

**ENVIRONMENT, POLITICS AND DEVELOPMENT WORKING PAPER
SERIES**

DEPARTMENT OF GEOGRAPHY, KING'S COLLEGE LONDON

Year 2010

Paper # 34

**RISK, WEALTH AND AGRARIAN CHANGE IN INDIA.
PARTICIPATORY ASSESSMENTS OF TRADITIONAL
HAZARDS VS. LATE-MODERN RISKS AT DIFFERENT
POINTS ALONG THE RISK TRANSITION.**

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Risk, wealth and agrarian change in India. Participatory assessments of traditional hazards vs. late-modern risks at different points along the risk transition.

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Draft

Abstract

Although spatial and temporal variations in both the distribution of natural hazards and people's perceptions of them have long attracted the attention of geographers, risk society approaches have tended to neglect spatial and socio-economic variations in different people's perceptions of and ability to manage different hazards. Because of their location at the centre of the 'risk transition' (Smith, 2005) many communities within the global South are struggling to cope with a double burden of high (albeit declining) levels of 'traditional' hazards alongside increasing levels of 'modern' and 'late-modern' risks. Many of the 'dollar poor' (living on less than \$1/day) that regularly struggle to meet their subsistence needs are forced to background late-modern risks such as global warming because of the more immediate risk of harvest failure. In this context, useful parallels can be drawn between Abraham Maslow's 'hierarchy of needs' and the 'risk transition' model in terms of understanding how risks/hazards are prioritized according to socio-economic status. With this in mind, the paper seeks to provide a 'hazardousness-of-a-place' (Kasperson and Kasperson, 2005, p.176) study of two sets of Indian villages situated within very different agrarian environments and at different points along the risk transition. Particular emphasis is placed on how villagers from different socio-economic groups compare late-modern concerns about biodiversity loss, agro-chemical pollution, genetic modification and other environmental/health problems associated with modern agriculture with more traditional hazards affecting their health and food security.

Keywords: Risk transition, wealth, agrarian change, India.

1. Introduction

Spatial and temporal variations in both the distribution of natural hazards and people's perceptions of them have long attracted the attention of geographers (White, 1945; 1974; Burton et al, 1978). Since the early 1990s, however, attention has tended to shift from more traditional, locally-oriented analyses of risk and hazards towards a 'risk society' focus on the dramatic increase of global threats to human life since the mid-twentieth century (Beck 1995). Distinguishing between the risks faced by pre-modern, early modern and contemporary societies, Beck regards 'risk society' as a consequence of modernisation and its 'globalisation of doubt' (Beck, 1992, p.21). He argues that the more 'personal' risks produced by early industrialisation have now been replaced by risks that know no spatial or social boundaries and have the potential to threaten all life on earth. Beck links the concept of risk to that of reflexivity and argues that the process of modernity examines and questions itself though 'reflexive modernisation': 'the combination of reflex and reflections which, as long as the catastrophe itself fails to materialise, can set industrial modernity on the path to self-criticism and self-transformation' (Beck, 1996, p.34).

Beck also distinguishes between the calculation of risk in late-and pre-modern societies, arguing that pre modern societies often regarded life-threatening hazards¹ such as famine and plague as incalculable as they were attributed to external or supernatural causes. In early modern societies, by contrast, the development of instrumental rational control enabled the attempted calculation of such risks while in late-modern 'risk societies', such calculations fail in the face of the uncertain, long-term and globalised nature of risk (Beck, 1995). In a similar vein, Giddens (1991) talks of a 'late-modern single world' or 'risk culture' which faces wide-reaching and potentially disastrous problems which didn't exist in pre-modern times² while Douglas, views current concerns with risk as a response to globalisation and as part of 'a public backlash against the great corporations' (Douglas, 1992, p.15), whereby risk becomes 'a stick for beating authority' (ibid., p.39).³

But as emphases on 'world risk society' have increased, the influence of socio-economic and 'development' status on perceptions of risk/hazard and the ability of individuals or societies to manage these seem to have been somewhat eclipsed, despite obvious spatial variations in how different risks are prioritised. Interestingly, Deborah Lupton's (1999) popular overview of the academic literature on risk makes almost no mention of contemporary threats to the survival of resource poor communities in the global South. Yet as Allan (2010) points, although the 'risk-society mentality' present in many late-modern neo-liberal societies has changed the ways they manage environmental resources 'only one in five people world-wide lives in these c. 35 economies. The risk society has not been much established in the five BRICS economies or in the c. 170 developing economies' (p.30). Yet many of these countries bear a disproportionate share of 'the harmful consequences of hazardous events, activities and processes' (Bowonder and Kaspersen, 2005, p.167).

