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Flood Warning for Vulnerable Groups:
A review of literature

R&D Technical Report W5C-018/1

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Flood Warning for Vulnerable Groups: A review of the literature

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Statement of use
This report provides us with information about those groups most vulnerable to flooding. It considers their vulnerability in terms of their awareness of being at risk and their ability to respond to and recover from a flood event. The information helps us to target messages to these vulnerable groups to help them prepare for a flood event. It provides useful supporting information for planning communications with and flood warning services for the most vulnerable groups.

Keywords
flooding; flood warning; vulnerable; older people; parents; children; tenants; mapping; socio-economic; flood recovery

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CONTENTS

		Page No
1	Introduction	2
1.2	Background	2
2.	Vulnerability to Natural Hazard Events	3
2.1	Vulnerability – Defining the Terms	4
3.	Categories of Vulnerability	6
3.1	Social Exclusion	7
3.2	The Nature of Vulnerable Groups	7
3.3	Age	8
3.4	Gender	9
3.5	Race and Ethnicity	10
3.6	Socio-economic Factors	11
3.7	Disability, Infirmity and Long-Term Sickness	12
3.8	Special Needs Populations and Locations	13
3.9	Mobile and Holiday Homes	13
3.10	Transient Populations	13
4.0	Conclusion	14
	References	15

1. INTRODUCTION

This document forms the first of a four part Final Report of research commissioned by the Environment Agency that examined vulnerability with regard to flood warning and flood event[1]. It comprises a review of the body of published literature covering issues of social inequality in natural hazard research. After a brief overview of the background to the research study (Section 1.2), the literature review is presented in three sections. Section 2 explores the concept of vulnerability in relation to natural hazard events. The categories and characteristics of vulnerability found to be particularly at risk in terms of natural hazard and hazard warning are outlined in Section 3. Section 4 serves as a brief conclusion.

The aim of this report is to review and synthesise the existing literature on issues of social inequality in natural hazard research. Its purpose was three-fold: to identify what is currently known and what remains to be investigated; to provide a basis for the second stage of the research study by highlighting appropriate targets and discussion topics for interviews with key informant and victims of flood (see companion Report W5C-018/3); and to identify existing and potential social indicators for use in secondary data analysis (see companion Report W5C-018/2). Its intention was to be thorough and inclusive without the unnecessary rehearsal of material already well known to the Environment Agency.

The starting point for the literature review was a reading of reports provided by the Agency to ascertain the extent of research findings already known to them, widening the search to find any follow-up studies and research in progress. This was followed by a search of libraries, relevant websites and on-line electronic databases, including Ingenta, Bids and Web of Science.

1.2 Background

Approximately five million people in England and Wales are at risk of flooding, yet only one in ten is likely to know what to do in such circumstances (BBC Radio: 'Today': 16.9.2001). The Environment Agency, formed in April 1996 and incorporating the former National Rivers Authority, now takes the lead role in disseminating flood warnings to those at risk of flooding; its eight regions bear responsibility for issuing flood warnings directly to the public, and to police, local authorities and media to cascade in their own region. Direct warnings can be given to at-risk households and businesses via methods such as automatic voice messaging (AVMs), flood wardens, sirens and dialled flood information services (*Floodline*).

The Bye Report to the Environment Agency, an independent report on the Easter 1998 flooding, highlighted the need for improvements to existing information and communications systems with regard to flooding in the United Kingdom (Bye and Horner, 1998). The Agency is currently working on a ten-year strategy to improve its flood warning service to ensure that sufficient and appropriate information reaches those who need it; an annual programme of research is already in progress, monitoring awareness of the flood warning service amongst the general public of England and Wales and at-risk populations (British Market Research Bureau, BMRB 1997-2001). In addition, the Agency commissions surveys to measure the effectiveness of its flood

[1] This research project was funded jointly as part of the Environment Agency and DEFRA Research and Development Programme for Flood and Coastal Defence, under the Flood Forecasting and Warning Theme.

warning service following a flooding event (Post Event Surveys, BMRB 1997-2001). Wherever possible, the Agency provides a direct flood warning service for 'at risk' properties; however, for a proportion of the 1.9 million at-risk properties in England and Wales, the Agency does not currently have the necessary telemetry to provide a direct flood warning service and residents must therefore rely on general warnings broadcast on national and local television and radio.

There is a need for further research in order to improve flood warning dissemination still further (see Penning-Rowsell and Tunstall, 1997; Tapsell et al, 1999; Tapsell, 2000). In accordance with conclusions from a scoping study prepared for the Environment Agency by MXC Communications (2000), the Agency is also cognisant of its responsibility to improve its communications with disadvantaged groups, targeting messages to the needs of the particular group in point. As part of a commitment to improve its service further, and in line with its policy of addressing vulnerability, social inclusion and equal opportunities, the Agency commissioned this investigation of groups within the general population who may be particularly vulnerable with regard to flood warning dissemination.

2. VULNERABILITY TO NATURAL HAZARD EVENTS

The popular notion of hazards such as floods is that they act as a social leveller, affecting all residents of the stricken area indiscriminately. Research evidence suggests, however, that this is far from the case. As Cutter and her colleagues have noted, the degree to which people are vulnerable to natural disasters is not dependent simply on proximity to the source of threat (Cutter et al, 2000); even though many people may experience the same flood, in the same area and at the same time, their perceived and actual levels of suffering are likely to differ greatly. Natural hazards are not merely physical events; as Weichselgartner (2001) states in his recent paper on disaster mitigation, any so-called 'natural' disaster is an interaction of physical change and social conditions, which may in turn be viewed differentially according to the time and space in which it occurs, and may thus more accurately be interpreted as a social phenomenon.

The work of many authors has highlighted the fact that vulnerability to disaster is socially constructed (see Blaikie et al, 1994; Wisner et al, 2003; Morrow, 1999; Cutter et al, 2000). The experience of hazard events is influenced at least in part by "deeply embedded patterns" based on demographic and socio-economic class (Enarson and Fordham, 1999). Such divisions will demonstrate their effect on vulnerability in a multiplicity of ways. As far as flooding is concerned, they will impact upon the risk of experiencing a flood event; on perceptions of risk and response to risk communication (in this case to flood warning); on physical and psychological recovery from the after-effects of flooding; and upon the degree to which an individual is able to engage in community reconstruction (Blaikie et al, 1994; Wisner et al, 2003; Peacock et al, 1997, Enarson and Morrow, 1998). Indeed, it has been argued that since the damage potential of hazards exist only in the presence of a vulnerable community, the adverse effects of such events can be diminished by reducing levels of vulnerability (see Hewitt, 1983; Brown and Damery, 2002).

