorpe. Other rural areas may present rather different food environments; the mining villages of Durham may contain more households in poverty, while holiday homes are common in other countryside locations. The 'deep rural' areas of the Scottish Islands likely present another form of rural 'food desert' for some. Access from North Lincolnshire villages is not especially limited by hypsography, but in areas such as the Welsh Valleys, access is highly linear in certain directions. It is possible that future research in these areas may increase the numbers of food desert types listed above.

Besides widening the taxonomy to include more neighbourhood types, the classification may be deepened to put more precise values than high/medium/low on the causative factors of ability/assets/attitude. Because some of the factors creating food deserts are subjective, one approach could be to survey the potentially affected group and ask each respondent to rank on a 1–5 Likert scale their perceived importance of each factor. For example, 50% of the south Asians in Beeston Hill might rank low pay/poverty [assets] as 5 [most important] as to why they do not consume a healthy diet; whereas 30% might put fear of crime or reluctance to venture to unfamiliar places [attitude] as the most important factor. Rankings of all factors mentioned by Likert scale number could then give a phenomenological 'weight' to the three classification factors. Other ways of placing numerical values on ability/assets/attitude could be according to the extent to which each factor individually hinders consumption of the various elements of a healthy balanced diet; alternatively the 'cost' of coping strategies that individuals are forced to employ because of each factor could be the yardstick. 'Cost' would need to be wider than monetary value alone, including, for example, social capital used in requiring friends and relatives to bring in groceries. One

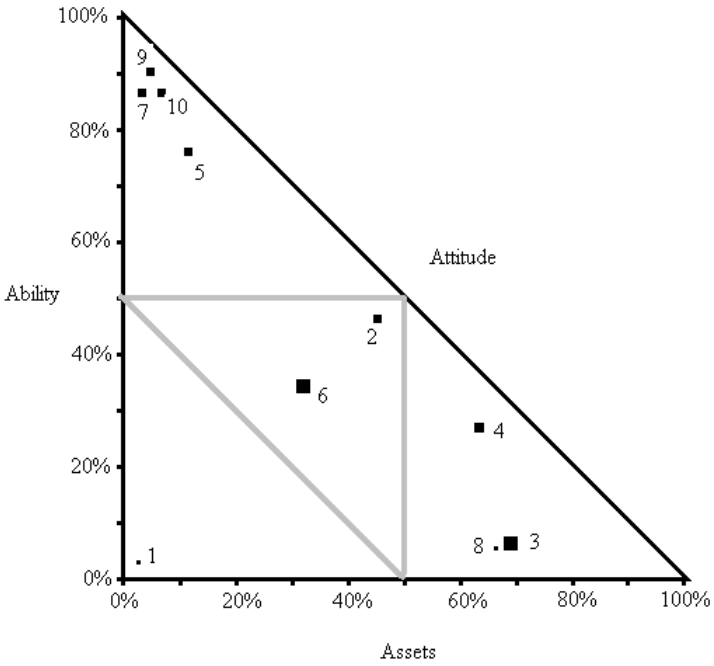

Fig. 5. Ingram-type ternary diagram showing possible food deserts in Leeds and North Lincolnshire; plots adjusted for likely 'size' of food deserts

method, with direct links to funding costs, would be to estimate the cost of alleviating each factor alone; for example, cost of education to alleviate 'attitude' barriers, or altering the physical infrastructure to alleviate 'ability' problems, or tax/benefit redistribution to tackle 'asset'-based difficulties.

Each of these methods would be costly in terms of research resources, and a simple method of plotting both the initial food access situation and how any improvements were progressing would be a useful policy tool. One such method might be the application of ternary diagrams. However, conventional ternary diagrams, with their axes at 60° rather than a more conventional 90°, can be hard to read. Ingram (1984) has suggested an alternative ternary diagram, (reproduced in Fig. 4), where two of the axes are at the conventional 90°, and the third is derived diagonally. Figure 4 is derived from Ingram's ternary diagram, with the lines for 50% ability, assets and attitude added. Plotting the hypothetical food desert mentioned in the previous paragraph, with assets = 50%, attitude = 30%, and ability = 20% on such an 'Ingram' ternary diagram, would give point A on this diagram.

Plotting food deserts on this type of diagram can show their 'position' at one point in time, but may not show progress in reducing their causal factors; for example, if all the causative factors of the Seacroft food desert in Leeds (ability, assets, attitude, all 'high') were reduced, or the number of households affected were to fall, the plot position of this 'food desert' might not change much. Further dimensions may be added to the ternary diagram by, for example, altering the size of the plot points to reflect the number of households affected by unsupportive food environments. Other factors could be shown by different coloured or different shaped plots, adding several more dimensions to the three axes of ability, assets and attitude.

A prospective plot of the ten food desert types mentioned above is shown below, with the size of plot adjusted for likely household numbers in each 'food desert' in Leeds/North Lincolnshire. Numbers by each plot correspond to the numbers of the possible 'food desert' types listed in Table 1.

As may be seen in Fig. 5, progress towards alleviating food deserts would be indicated not by changing position of the plots but by their shrinking in size, and possibly even vanishing from the diagram altogether. If a more quantified version of this diagram held true for a city such as Leeds, the cluster of plots in the top left-hand corner suggests a need for initiatives to alleviate ability-based problems, but the large plot (No. 3) also suggests assets-based factors as a barrier to healthy food for some. Differ-

ent cities would each have their own version of this diagram, indicating what types of initiatives were needed and where these could be implemented.

Conclusion

The nature and very existence of 'food deserts' remains contested territory, perhaps partly because the term 'food desert' is, as Wrigley (2002) stated, imprecisely defined and liable to be used in a loose, even rhetorical way that blurs any meaning it might have. Some researchers have doubted the true reality of food deserts, perhaps because discount supermarkets and small independent grocers are more plentiful in certain deprived areas compared to some more affluent areas. Others contend that poverty or other barriers do create food deserts, or alternatively that consumer attitude to food is the main cause of failure to consume a healthy diet. The food access study of Newcastle (White *et al*., 2004) concluded that food deserts do exist – at least for some. Classifying 'food deserts' according to their causative factors may facilitate the development of a more precise definition, or perhaps suggest an alternative name for the unsupportive food environments, for example, 'food denial situations', where 'denial' includes 'self-denial'. This would cover the 'attitudinal' situations described above where consumers have physical and financial access to a healthy diet but choose, for reasons of time pressure, lifestyle or cultural preferences, not to purchase healthy food. This is a very different situation from consumers in deprived neighbourhoods who cannot afford either healthy food or the travel required to purchase it, but ultimately the medical problems of failing to consume a healthy diet are similar, whatever the reason for non-consumption.

More importantly, the recognition of different types of 'food deserts', 'unsupportive food environments' or 'food denial zones' may facilitate a more efficient use of funds to alleviate the health problems this phenomenon causes, as well as highlighting the wider range of agencies that may need to be involved in tackling each sort of 'food desert'. Cummins *et al*. (2005) call for a joint approach of 'changing knowledge and access simultaneously' to improve diet and reduce health inequalities. Discriminating between different kinds of food deserts may ultimately facilitate the holistic and joined-up approach towards alleviating the effects of an unhealthy diet that many researchers have called for.

Dr Hillary J Shaw
School of Geography
University of Southampton
Highfield
Southampton
SO17 1BJ
United Kingdom
E-mail: h.j.shaw@soton.ac.uk

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