Although Beck does acknowledge that poverty 'attracts an unfortunate abundance of risks' (Beck, 1992, p.35), while wealth 'can purchase safety and freedom from risk' (ibid., p.35), he argues that the hazards of 'risk society' affect the rich and poor alike. But their limited means and generally lower levels of education often means that the poor in both North and South are less well placed to either mitigate personal hazards

¹ Elaborating on the difference between risk society and more traditional risks, Beck argues that: 'Human dramas – plagues, famines and natural disasters, the looming power of gods and demons – may or may not quantifiably equal the destructive potential of modern mega-technologies in hazardousness. They differ essentially from 'risks' in my sense since they are not based on decisions, or, more specifically, decisions that focus on techno-economic advantages and opportunities and accept hazards as simply the dark side of progress ... risks presume industrial, that is techno-economic, decisions and considerations of utility (Beck, 1999, p. 50).

² Giddens diverges with Beck, however, in his view that risks to late-modern societies are not necessarily greater. Rather, they are *thought* to be greater 'because the nature of subjectivity in general has changed to an approach to life that is far more sensitive to the possibility of risk than in previous eras' (Lupton, 1999, p.81)

³ For contemporary Western societies, issues of blame and compensation are hugely important. As Douglas points out, 'Under the banner of risk reduction, a new blaming system has replaced the former combination of moralistic condemning the victim and opportunistic condemning the victim's incompetence' (Douglas, 1992, p.16). Douglas recognizes that 'the reality of dangers is not at issue. The dangers are only too horribly real, in both cases, modern and pre-modern' (Douglas, 1992 p.29), but has focused her research on how risks are represented and politicised rather than how societies manage risk on a daily basis. According to Lupton, 'Risk has largely replaced older ideas about the cause of misfortune. Concepts such as sin, that were once used to provide explanation for misfortune, are now discredited. In their place is the 'modern, sanitized discourse of risk' (Lupton, 1999, p.46).

or contribute to a wider reflexivity regarding global risks because, as Lash comments, 'Just how 'reflexive' is it possible for a single mother in an urban ghetto to be?' (Lash, 1994, p.120).⁴ Citing this quote, Lupton rather tentatively points out that access to 'material resources may be a central feature of risk behaviour' (Lupton, 1999, p.117), but surely this is central to how societies perceive and respond to different forms of risk?

While wealthy members of late-modern risk societies may claim not to want 'a world in which the guarantee of no longer dying of hunger is exchanged for the risk of dying of boredom' (Cohen and Taylor, 1992, p.160), this is not an option for well over 50% of the world's population. According to the risk transition model (Smith, 2005, p.159), as societies 'develop' over time, 'a long-term shift occurs in mortality and disease patterns in which traditional risks related to pandemics of infection and rural poverty are displaced at lower and lower levels of total ill-health by modern risks of degenerative, human-caused and global ill-effects'. Nevertheless, the majority of the world's population continue to suffer most from 'familiar hazards, many of them rooted in nature and in poverty... communicable diseases still account for 10 to 25 per cent of human mortality; and vermin, pests and crop diseases destroy fully 50 per cent of the world's food crops' Kasperson and Kasperson (2005, p. 173).

The situation in many parts of the global South is complicated by the frequent juxtaposition of a wide range of natural, technological and environmental hazards with wider factors such as slow economic growth, poorly developed infrastructure, weak political systems, low levels of education and a lack of civil society pressure. As a result, many communities at the centre of the risk transition are struggling to cope with high (albeit declining) levels of 'traditional' risks/hazards alongside increasing levels of 'modern' and 'late-modern' risks'. According to Kasperson and Kasperson, (2004, p.175) the 'double burden of having to grapple simultaneously with old, traditional perils and new, often hidden or invisible hazards' is far more formidable than the risk burden faced by late-modern societies and the 'handling of hazards in developing countries will reverberate not only on physical quality of life, but on the very survival of the Earth' (ibid., p.168). Yet late-modern risks currently seem to attract far more attention from risk researchers than the ways in which communities at the centre of the risk transition perceive and prioritise 'traditional' hazards in relation to late-modern threats associated with the 'destructive potential of modern mega-technologies' (Beck, 1999, p. 50).