It is due to an increasing acceptance of the social nature of disasters that a consideration of vulnerability (perhaps more accurately termed 'social vulnerability') has for some

time been seen as a necessary part of effective disaster management and mitigation (Buckle et al, 2000). This has in turn uncovered the need to identify those groups in society who are especially prone to suffering the adverse effects of natural hazard (Salter, 1997). It is, however, of considerable import that vulnerability to hazard is seen not as a discrete phenomenon but as an inseparable component of vulnerability in everyday living (Fordham, 1998).

2.1 Vulnerability - Defining the terms

Before considering the research findings that identify which groups are particularly vulnerable in terms of flood and flood warning, it may be helpful to define what is understood by the term 'vulnerability'; as Cutter (1996) demonstrates, however, arriving at a simple explanation is not an easy task for the concept has multiple definitions (see also Cutter et al, 2000). From an environmental hazard perspective, vulnerability has frequently been considered purely in terms of loss of property or of life (see Cutter et al, 2003). In this context, although often taken to be an absolute measure of loss, it is important to consider the *relative* vulnerability of different groups since actual levels of loss (which may perhaps appear to be slight) are greatly increased where there is an inability to make good those losses or to maintain acceptable living conditions.

Blaikie et al (1994), in their account of natural hazards and disaster in the third world, offer a wider yet relatively simple working definition of vulnerability:

> *"By vulnerability we mean the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete and identifiable event in nature or in society". (p.9)*

Certain of these factors are demographic: age; gender; race and ethnicity; class and caste for example (see Blaikie et al, 1994; Wisner et al, 2003; Enarson and Morrow, 1998; Perry and Lindell, 1991; O'Brien and Mileti, 1992). Others, also fundamental in understanding the causes of human vulnerability, include insufficient access to resources, information and knowledge, and a lack of political power and representation – all of which will in their turn be influenced by the factors mentioned above (Cutter et al, 2003; Blaikie et al, 1994; Wisner et al, 2003). For many years, researchers have noted that vulnerability to natural hazard is affected by social and political decisions concerning housing: population density; urban development; racial or ethnic bias reflected in 'redlining neighbourhoods'; and economic barriers to safe housing (eg: White and Haas, 1975; Enarson and Fordham, 2001; Cova and Church, 1997; Cutter et al, 2000; Cutter et al, 2003).

In a paper setting out new approaches in the area of emergency planning, Buckle et al (2000) remind us that vulnerability is also dynamic, varying not only within categories but over time and according to the characteristics and circumstances of the individual. Experience of hazard can in itself cause or exacerbate vulnerability, giving rise to what has been termed a "ratchet effect" (Chambers, 1983). Though there are clearly several stable characteristics that may render an individual or group more prone to vulnerability (gender being an example), it is important to bear in mind the wider context. Locality forms yet another dimension of vulnerability, though it is too simplistic to assume that

places most at risk from a biophysical standpoint will necessarily correlate with most vulnerable populations (Cutter et al, 2000): rural and remote area dwellers are likely to experience greater difficulties in accessing services and support than their urban counterparts; and the presence of place-specific hazards such as proximity to chemical or toxic waste plants may pose an added risk (Buckle et al, 2000; Blaikie et al, 1994; Wisner et al, 2003).

Buckle and his colleagues are critical of "simple typologies" of vulnerability that ignore these temporal, spatial and socio-economic factors. They favour instead "a framework which includes multiple levels of social life", and stress the need to consider the wider community and environment since damage to infrastructure, services or economy is likely to increase the vulnerability of its members (Buckle et al, 2000). Vulnerability to hazard is embedded within the resistance and resilience of at-risk populations; it is a compound phenomenon in which multiple factors coexist, intensifying the hazard experience by impacting negatively on the community's (and the individual's) capacity for recovery and ability to resist its negative effects (Brown and Damery, 2002). Community networks and relationships, if disrupted, will adversely affect coping and support systems on both a community and a personal level (Buckle et al, 2000) and, in turn, the community's vulnerability or resilience to hazard will be affected by the attitudes and values of its members (King and MacGregor, 2000). Post-disaster changes (damage to homes, livelihoods, social networks) as well as changes in the economic, environmental or social climate may therefore generate new conditions of vulnerability.

Other levels of vulnerability, though perhaps not all easily addressed, are nonetheless important in informing policy and practice. Kasperson et al (1988), in their discussion of the social amplification of risk, draw our attention to the fact that public responses to various hazard events can be either attenuated or tempered by an interaction between the risk itself and various social, cultural and institutional processes. Effective mitigation policies and practices can reduce risk (Cutter et al, 2000) and media and other social representations of flood events can play a key role in the formation of public perceptions.

A full discussion of vulnerability should not, however, be limited to politico-socio-economic or demographic issues. One other important area in which people may exhibit vulnerability involves intra-personal or psychological factors. Whilst less clear cut than many of those mentioned above (and certainly less easily identified), these factors may play a vital part in the public's interpretation of flood-warning messages and are thus useful in informing the way such messages are constructed. There is a considerable body of literature relating to those psychological factors which may affect the individual's outcome in relation to natural hazard: of particular importance here are those which impact upon responses to warning of hazard events.

Perception of risk is an important component of the decision process determining the action taken on receipt of flood warning (Tunstall and Parker, 1999; Tunstall et al, 2000). From the considerable body of literature on risk perception (eg: Slovic, 2000; Pidgeon et al, 1992), it is worth noting that not all risks are actually perceived as such and that the probability of risk, too, is frequently underestimated (eg: Blomkvist, 1987; Slovic and Lichtenstein; 1971; Bratfisch et al, 1971; Lundberg and Elleonen, 1976). As Bjorkman (1987) notes, individuals have a strong need for control over "environmental uncertainty", a need which he suggests is primitive in its origin. Active planning for

such uncertainties can, however, result in an exaggerated feeling of mastery over future events, an illusion of control which can affect a person's perception of and reaction to hazard risk with potentially adverse results (eg: Cohen, 1960; Howell, 1971; Howell, 1972).