The 'foregrounding' and 'backgrounding' of different risks has been well studied in the risk literature (Douglas and Widalsky, 1982) and is constantly being carried out by 'communities and higher level polities according to recent events and the way knowledge is constructed in the communal discourse' (Allan, 2000, p.4). For many of the 'dollar poor' (living on less than \$1/day) that regularly have difficulties in meeting their subsistence needs, for example, late-modern risks such global warming are firmly in the background compared to the more immediate risk of harvest failure, and high mortality levels and debilitating illnesses that restrict livelihood opportunities.

⁴ Beck (1999), however, argues that if 'one demonstrates 'reflexive modernization' [as he does] not on the distribution of knowledge, but on the distribution of unawareness of unintended consequences [of industrialisation] then one cannot ascribe the adjective 'reflexive' either to traditional societies or to classical industrial modernity' (p.127).

Similarly, the tendency for unknown risks associated with genetic modification (GM) and biotechnology to be foregrounded in Western European societies contrasts with the backgrounding of such risks by many resource poor communities in the global South who want better security from the hazards associated with farming unpredictable environments (Bouis, 2007; Herring, 2007; Lipton, 1999; 2007; The Economist, 2010).⁵ In this context, useful parallels can be drawn between Abraham Maslow's 'hierarchy of needs' and the risk transition model in terms of understanding how risks/hazards are prioritized according to socio-economic status.

For the dollar poor preoccupied with the satisfaction of their basic 'physiological needs' including food, shelter and water (Maslow, 1970), for example, more 'personal' hazards of famine, disease and high levels of infant mortality tend to dominate everyday life and require urgent minimisation. For societies whose basic needs are assured, the need for safety, 'belongingness' and 'esteem' tend to become more important (Maslow, 1970) and other types of risk are foregrounded. Typical examples include falling ill, losing employment and being the victims of crime: all very real risks to the societies concerned but risks over which a higher degree of control is often possible due to the existence of well-organised and wealthy societies with institutions for dealing with disease prevention and management, insurance, crime prevention and control.

Applying ideas of a needs hierarchy to late-modern risk societies where material and safety needs are largely satisfied, there is evidence to suggest that 'aesthetic' and 'self-realisation' needs become more dominant; often accompanied by an increase in 'post-materialist values' (Inglehart, 1977; 1997). Although the explanatory power of the post-materialist thesis has significant limitations (Brechin and Kempton, 1994; Adeola, 1998), it does provide insights into why anxieties range beyond the domain of the immediate family as concerns increase over spatially or temporally more distant (and often invidious or unassessable) risks such as global warming and acid rain that 'know no boundaries', because they are 'universalized by the air, the wind, the water and food chains (Beck, 1999, p. 141). Public perceptions of such risk are well studied by proponents of traditional cognitive as well as 'risk society' approaches (Beck, 1992; 1994; Beck et al, 1994). Studies of late-modern risk have also provided better understandings of the political ecology of risk; notably how risk is constructed as social fact with the subjectivity of risk analysis being obscured by the myth of value free scientific facts (Beck 1995; 1996; 1999).

Less well understood is how 'world risk society' approaches interact with more 'everyday' risks/hazards in regions and amongst communities closer to the centre of the risk transition and how these interactions change over time. With this in mind, the rest of the paper seeks to provide a 'hazardousness-of-a-place' (Kasperson and Kasperson, 2005, p. 176) study of two sets of Indian villages situated within very

⁵ According to Lipton (2007, p.65), late-modern anti-GM protests are likely deny the dollar poor greater opportunities for food security as well as hazard minimisation in unpredictable environments as the 'initial escape route from dollar poverty is likely to be through cereals-based, labour-intensive farm production and employment. In steering through that escape route, transgenics appears well placed to improve the productivity of crops adapted to agro-ecologies recalcitrant to seed-fertiliser-irrigation-based development'. Writing of the Golden Rice project which uses transgenics to add vitamin A to rice, Lipton argues that every year of delay brings the Philippines 9000 more blind children and at least 60 extra deaths.

different agrarian environments and at different points along the risk transition. Smith's (2001) emphasis on the need to focus on individual health risks rather than national wealth indicators will be taken on board along with his comment that a modified risk transition framework should include 'non-health risk attendant on development' (p.169-70) such as ecosystem sustainability, political and economic risk. Particular emphasis will be placed on how villagers from different socio-economic groups compare late-modern concerns about biodiversity loss, agro-chemical pollution, GM and other environmental/health problems associated with modern agriculture with more traditional hazards affecting their health and food security.