Other biases capable of introducing error into the process of risk perception include 'optimistic bias', which in the context of threat is sometimes referred to as 'perceived invulnerability' (see Weinstein, 1980; Rothman, Klein, & Weinstein, 1996). This phenomenon is moderated by prior experience and by perceived lack of control; unrealistic optimism is less likely when the risk is considered to be beyond the control of the individual and where there is first hand experience of the hazardous outcome. Helweg-Larsen (1999) found less evidence of optimistic bias in respect of earthquake survival in the aftermath of the 1994 Northridge earthquake in California even though the sample still displayed an optimistic bias with respect to other hazards. There is, however, no consistency in the effect of prior hazard experience. As Tunstall et al (2000) have noted in their Scoping Study for the Environment Agency, the need for further research into the risk perceptions of potential flood victims is clear.

Denial and disbelief, coupled with a tendency to act in accordance with the normal routine, are common responses to hazard warnings (Drabek, 1986). This can sometimes be explained, at least in part, by a stoical desire to remain in control and to avoid panic (King, 2000). There are other reasons too why many people tend to deny the likelihood of environmental risk. Strong attachment to a locality is a case in point. Work by Bonaiuto et al (1996) demonstrates that attachment to a particular locality tends to influence the resident's environmental evaluation of that place; the authors interpreted the denial of physical assessments of, in this case, pollution, as a strategy to cope with threatened place identity. Intra-personal factors may also inhibit appropriate action on receipt of warning; there is, for example, a link between risk perception and anxiety whereby very high levels of anxiety may paralyse action and reduce clarity of thought (Lyttkens, cited in Sjoberg, 1987). The fact that people are differentially responsive to risk communication introduces yet another layer of complexity. It is recognized that information, such as that contained in hazard warning for example, is frequently acted upon in a way that 'experts' might find unexpected (see Scanlon, 1990); however, what is often ignored is that members of the at-risk public, far from being ignorant or illogical with regard to their understanding of and reaction to risk, may well be experts themselves as a result of their contextualised local knowledge (see Irwin and Wynne, 1996).

It becomes clear then that vulnerability is a multi-faceted, complex and dynamic concept, not determined simply by personal and demographic characteristics but by social, political, cultural and economic conditions, all of which are deeply embedded in community. There is, therefore, a need for those responsible for the preparation and dissemination of hazard warnings to be alert and sensitive to these levels of complexity.

3. CATEGORIES OF VULNERABILITY

Typically, social vulnerability research reveals groups of people who are categorised as particularly at risk in the face of natural hazard. Indeed, in the context of flood victims, Blaikie et al (1994) would argue that vulnerability will be present in all cases; what is important is to uncover those who are more at risk than others. Much of this work has

been carried out in the third world context. Blaikie and colleagues (1994) found that key characteristics of vulnerability in third world countries included age, gender, class, caste, ethnicity, poverty and disability (see also Wisner et al 2003). Though these findings *per se* cannot be extrapolated to the Western world (and there is as yet only a small body of literature pertaining specifically to flood events and vulnerability within the United Kingdom), data from Australian, American and UK researchers support the presence of certain hazard-vulnerable groups in these populations, and it is these very characteristics which (with the exception of caste) appear common to both Western and third world countries (see Buckle et al, 2000; Cutter et al, 2000; Tapsell et al, 1999; Tunstall and Parker, 1999; Green et al, 1985). These characteristics are also descriptive of groups who commonly fall into the category of the socially excluded.

3.1 Social Exclusion

Extensive work within the US has demonstrated that the experience of many environmental problems is unequally distributed; for example, poor and minority ethnic communities are often disproportionately exposed to environmental health risks from hazardous facilities and waste sites (see Bullard, 1993; 1999). Research suggests that a similar correlation between social disadvantage and environmental hazard may exist in England and Wales (McLaren et al, 1999; Burningham and Thrush, 2001). Authors of a recent report for Friends of the Earth, for example, claim that 'almost two thirds of the most polluting industrial facilities are to be found in areas of below average income' (Mclaren et al, 1999:1). Poorer people, then, tend to be subjected to greater risks and impacts from pollution and have less control over their environment. Whilst the bulk of UK research on social inequalities in environmental terms has focused on living close to hazardous facilities, there is as yet little information available on the social distribution of flood risk. The question remains unclear as to whether or not flooding is yet another environmental hazard that is unequally distributed within the United Kingdom. There are, however, overviews of inequalities in awareness of flood risk and ability to respond appropriately to flood warning (see Tunstall et al, 2000 and Tunstall and Parker, 1999). Amongst the groups these authors nominate as particularly vulnerable are many who can be defined as socially excluded: the unemployed, those on low income; single parent households; members of minority ethnic groups; older people; and those with a long term illness or disability.

3.2 The Nature of Vulnerable Groups

Before embarking on any further discussion of vulnerability in relation to flooding, it is important to highlight a caveat with regard to the nature of the groups themselves. It is, of course, a truism to say that these populations do not represent homogeneous groups; each one, though unified by its principal descriptor (gender, race and so on), will contain a wide and disparate range of other characteristics. Minority ethnic groups within the UK alone will include Indians, Pakistanis, Bangladeshis, Africans, Afro-Caribbeans, Chinese and Vietnamese with attendant differences in culture, religion and language (Petts and Leach, 2000). The disaster research literature applies the ‘older people’ category to people aged fifty-five and above, yet not all will fit the stereotypical picture of the frail and impoverished older person. Chronological age does not in itself engender vulnerability but interacts with many other factors: for example, pre-existing health and fitness; mobility; income; and family support. Levels of disability and impairment will vary considerably, as will the amount of social and financial support available to a sick or disabled person. All these and other variations will impact

differentially on levels of vulnerability and many of them are likely to be changeable over time.

The unit of analysis in assessments of vulnerability must also be considered. Just as groups are heterogeneous, so too are households; most people will experience and respond to a hazard event as a member of households (Morrow, 1999) yet not all members of the household will experience it in the same way; women and children, for example, will often bear the brunt of the hazard experience. The findings that appear below should therefore be interpreted in the light of these comments.

What follows is a brief overview of each of those groups that have been identified as vulnerable in terms of flood hazard. Much of the material on variance in awareness of flood warnings and in ability to respond has already been covered in comprehensive reviews of the academic and practitioner literature available to the Environment Agency (see Tunstall et al, 2000; Tunstall and Parker, 1999; also Tapsell et al, 1999; Tapsell, 2000). There would appear to be relatively little new UK research in this field at the present time.

3.3 Age

The two extremes of the age span render an individual more vulnerable to damage, loss or suffering in the face of natural hazard. In terms of flood warning dissemination, however, it is assumed that the very young will not be key actors in flood response, though it is acknowledged that their presence is likely to influence the perceptions and behaviours of their carers before, during and following flood event. This section will therefore deal only with findings concerning older age groups.

Findings from 'At Risk' Surveys conducted for the Environment Agency (i.e. BMRB, 1998; 1999; 2000) show that residents in some flood zone areas tend to be older than the national population; many coastal areas, for example, are popular with retired people. There is much research to demonstrate that many older people have a disproportionate vulnerability to the effect of disasters, with those who are frail or disabled being particularly at risk (see Tapsell et al, 2002; Tapsell et al, 1999; Tunstall and Parker, 1999); given the growth in the UK's older population, this could represent a significant problem for disaster management in years to come.

Older people are likely to suffer (and perceive) a greater relative loss from natural hazard events (Ngo, 2001). Those who have suffered any adverse physical effects, and older people are at greater risk of such harm than younger people (Green et al, 1985), perceive their losses as more severe even if levels of actual loss are equivalent (Ngo, 2001).

Although there are many characteristics which might increase psychological vulnerability (fewer resources; living alone; reduced social networks), older people often have life experiences which act as mechanisms to reduce rather than exacerbate psychological distress after a disaster (e.g. Ngo, 2001). This resilience may, however, act to inhibit appropriate action on receipt of hazard warning; life experience and a strong sense of independence are cited as characteristics associated with failure to heed warnings or orders to evacuate (Perry and Lindell, 1997).

Whether or not older people (or some sub-groups amongst them) are less likely to receive warnings is, as yet, not fully understood. There is also a clear need for further research into this heterogeneous age group in order to help determine which particular groups are most at risk.

3.4 Gender

As Tunstall and Parker (1999) have noted, the majority of gender-related work in the field of natural hazard has its focus either on physical and psychological impacts or on the role of women in response and recovery (eg: Enarson and Fordham, 2001). These authors have furnished a comprehensive overview of the many and varied reasons underlying gender differences in these areas: these include socio-economic and political positions; their reproductive and caring role; and the amount of time spent in the home.

Work by Enarson (2000) confirms that women tend to recover more slowly than men from natural disasters, even in Western societies. She highlights many barriers to women's recovery. Some are economic (despite the fact that women are important economic actors throughout the disaster cycle): women in low-paid or part-time employment are less likely than men to receive wage or benefit payments whilst involved in the lengthy and often arduous work of recovery; insurance and government relief cheques are usually in the male partner's name. Others are a result of an unbalanced power structure: women are more involved in the work of recovery, obtaining relief and 'rebuilding' the home, yet have to deal with male-dominated authorities and institutions which are not always sympathetic to their needs (Enarson, 2000); single women were found to be particularly disadvantaged in this regard (Tapsell et al, 2002). Even UK emergency services (again male-dominated) have not always been found to have treated women flood victims with sympathy and understanding (Fordham and Ketteridge, 1998; Tapsell et al, 1999).

Third-world research, too, teaches us that economic and cultural systems are usually male-dominated, despite the fact that disaster recovery is disproportionately conducted by women (Wisner et al, 2003; Blaikie et al, 1994). It is therefore likely, though of course not inevitable, that women in some minority ethnic households in the UK will be additionally disadvantaged by their own cultural traditions and expectations. Research with Asian women in Banbury (Tunstall and Parker, 1999) revealed that risk of flooding in a technologically advanced country such as Britain was deemed to be non-existent; moreover, these expectations result in considerable disappointment at what they perceive as failure in the warning and management of flood events.

As well as suffering the emotional impact of flood events themselves, women carry the primary responsibility in caring for other family members whose health or psychological well-being may have been damaged. For many women, care-giving arrangements (child-care, day centres for older relatives) may have been disrupted by relocation, making their lives all the more difficult. In an examination of the Australian hazard literature, Buckle et al (2000) found that single parent families (who tended to have low incomes and considerable time constraints) were especially vulnerable in terms of their ability to cope with the aftermath of disaster. Enarson (2000) draws our attention to demographic trends in longevity: more older women than men live alone, and there is evidence to show that female-headed households are less able to receive or act appropriately to warning and recovery information as well as suffering

disproportionately after flood events (eg: Morrow, 1999; Enarson, 2000; Tapsell et al, 1999; Tapsell, 2000).

From the growing body of knowledge on gender and flooding, it is clear that women experience flooding differently from men in many ways (see Fordham and Ketteridge, 1998; Enarson and Morrow, 1997; Tapsell et al, 1999; Enarson and Fordham, 2001; Tapsell et al, 2002) but the study of gender issues within the UK is as yet limited. As Tunstall and Parker (1999) note, there is a particular dearth of work on gender differences in the area of flood warning although there is some evidence from American studies to suggest that women are more responsive to warnings (Fothergill, 1996) and more willing to evacuate their homes than men (Drabek, 1986). Further work is necessary to determine women's responses to flood warning in this country and to investigate which particular groups of women are most vulnerable.

3.5 Race and Ethnicity

Racial and ethnic divisions have long been recognised as a dominant factor in vulnerability (see Wisner et al, 2003). In a review of disaster research addressing issues of race and ethnicity in America, however, Fothergill et al (1999) found little attention given to social inequity arising from vulnerability to natural hazards despite considerable concern regarding inequity from technological risks (e.g. Bullard 1990 and 1999). The authors concluded, however, that vulnerability to and risk of disasters is increased for racial and ethnic communities in the US. There is also some evidence from Australian and American research that minority ethnic groups may be differentially affected in terms of flood warning. In the Alice Springs floods of 1985, Aboriginal residents were the worst hit, partly because radio warnings were not issued on channels customarily heard by this population (Hazards Panel Newsletter, November 1985). In a study of US employees' hurricane warning and evacuation responses, Drabek (2001) found that employees from minority ethnic groups were particularly liable to suffer high levels of family and work-related tensions during the evacuation period.

There are various reasons that may explain these particular vulnerabilities, a poor command of the English language being only one. Despite the fact that recent Environment Agency research found that only one in over a hundred flood victims did not have English as a first language (BMRB, 2000), this figure may hide a far greater language barrier than might at first appear; the BMRB surveys did not examine fluency in English nor did they take account of concentrations of minority ethnic groups in areas particularly at risk of flood (Tunstall and Parker, 1999).