The main focus will be on farmers as their role in the management of food and water resources is key to understanding and managing global risks surrounding food and water security as well as wider environmental management risks (Allan, 2010). As the two case studies will illustrate, farmers have the power to obtain high or low returns to water and land according to the ways in which they combine a range of different inputs and endowments including soil, water, seeds and agro-chemicals. But their activities are usually constrained by a range of different structures including agricultural policies that protect and subsidise farmers but have side-effects 'ranging from the provision of support mechanisms for the poor to the creation of international havoc across a wide range of agricultural economies' (Allan, 2010, p. 14)

2 Background to the research areas

Although India is characterised by the World Bank (2009) as a 'transforming agricultural world', agricultural livelihoods in the two case study areas are very different. One set of study villages is situated within Ranchi District, Jharkhand; a predominantly rainfed area 'left out' by the Green Revolution (Lipton and Longhurst, 1989) and characterized by a significant risk of food insecurity. Because local people have to manage a wide range of traditional risks as well as modern and late-modern risks, the villages provide a good example of communities towards the center of the risk transition.

Field research in Ranchi has been ongoing since 1993 and draws upon detailed ethnographic and participatory research carried out in two villages of Bero Block. The lack of irrigation in the District has limited the adoption of high yielding varieties (HYVs) of wheat and rice and food insecurity is pronounced with only around 30% of households regularly growing enough food to meet their subsistence needs. Ranking number 455 out of 569 districts in India on a combination of 'development' indicators (see table 1), Ranchi sits towards the bottom of India's socio-economic hierarchy (JSAC, 2010). Consequently, it is argued that although the risks of pollution from agro-chemicals, declining water table levels and climate change may be foregrounded in future, at present most villagers background these risks relative to the more immediate danger of food insecurity. Moreover, the backgrounding process has been encouraged by one of the study village's success in adopting irrigated winter cropping which has been associated with substantially better food security, reduced levels of seasonal migration and greater village-wide co-operation. Elsewhere in the District, a desire to achieve greater food security (and variety) in the face of population increase and land fragmentation has encouraged a shift towards more capital intensive and market-oriented agriculture.

The second set of study villages is situated within Bulandshahr District, Uttar Pradesh: a key 'green revolution' District which overcame widespread food insecurity during the late 1960s and early 1970s through the adoption of high yielding varieties (HYVs) of wheat and rice. But while the threat of starvation has diminished significantly for most households, Bulandshahr, like much of Uttar Pradesh, has lower social development indicators than its agricultural prosperity might suggest (see table 1). In addition, farmers in the District are facing increasing risks associated with yield stagnation, declining economic returns to agriculture and inter-community wealth differentiation. Participatory research in Bulandshahr started in 2001 but has been carried out in collaboration with Author whose research on agrarian change in the district dates back to 1972 when HYVs were just in the process of being adopted.

Drawing on these data plus colonial and anthropological information dating from the late nineteenth and early twentieth centuries (Atkinson, 1903; Cautley, 1854; Hallet, 1917; Reid, 1912; Roy, 1912; 1915; 1928) attention is drawn to how risks have changed over time in response to the different historical trajectories taken by the two research sites. While such a micro-scale study can hope to add little to the wider theoretical body of literature on risk assessment, analysis or perception, it does seek to challenge analysts in this field to further examine the influence of wealth, food security and position within the risk transition on the foregrounding and backgrounding of different risk and hazards. Drawing on the work of Tullock and Lupton (2003) Kaspersen et al (2005) and Parkhill et al (2010), the intersection of risk/hazard perceptions with the socio-economic, cultural, temporal, environmental and spatial contexts within which they are situated is central to the analysis.

3 Risk and agrarian change in the research areas

Most of the empirical data result from detailed empirical research in two villages (Ambatoli and Jamtoli) within Ranchi District from 1993 onwards and in three villages (Sabdapur, Chirchita and Kurwal Banaras) within Bulandshahr District from 1972 onwards. The different levels of food security and economic development in the two Districts enabled qualitative (participatory) assessments of how farmers from different socio-economic groups and at different points along the risk transition prioritised late-modern risks in relation to more immediate traditional risks such as ill health and food insecurity. Attempts were made to investigate additional 'non-health risks' (Smith, 2005) such ecosystem sustainability, economic and personal risks as well as the extent to which late-modern global risks such as climate change and the environmental/health risks of GM cause concern in the study areas. The impacts of socio-economic status and varying levels of food security on risk perception provides the main focus for analysis.

3.1 Ranchi

Until recently, much of Ranchi District was blanketed with dense forest stands which provided an important subsistence resource for the local population, but with the conversion of much forest for cultivation during the last century, agriculture replaced hunting and gathering as the main form of subsistence. When S.C. Roy undertook his ethnographic work in Ranchi during the early part of the last century (Roy, 1915; 1928), agriculture provided a major socio-religious focus as well as being the prime economic activity. As a majority of the region's tribal population are animists, the risk of food security was (and continues to be) managed through the propitiation of local

deities as well as through the skillful matching of different crop varieties, water and other inputs to different land types (Author 2002a, 2002b).

Because of Jharkhand's undulating and rocky landscape, however, only 27% of the state's land is actually cultivable and opportunities for large-scale irrigation are few: a situation that creates a high level of dependence on subsistence-based rainfed farming. Low levels of both access and returns to water have long undermined food security as 'water drains away from the uplands (tanr) and even the higher low lands (don) with great rapidity; and unless the crops growing on these lands receive a plentiful and continuous supply of rainfall, they wither and die very quickly' (Reid, 1912, p.5). Most farmers rely on one rainfed (monsoon) crop of paddy and pulses as their main form of subsistence as apart from the cultivation of hardy millets, pulses and oilseeds on the more moisture-retaining land or garden vegetables on intensively managed homestead land, winter crops have been unimportant until recently.

Opportunities to take advantage of new agricultural markets are limited by poor infrastructure; especially during the monsoon when the local dirt roads become impassable for most vehicles. At the time of the last field visit, there was little expectation that the study villages would be connected to the national grid in the near future. Health infrastructure is also poorly developed in the District and many villagers continue to rely on herbal medicines derived from forest products although allopathic medicine is increasingly accepted. 'Traditional' diseases such as malaria, dysentery and respiratory problems are common causes of illness and death in the study villages and infant mortality rates are 67/1000 (Department of Forest and Environment, Jharkhand, 2010) <http://jharenvis.nic.in/ranchi.html>). Life expectancy for Jharkhand as a whole is 62.3 for females and 62.9 for males.

A long history of land alienation and fragmentation has reduced the average farm size per household from 8.72 acres in 1935 to around 5 acres nowadays with the result that household survival strategies have become more tenuous. Consequently, many households seek to increase their food security by finding off-farm employment such as casual labour or seasonal migration to brickfields in West Bengal and Uttar Pradesh. The latter strategy became widespread after the late 1970s when bad harvests put severe strain on existing household survival strategies.

Families that retained farming as their primary economic activity sought to obtain better returns to labour and water by intensifying production (Hallet, 1917). Most villagers now use annual manure (and increasingly chemical fertiliser) applications to enable all of their fields to be cultivated at least once a year. Nevertheless, the small size of fields and limited farmer income inhibit the use of tractors, so cattle remain the primary means of transport and draught power and most of the agricultural equipment used has changed little since the early twentieth century (Roy, 1912; 1915; 1928).

Echoing the World Bank's emphasis on irrigation as the major determinant of land productivity and 'stability of yields' (World Bank, 2008, p.8), the most important source of intensification has been the spread of irrigation. Ranchi's proportion of irrigated land increased from 0.2% of the District's gross cultivated area in 1911 (Government of India, 1911) to 4.53% in 1981 and is currently available on approximately 13.3% of the net cropped area.

In addition to making monsoon crops less vulnerable in dry years, irrigation has increased the importance of winter season upland cultivation and enabled the use of HYVs along with chemical fertilisers and pesticides in certain areas. Although villagers do not (yet) complain of yield stagnation, yield increases (to an average of 2075 and 2016 kg/ha for rainfed monsoon season HYV and local variety paddy) have been insufficient, in the face of fairly rapid population increase, to reduce the risk of food insecurity in most villages.