The Environment Agency disseminates flood information in seven different languages, yet minority ethnic groups often report difficulties in accessing appropriate information, services and support (Tapsell et al, 1999). Many Asian women, though more likely to be at home to hear radio broadcast warnings, tend not to listen to radio programmes particularly as there are few British channels catering mainly for non-English-speaking minorities (Tunstall and Parker, 1999). Reading skills in English (and sometimes in the mother tongue) may also be poor in some minority ethnic groups, particularly amongst women (Tunstall and Parker, 1999). Flood events themselves may be interpreted differently (Schmuck, 2000) and an awareness or expectation of hazard may be lower in some of these groups than in the general population (Tapsell et al, 1999), a factor that may compound the already 'normal' bias towards denial and disbelief on receiving a

flood warning. Even one year after the Banbury floods, a follow-up study of the Asian population found little knowledge of flood alleviation or flood warden schemes amongst non-English speakers, nor even an awareness of Asian flood wardens in the area (Tapsell, 2000). Language barriers and a sense of isolation from the wider community have serious implications for receiving flood warnings as well as for post-disaster support.

A study of the impacts of flood on an Asian community in Banbury found that adverse effects were exacerbated by several factors including language and economic difficulties and a lack of knowledge of the system for protection and recovery (Tapsell et al, 1999). Cultural differences may make social support networks more difficult to access, despite the presence of large and extended family systems: women may be chaperoned or even confined to the home; hidden feelings lead to increased stress, and to feelings of neglect and isolation (Tapsell et al, 1999). Religious factors, such as an acceptance of disaster as an Act of God, may partially explain differences in responses to flood warning and the experience of flooding (Schmuck, 2000).

Apart from the findings of the study conducted by Tapsell and her colleagues (1999), there is currently little research on ethnicity and flood warning in the UK; this highlights a need for further work in this area, particularly in the field of flood warning dissemination.

3.6 Socio-economic factors

Blaikie et al, (1994) state that the most vulnerable groups are those that find it hardest to rebuild their lives after a disaster. As these authors have noted, vulnerability in third world countries is closely correlated with socio-economic position; although clearly not invariably so, the effects of hazard usually impact more heavily on the poor.

3.6.1 Financial resources

Many researchers have highlighted the notion that natural hazard impacts more severely on poorer people (eg. Morrow, 1999; Bolin and Bolton, 1986). Actual levels of loss, often lower than those of wealthier households, are less easily remedied due to limited access to appropriate resources; financial reserves or access to credit are a case in point. Although a phenomenon not restricted to poorer households, an insufficiency or lack of insurance has also been found to heighten the adverse effects of flooding (Fordham and Ketteridge, 1995). Costs associated with alternative accommodation during the flood recovery process hits hardest at those least able to cope. The potential for increased transport costs associated with relocation or evacuation will impose an additional strain on an already disadvantaged household, a burden that is disproportionately felt by poorer people (see Lucas et al, 2001).

American researchers have also found evidence of social exclusion in disaster response, with low-income and ethnic minority groups receiving inadequate levels of support and relief (eg: Bolin and Stanford, 1998; Kaniasty and Norris, 1995); Tapsell (2000) suggests that the lower-income victims of the Banbury and Kidlington floods may also have received inadequate levels of support and disaster relief. There is, however, little known about socio-economic factors in relation to flood in this country and there is an urgent need to collect and explore data which will allow a fuller understanding of these issues.

3.6.2 Housing

Inequalities in housing are a reflection of inequalities in income and wealth (Huby, 1998). For many people, access to housing is restricted both in type and in location, with the result that those least able to exercise choice accept properties that others are able to refuse (see Huby, 1998). In addition, poor people are less likely to be in a position to move away from a hazardous environment. As Leather and Morrison (1997) have commented, the worst housing is lived in by the poorest people. Pensioners, minority ethnic households, young single men and households headed by older women also fall into those categories most likely to live in unfit or vulnerable homes; many of these properties will be at particular risk of flooding. Such homes include caravans or mobile homes (King, 2000; Tunstall and Parker, 1999) and bungalows (King, 2000). Since most of these groups are already vulnerable to flood events (see Tapsell et al, 1999), their health and psychological well-being is likely to be compounded still further by pre-existing conditions of cold and damp.

UK research suggests that there is a link between dwelling type and severity of flood impact (Parker et al, 1987); further investigation is needed here.

3.6.3 Education

Lower levels of education, which frequently correlate with other measures of disadvantage, may heighten vulnerability for many people, particularly where dissemination of written information is concerned. In an assessment of environmental impact statements on citizens in Illinois, Sullivan et al (1996) found that reading ability was closely linked with understanding. Education, coupled with knowledge of natural disaster warning systems, was also found to be a key predictor of shelter-seeking behaviour (i.e. appropriate behaviour) following a tornado warning in Alabama (Liu and Quenemoen, 1996). Little is known about this factor in terms of UK research on flooding.

3.7 Disability, Infirmity and Long Term Sickness

In the third world context, research findings have highlighted disability as one of the key characteristics of vulnerability to natural hazard (e.g. Wisner et al, 2003; Blaikie et al, 1994). Work in the United Kingdom lends support to this finding, with physical and mental disability, long-term illness and infirmity noted as factors needing special support with regard to flood events (Tapsell et al, 1998; Tapsell, 1999; Tapsell et al, 2002). Whilst such characteristics are clearly important factors in assessing an individual's vulnerability to disaster, they will also impact upon the household in which that individual resides. Almost a fifth of households surveyed in Post-Event research conducted for the Environment Agency contained a member affected by that long-term illness, disability or infirmity (see also BMRB 1998; BMRB 1999; BMRB 2000). Flood warnings are known to increase anxiety for households containing a vulnerable person (BMRB, 1997) and many of those households are likely to find it difficult or impossible to act on a flood warning (BMRB 2000).

There is, however, as yet a very limited literature dealing with the requirements and experiences of the disabled or infirm in disaster situations (Norman, 2000). The need for these groups to be considered, and involved, in disaster mitigation planning and policy is highlighted by several authors (eg: UNDRO, 1982; Parr, 1997-80). Affording an equal opportunity with regard to survival and minimising loss or damage to those who are less able-bodied is something that will resonate with the Environment Agency

(see Parr, 1987 and 1997-80). The Agency already produces *Floodline* information that is appropriate for the sight- and hearing-impaired but other forms of disability and infirmity are less well served. As Tunstall and Parker (1999) and Tapsell et al (1998) have noted, there is a clear need to examine further the special requirements associated with disability, infirmity and illness in connection with flood warning dissemination and response.