Participatory risk analyses involving the allocation of scores (out of 10) to different risks/hazards were undertaken in the study villages to investigate how villagers prioritized different health- and non-health related risks/hazards. To generate a village-based risk transition, older villagers were asked to indicate how risks/hazards had changed over their lifetimes. These exercises clearly indicated that the fear of food insecurity and 'traditional' disease continue to dominate villagers' risk perceptions although there was general agreement that these problems were not as severe as they once were (see figure 1). Communicable diseases were widely viewed as being on the decline as education and health extension had increased awareness of how to prevent such diseases and access to modern medicine had become easier and more acceptable financially and culturally. Conversely, 'modern' diseases such as cancer and heart problems were perceived to be 'on the increase'.

As figure 1 indicates, the fear of food insecurity is more dominant in Ambatoli where only 41% of Ambatoli's sample households regularly grow enough food to meet their annual subsistence requirements and most have to find additional sources of income to make ends meet. Average landholdings are small in the village (1.89 ha) and only around 18 ha of cultivable land is irrigated. Typical yields are 495-3950 kg/ha for traditional varieties (TV) of lowland paddy, 790-3950 kg/ha for HYV lowland paddy, 495-1480 kg/ha for TV upland paddy and 1180-1480 kg/ha for HYV upland paddy.⁶ Between 1993 and 2004, winter season vegetable cultivation was undertaken by those farmers (around 30%) that had access to wells and pumpsets or with landholdings close to streams or the village's two tanks. Reflecting the need to maintain food security, the amount of land that villagers choose to plant with winter season crops is usually determined by the success of the previous paddy harvest. In poor years, more vegetables are cultivated for home consumption as well as for cash sales.

Although Jamtoli has similarly small average landholdings (1.66 ha), food security has improved dramatically over the past thirty years due to a series of dam-building initiatives organised by a village elder. Between 1981 and 2004, the village's irrigable land increased from 23.25 ha to over 80 ha (Government of India, 1981) and over 75% of households now cultivate winter crops. In addition to substantially reducing poverty levels, this has dramatically reduced the risk of harvest failure as villagers can provide supplemental water for their monsoon season paddy when rainfall is poor and maximise cropping intensities by growing additional winter and even summer crops. Reflecting the role of irrigation as the key input influencing yield, irrigated lowland fields close to check dams, canals and wells regularly yield over 4900 kg/ha of paddy while irrigable upland fields yield over 1480 kg/ha of

⁶ These correspond closely and not particularly favourably with a working average of 14 maunds (1283 kg/ha) of lowland paddy and seven maunds (692 kg/ha) of upland paddy per acre noted in the Settlement and Survey report of 1902-1910 (Reid, 1912 p.115).

paddy. Indeed, higher paddy yields plus the profits made from (and employment generated by) winter vegetables has virtually halted the need for seasonal migration in the village.

As irrigated winter and summer crops do not benefit from the nutrients carried in the monsoon rainfall and runoff, it has become common practice to apply chemical (NPK/urea) fertilisers. To reduce capital expenditure and minimise the risk of the soil becoming 'used to chemical fertilisers and demanding ever increasing quantities' (Ambatoli group discussion, 05/99) as a result of declining in organic matter content, many villagers supplement fertiliser applications with manure and compost. Farmers in both study villages appeared to be remarkably well briefed (primarily as a result of effective agricultural extension) about the health problems and risks of water pollution associated with agro-chemicals and the need to control input levels while maintaining traditional composting and manuring techniques. Nevertheless, the introduction of HYVs coupled with more intensive farming and the increasing adoption of irrigated winter cropping has brought quite dramatic changes to the study villages; the environmental risks of which may not be fully apparent for many years. As figure 1 indicates, however, most farmers tend to background these risks in the face of what they perceive to be the far greater risk to food insecurity in the absence of intensification.

A number of farmers with wells on elevated land, however, are starting to foreground the risk of falling water table levels caused by increased irrigation from groundwater coupled with the loss of forests which, in their opinion 'provide food for the clouds and soak up the rain when it falls' (discussion with Simon Oraon, 10/93). Faced as they are with uncertain monsoon rainfall, increasing population, fragmented land-holdings and declining opportunities for forest-based subsistence, most continue to see irrigation as a key strategy for increasing short-term food security, regardless of the longer-term environmental consequences. After all, with irrigation, even the smallest landowners can improve subsistence production while landless villagers have benefited from greater income security due to more year-round agricultural employment. This issue was hotly debated during the participatory risk assessments, however, as villagers were clearly aware that falling water tables will have serious implications for the continued success of irrigated farming as a means of meeting subsistence needs in this rather unfavourable and risk-prone agrarian environment.

Discussions surrounding other non-health risks revealed that concern about biodiversity loss in the villages is negligible as even the coarsest grains and pulses are still cultivated on the poorest land and farmers argue that the influx of HYVs and vegetable cultivation has increased overall crop diversity in the area (Author, 2002b). Market-related risks were of greater concern to farmers that cultivated cash crops than to subsistence farmers and farmers involved in the cultivation of 'early winter vegetables' for the Calcutta market were especially aware of market-based hazards.

The 'personal' hazards associated with agrarian class differentiation experienced in core green revolution (Shiva, 1991), meanwhile, appear to have been limited in Jharkhand; possibly a result of rural Jharkhand's relatively low levels of initial economic inequality, restrictions on the sale of land to non-tribals and limited scope for large-scale irrigation. There is some evidence of increasing gendered health risks in the region, however, following the steady influx of plains Hindu customs. Over the

past 130 years, the female:male sex ratio in Ranchi District has fallen from 1022:1000 in 1881 to a low of 927:1000 in 1991, indicating female foeticide and/or lower levels of healthcare and nutrition for female children. In addition, the risk of violence against women accused of witchcraft appears to be on the increase in Jharkhand (Mishra, 2003) and has been linked to uneven social and economic development that 'targets vulnerable women, often widows, as symbols of collective anger and thwarted aspirations' (Gokale, 2003, p.i).

3.2 Bulandshahr

Bulandshahr District forms part of the relatively prosperous area of western Uttar Pradesh that lies between the Ganges and Jamuna rivers. Agriculture there is quite capital intensive and involves the application of a wide range of inputs including HYVs, irrigation from canals and tubewells, and high levels of agrochemical use. Through the application of this package of inputs, soils are managed to assure the supply of a set of essential nutrients to the HYVs which can be grown in virtually any soils; unlike in Ranchi where the success of crops grown is more dependent on careful management of the risks associated with environmental variability. Two main cropping seasons dominate Bulandshahr's agricultural calendar: the monsoon season (July to October) is dominated by rice, sugarcane and maize and the drier winter season (October to April) is dominated by wheat but irrigation is necessary for a successful crop.

The District has not always been prosperous, however and drought was followed by crop failure in 1837–38 when 'the extent of human misery caused by utter failure of crops in the Central Provinces, especially in the lower districts of the doab [led] to famine in its most aggravated form' (Cautley, 1854 p.18). To bring 'stability and certainty to cultivation, and thereby to rent and revenue, by making husbandry easy and profitable' (Atkinson 1903, p.45), the British constructed extensive canal-based irrigation networks fed by the River Ganges. The Ganga Canal was completed in 1854 and its irrigation waters reached Bulandshahr the following year allowing rapid agricultural change that foreshadowed the increased returns to land, labour and water achieved by the Green Revolution a century later. Between 1871 and 1883 the District's irrigated acreage increased by 565% and the cultivable area increased from 54% to 73% of the District between 1854 and 1902 (Atkinson, 1903).

From the late 1960s, cropping intensities were raised using HYVs with shorter maturation periods that allowed farmers to harvest an extra winter crop if they used irrigation. By 1971, adoption of the new HYVs was widespread in all three study villages as they yielded 2550 kg/hectare with inadequate fertiliser to 4000 kg/ha with adequate fertilizer compared to 1000-1500 KG for traditional wheats. The HYVs thus played an important role in reducing the risk of food insecurity in a situation where 'the stork was beginning to outrun the plough' (Brown, 1970, p.5). Although most farmers initially proceeded with caution as the new technology was untested in the region, such concerns were quickly backgrounded once its potential to reduce the danger of famine had been demonstrated. Author (1975) found that most farmers were quickly won over by the new HYVs as they showed considerable tolerance for the harsh environmental conditions of the Ganga-Jamuna doab and were reliable and high yielding, as long as they received adequate and timely inputs of irrigation water and fertilizer (Author and Author, 2007). As the capacity of HYVs to outyield TVs

became apparent, risks associated with the pest susceptibility of early HYVs were often backgrounded by farmers who ignored official recommendations about pre-treating their seed and using pesticide on the plants themselves (Author, 1975).