3.8 Special Needs Populations and Locations

Cutter et al (2000) emphasise the need to consider what are termed "special needs locations or populations" in terms of emergency warning and response. They cite the following example: day-care centres, nursing homes, hospitals and schools. To that list we could add the following: residential care homes and sheltered housing for older people; similar centres caring for the physically or mentally disabled; pre-school institutions; and shelters for the homeless. To date, little if any UK research has been done in these areas, but the added difficulties involved in evacuating such locations, coupled with the special needs and characteristics of many of these populations (plus a possible lack of continuity in staffing), would seem to indicate high levels of vulnerability particularly as many such institutions are located in at-risk areas. Indeed, Green and Penning-Rowsell (1988) suggest that it is not too far from the truth to suggest that flood plains in any given area can be identified by mapping the location of sheltered housing for older people, and mobile home parks.

3.9 Mobile and Holiday Homes

Researchers in the US and Australia have suggested that people living in mobile home parks may be especially vulnerable to flood because of the insubstantial nature of their dwelling (e.g. Buckle et al, 2000; Cutter et al, 2000). In the United Kingdom, too, similar concerns have been expressed (Tunstall and Parker; 1999) and Green and Penning-Rowsell (1988) have noted the proliferation of caravan parks in flood plain areas. From his research on hurricane warnings in the United States, Drabek (2001) found that perceptions of risk amongst private business employees were higher for those who lived in mobile homes.

In this country, research on victims of last year's flood events has revealed a phenomenon hitherto unnoticed by the research community; owners of second homes who were not present at the time of flooding tended to travel towards the flooded area in order to check on their holiday properties (McCarthy, 2000). There is, however, currently insufficient information on mobile or second homes in terms of flood risk and further research is needed.

3.10 Transient populations

Here, too, very little could be found on this topic in the disaster mitigation literature, though some researchers have suggested that there may be an increased vulnerability to flood for transient populations, including holidaymakers (eg Tunstall and Parker, 1999; Morrow, 1999; Buckle et al, 2000). Given that an inadequacy of knowledge and information is one of the fundamental causes of human vulnerability (see Blaikie et al, 1994; Wisner et al, 2003), the risk for people travelling in an unfamiliar area (or indeed for short-term or new residents – see King, 2000) is likely to be heightened in terms of receiving and responding to flood warning dissemination. Drabek (2000) highlights this risk in a recent paper comparing the reactions of the travelling public and their professional hosts (e.g. hotel managers, resort operators) to US weather-related

emergencies. Perceptions of managers' emergency-related roles and responsibilities, and knowledge of special procedures and provision, varied considerably between the two groups; the tourists reported significantly lower levels of awareness and satisfaction regarding their hosts' disaster planning. Knowledge of, and access to, community networks and other forms of local social support are also likely to be restricted for these populations.

4. CONCLUSION

This review outlines the need for a considered and in-depth examination of vulnerable groups in relation to flood warning dissemination, an examination which extends beyond confirming or increasing the categories already known to the research and policy or practitioner communities that would do little to avoid a deterministic and unenlightening view of vulnerability. Although many of the findings discussed above will be familiar to the Environment Agency, those authors who have reported to the Agency have all recommended further research be done in order to generate a more complete understanding of these issues (Tapsell et al, 1999; Tapsell, 2000; Tunstall and Parker, 1999). There is a particular need to detect the most vulnerable sub-groups amongst the target populations already identified and to develop an understanding of the subtleties that surround vulnerability in relation to flood warning and flood event.

The fact that there is as yet little research into the social distribution of flood risk in this country highlights the need for further investigation in this area. Many of the research findings discussed in this document are drawn from the international arena, many from studies dealing with types of major hazard little known in this country (e.g. hurricanes, cyclones, flash floods and earthquakes) but, as Tunstall and Parker (1999) have noted, research findings from abroad are not necessarily transferable across cultures, or across hazard or hazard setting. Whilst some of the findings cited here are not specific to flood warning dissemination, given that flood-related vulnerability of any kind is likely to impact upon perceptions of risk (and therefore on reactions to risk events) they are considered germane to this research study. It is of particular importance that we develop a more detailed understanding of the social contexts and circumstances which are pertinent to people's perception of and responses to flood warning within the specific context of fluvial and tidal flooding within the United Kingdom, and of how those perceptions and responses might vary according to group membership. Findings from the qualitative component of this research study will explore these questions (see companion Report R & D Project W5C-018/3).

References

Björkman, M. 1987 '*Time and risk in the cognitive space'* in Sjoberg L. (Ed) Risk and Society. The Risks and Hazards Series: 3. Allen and Unwin: London

Blaikie, P.; Cannon, T.; Davis, I. and Wisner, B. 1994 *At Risk: Natural Hazards, People's Vulnerability, and Disasters.* Routledge: London.

Blomkvist, A-C. 1987 '*Psychological aspects of values and risks'* in Sjoberg L. (Ed) Risk and Society. The Risks and Hazards Series: 3. Allen and Unwin: London

BMRB 1998 Flood Warning Dissemination: Post Event Survey Report. Report prepared for the Environment Agency.

BMRB 1998) Flood Warning Dissemination: Report on 1998 and 1997 Public Awareness "At-Risk" Surveys. Report prepared for the Environment Agency.

BMRB 1998 Flood Warning Dissemination: Report on 1998 and 1997 Public Awareness Surveys. Report prepared for the Environment Agency.

BMRB 1999 Flood Warning Dissemination: Post-Event Surveys Report. Report prepared for the Environment Agency.

BMRB 2000 Flood Warning Dissemination: Post Event Survey Report. Report prepared for the Environment Agency.

Bolin, R.C. and Bolton, P. 1986 *Race, Religion and Ethnicity in Disaster Recovery.* University of Colorado: Boulder.

Bolin, R.C. and Stanford, L. 1998 *The Northridge Earthquake: Community-based Approaches to Unmet Recovery Needs.* Disasters, **22,** (1), 21-38.

Bonaiuto, M., Breakwell, G.M. and Cano, I. 1996 *Identity Processes and Environmental Threat: the Effects of Nationalism and Local Identity upon Perception of Beach Pollution*. Journal of Community and Applied Social Psychology, **6**, 157-175.

Bratfisch, O., Ekman, G., Lundberg, U. and Krüger, K. 1971 *Subjective temporal distance and emotional involvement.* Scandinavian Journal of Psychology, **12**, 147-160.

Brown, J.D. and Damery, S.L. 2002 *Managing flood risk in the UK: towards an integration of social and technical perspectives.* Transcripts of the Institute of British Geographers NS, **27**, 412-426.

Buckle, P., Mars, G. and Smale, S. 2000 *New Approaches to Assessing Vulnerability and Resilience.* Australian Journal of Emergency Management. Winter, 8-14.

Bullard, R. 1990 *Dumping in Dixie: Race, Class and Environmental Quality*. Westview Press: Boulder, Colorado.

Bullard, R. 1993 (Ed) *Confronting Environmental Racism: Voices from the Grassroots*. Boston: Southend Press.

Bullard, R. 1999 *Dismantling Environmental Racism in the USA*. Local Environment, **4**, (1), 5-19.

Burningham, K. and Thrush, D. 2001 *Rainforests are a long way from here; the environmental concerns of disadvantaged communities.* Report for The Joseph Rowntree Foundation. York.

Bye, P. and Horner, M. 1998 *Easter 1998 Floods: Volume 1.* Report by the Independent Review Team to the Board of the Environment Agency.

Chambers, R. 1983 *Rural Development: Putting the Last First*. New York: Longman.

Cohen, J. (1960) *Chance, skill and luck*. Harmondsworth, Middlesex: Penguin.

Cova, T.J. and Church, R.L. 1997 *Modeling Community Evacuation Vulnerability Using GIS.* International Journal of Geographical Information. Science, **11**, 763-784.

Cutter, S. 1996 *Vulnerability to environmental hazards.* Progress in Human Geography, **20**, 529-539.

Cutter, S.L., Boruff, B.J. and Shirley, W.L. 2003 *Social Vulnerability to Environmental Hazards*. Social Science Quarterly, **84**, (2), 242-261.

Cutter, S.L., Mitchell, J.T. and Scott, M.S. 2000 *Revealing the Vulnerability of People and Places: A Case Study of Georgetown County, South Carolina*. Annals of the Association of American Geographers, **90**, (4), 713-737.

Drabek, T. 2000 *Disaster Evacuations: Tourist-business Managers Rarely Act as Customers Expect*. The Cornell Hotel and restaurant Administration Quarterly, **41**, (4), 48-57.

Drabek, T. 2001 *Disaster Warning and Evacuation Responses by Private Business Employees*. Disasters, **25**, (1), 76-94.

Drabek. T.E. 1986 *Human Systems Responses to Disaster: An Inventory of Sociological Findings*. New York: Springer-Verlag.

Enarson, E. 2000 *Gender and Natural Disasters*. Working Paper 1: In Focus Programme on Crisis Response and Reconstruction. Recovery and Reconstruction Department: Geneva.

Enarson, E. and Fordham, M. 2001 *Lines that divide, ties that bind: race, class and gender in women's flood recovery in the US and UK.* Australian Journal of Emergency Management, 43-52.

Enarson, E. and Morrow, B.H. (Eds) 1998 *The Gendered Terrain of Disaster: Through Women's Eyes.* Praeger: London

Fordham, M. 1998 *Making women visible in disasters; problematising the private domain.* Disasters, **22**, 126-143.

Fordham, M. and Ketteridge, A-M. 1998 "*Men must work and women must weep: examining gender stereotypes in disasters*" in Enarson and Morrow (Eds). The Gendered Terrain of Disaster. Praeger: London

Fothergill, A. 1996 *Gender, Risk and Disaster.* International Journal of Mass Emergencies and Disasters. **121**, (1), 33-56.

Fothergill, A., Maestas, E. and Darlington, J.D. 1999 *Race, Ethnicity and Disasters in the U.S.* Disasters, **23**, (2), 156-173.

Green, C.H., Emery, P.J., Penning-Rowsell, E.C. and Parker, D.J. 1985 *The Health Effects of Flooding: a Survey at Uphill, Avon.* Flood Hazard Research Centre, Middlesex Polytechnic.

Green, C.H. and Penning-Rowsell, E.C. 1988 *Flooding and the quantification of 'intangibles'*. Proceedings of the IWEM Annual Symposium 1988. London.

Handmer, J. 2001 *Improving flood warnings in Europe: a research and policy agenda*. Environmental Hazards, **3**, 19-28.

Hazards Panel Newsletter, 1985 November.

Helweg-Larsen, M. 1999 *(The lack of) optimistic biases in response to the 1994 Northridge earthquake: The role of personal experience*. Basic and Applied Psychology, **21**, (2), 118-129.

Hewitt, K. (Ed) 1983 *Interpretations of Calamity: from the viewpoint of human ecology.* London: Allen and Unwin.

Howell, W. C. 1972 *Compounding uncertainty from internal sources*. Journal of Experimental Psychology, **95**, 6-13.

Howell, W.C. 1971 *Uncertainty from internal and external sources: a clear case of overconfidence.* Journal of Experimental Psychology, **89**, 240-243.

Huby, M. 1998 *Social Policy and the Environment.* Buckingham: Open University Press.

Irwin, A. and Wynne, B. 1996 *Misunderstanding science? The public reconstruction of science and technology.* Cambridge: Cambridge University Press.

Kaniasty, K. and Norris, F.H. 1995 *In search of altruistic community: Patterns of social support mobilization following Hurricane Hugo.* American Journal of Community Psychology, **23,** (4), 447-477.

Kasperson, R.E., Renn, P., Slovic, P., Brown, H., Emel, J., Goble, R., Kasperson, J. and Ratick, S. 1988 *The Social Amplification of Risk: A Conceptual Framework.* Risk Analysis, **8**, 177-187.

Ketteridge, A-M. and Fordham, M. 1998 *Flood Evacuation in Two Communities in Scotland: Lessons from European Research.* International Journal of Mass Emergencies and Disasters, **16**, (2), 119-143.

King, D. 2000 *You're on Your Own: Community Vulnerability and the Need for Awareness and Education for Predictable Natural Disasters.* Journal of Contingencies and Crisis Management, **8,** (4), 223-228.

King, D. and MacGregor, C. (2000) *Using social indicators to measure community vulnerability to natural hazards.* Australian Journal of Emergency Management, Spring 2000, 52-57.

Leather, P, and Morrison, T, 1997 *The State of UK Housing: A Factfile on Dwelling Conditions*, Bristol: Policy Press.

Lucas, K., Grosvenor, T. and Simpson, R. 2001 *Transport and Accessibility: The Perspectives of Disadvantaged Communities.* Report for The Joseph Rowntree Foundation. York.

Lundberg, U. and Elleonen, E. (1976) *Involvement in potential future events estimated by males and females.* Reports from the Department of Psychology Number 469. The University of Stockholm.

Lyttkens, H. 1987 '*Reactions to Risk'* in Sjoberg L. (Ed) Risk and Society. The Risks and Hazards Series: 3. Allen and Unwin: London

McCarthy, S. 2000 Internal report on PhD research. Department of Sociology, University of Surrey.

McClaren, D., Cottray, O., Taylor, M., Pipes, S. and Bullock, S. 1999 *Pollution Injustice: The Geographic Relation Between Household Income and Polluting Factories.* A Report for Friends of the Earth.

Morrow, B.H. 1999 *Identifying and Mapping Community Vulnerability.* Disasters, **23**, (1), 1-18.

MXC Communications Ltd 2000 *The Environment and the Socially Disadvantaged: Scoping the issue of Pollution Injustice.* Draft Scoping Report prepared for the Environment Agency.

Ngo, E.B. 2001 *When Disasters and Age Collide: Reviewing the Vulnerability of the Elderly.* Natural Hazards Review, **2**, (2), 80-89.

Norman, A. 2000 *Investigating the Needs of Disabled People in Flood Warning and Response*. Interim Report for MSc Dissertation. Anglia University.

O'Brien, P.W. and Mileti, D.S. 1992 *Citizen Participation in Emergency Response following the Loma Prieta Earthquake.* International Journal of Mass Emergencies and Disasters, **10,** 71-89.

Parker, D.J., Green, C.H. and Thompson, P.M. 1987 *Urban Flood Protection Benefits: A Project Appraisal Guide.* Gower: Aldershot

Parr, A. 1987 *Disaster and Disabled Persons: an Examination of the Safety Needs of a Neglected Minority.* Disasters, **11**, (2), 81-159.

Parr, A. 1997-80 *Disaster and Human Rights of Persons with Disabilities: a Case for an Ethical Disaster Mitigation Policy.* Australian Journal of Emergency Management.

Peacock, W.G., Morrow, B.H. and Gladwin, H. (1997) *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disasters.* Routledge: London

Penning-Rowsell, E.C. and Tunstall, S.M. 1997 *The weak link in the chain: flood warning dissemination.* Flood Hazard Research Centre, Middlesex University: Enfield.

Perry, R.W. and Lindell, M.K. 1991 *The Effects of Ethnicity on Evacuation Decision-Making.* International Journal of Mass Emergencies and Disasters. **9**, (1), 47-68.

Perry, R.W. and Lindell, M.K. 1997 *Aged Citizens in the Warning Phase of Disasters: Re-examining the Evidence.* International Journal of Aging and Human Development, **44,** (4), 257-267.

Petts, J. and Leach, B. 2000 *Evaluating Methods for Public Participation: Literature Review.* Report prepared for the Environment Agency. ENTEC: Birmingham.

Pidgeon, N.F., Hood, C., Jones, D., Turner, B.A., and Gibson, R. 1992 Risk Perception. In The Royal Society (Ed.), Risk: Analysis, Perception and Management. (pp. 89-134). London: The Royal Society.

Rothman, A.J., Klein, W.M., & Weinstein, N.D. 1996 *Absolute and relative biases in estimations of personal risk.* Journal of Applied Social Psychology, **26***,* 1213-1236.

Salter, J. 1997 '*Risk Management in the Emergency Management Context'* in D. Smith (Ed) Risk Management for Safer Communities: World Disaster Reduction Day 1997. Resource and Environmental Studies, Number 16, Center for Resource and Environmental Studies, Australian National University

Scanlon, J. 1990 *People and Warnings; so hard to convince* in J.W. Handmer and E.C. Penning-Rowsell (Eds) Hazards and the Communication of Risk. Gower Technical; Aldershot.

Schmuck, H. 2000 *"An Act of Allah": Religious Explanations for Floods in Bangladesh as Survival Strategy.* International Journal of Mass Emergencies and Disasters, **18**, (1), 85-95.

Sjoberg L. (Ed) 1987 *Risk and Society.* The Risks and Hazards Series: 3. Allen and Unwin: London.

Slovic, P. and Lichtenstein, S. 1971 *Comparison of Bayesian and regression approaches to the study of information processing in judgement.* Organisational Behaviour and Human Performance, **6**, 649-744.

Slovic,P. 2000 *The Perception of Risk.* London: Earthscan.

Sullivan, W.C., Kuo, F.E. and Prabhu, M. 1996 *Assessing the impact of environmental impact statements on citizens.* Environmental Impact Assessment Review. **16,** (3), 171-182.

Tapsell, S.M. 2000 *Follow-up Study on the Health Effects of the 1998 Easter Flooding in Banbury and Kidlington.* Report to the Environment Agency. FHRC. Middlesex University: Enfield.

Tapsell, S.M., Penning-Rowsell, E.C., Tunstall, S.M. and Wilson, T.L. 2002 *Vulnerability to flooding: health and social dimensions*. Phil. Trans. of The Royal Society London, **360**, 1511-1535.

Tapsell, S.M., Tunstall, S.M. Penning-Rowsell, E.C. and Handmer, J.W. 1999 *The Health Effects of the 1998 Easter Flooding in Banbury and Kidlington.* Draft Report to the Environment Agency, Thames Region. FHRC: Middlesex University: Enfield.

Tunstall, S.M. and Parker, D. 1999 *Flood Warning Research Audit Report to the Environment Agency.* FHRC. Middlesex University: Enfield.

Tunstall, S.M., Sarch, M-T., Parker, D.J. and Penning-Rowsell, E.C. 2000 *Flood Forecasting and Warning Research Programme: Social Issues and Flood Hazard Warning – Scoping Study: Volume 1.* Report prepared for the Environment Agency. Flood Hazard Research Centre: Middlesex University: Enfield

UNDRO 1982 *Disaster and the Disabled.* Report. UN. New York.

Weinstein, N.D. 1980 *Unrealistic optimism about future life events.* Journal of Personality and Social Psychology, **39**, 806-820.

Weischelgartner, J. 2001 *Disaster mitigation: the concept of vulnerability revisited.* Disaster Prevention and Management **10**, (2). 85-94.

White, G.F. and Haas, J. E. 1975 *Assessment of Research on Natural Hazards.* Cambridge: MIT Press.

Wisner, B., Blaikie P. et al (Eds) 2003 *At Risk: natural hazards, people's vulnerability and disasters.* Second Edition. Routledge. London.