In contrast to fears that only rich farmers could benefit from the GR (Byres, 1981; 1983), Author (1975) found that HYVs enabled even the smallest farmers to lower the risk of household food shortages by increasing the quantity of wheat available for consumption. Nevertheless, her research showed that wealthier dominant-caste Brahmin/Jat/Rajput cultivators could better afford (or obtain credit to purchase) inputs of fertilizer and irrigation water and could thus obtain higher yields than Scheduled Caste and Muslim farmers (Author and Author, 2006).

Nearly forty years on, Green Revolution agriculture in the Bulandshahr study villages is still winning the competition against population growth. More importantly, the risk of starvation that villagers came to fear in the late 1960s is no longer present for most households as 'nobody sleeps with an empty stomach nowadays' (Chirchita farmer group, 12/04). Indeed, many villagers get 5000-6000 kg/ha of wheat in a good year with an average yield of 4000 kg/ha while basmati-type HYV rice can yield over 5000 kg/ha. Discussions with different landholding and socio-economic groups revealed that even farmers with marginal holdings were achieving HYV wheat yields of 4-5000 kg/ha which had increased their food security. Improved infrastructure has accompanied the District's rapid agricultural development and all of the study villages have long had access to electricity and paved roads. Male and female literacy rates have improved steadily over the past 30 years and all villagers have ready access to modern medical care. The infant mortality rate is 68/1000 and although life expectancy data was not available for the District, the average figures for Uttar Pradesh (a state with notoriously low development indicators) are 58.9 for males and 57.7 for females: well above the level at which the probability of dying from a modern disease exceeds that of dying from a traditional disease (Smith, 2005).

Within the study villages, however, participatory risk assessments revealed clear differences in the foregrounding and backgrounding of risks between households belonging to different caste, landholding and socio-economic groups situated at different positions along the risk transition and within Maslow's needs hierarchy. Life remains particularly hard for the poorest Scheduled Caste households for whom the fear of food insecurity remain firmly in the foreground, along with 'traditional' health threats associated with communicable diseases (see figure 2). In Sabdalpur and Chirchita, families from the Balmiki or 'sweeper'⁷ caste form the bottom of the village socio-economic hierarchy. Participatory risk assessments with this group revealed that their concern about (and knowledge of) late-modern risks such as global warming and GM was greatly overshadowed by more tangible concerns relating to meeting immediate subsistence requirements. Some Balmiki men work as rikshaw drivers and labourers outside the village but most work as sweepers. Most Balmiki women rear poultry and goats within the household in addition to 'sweeping' for around ten families. This earns them around Rs. 2500 per year (around 33 UK pounds) which is well below \$1 per day but marks a significant improvement on the situation a few years ago when they were only paid 20 kg of wheat (Rs. 125) per

⁷ 'Sweeper' usually refers to so-called untouchable castes that have responsibility, under the Indian caste system, for latrine cleaning and the collection of human excrement.

household/year. Nevertheless, they are very vulnerable to food price fluctuations that can make it difficult for them to meet their subsistence needs. Other 'personal' risks that they face include routine violence from dominant caste villagers as caste-based violence and subsequent official inaction are increasingly common (Jeffrey, 2002). There are also a number of 'personal' risks linked to wider gender inequalities in the region which tend to have a disproportionate impact on lower/Scheduled caste groups. Although issues of violence against women was never overtly raised during fieldwork, increasing levels of gender discrimination are indicated by the male:female sex ratio in the District which declined from 901:1000 in 1901 to a low of 855:1000 in 1971. Despite the increased availability and affordability of foetal sex determination tests, the District's sex ratio increased slightly thereafter, reaching 865:1000 in 1981 and 881:1000 in 2001, but the increasing cost of dowries was a common complaint.

For many landowners, the yield gains brought by the green revolution have been diluted to a greater or lesser extent by population increase coupled with partible inheritance systems that have caused significant land fragmentation. Average landholdings are around half what they were in 1971 (3.44 ha) and this, coupled with yield stagnation, means that periodic food insecurity remains an occasional threat to those small and marginal farmers (owning under 1 ha) that make up over half of the landowning households (see figure 3)⁸. Although this group has gained, as consumers, from improved food affordability and depressed cereal prices, they tend to have high agricultural input costs relative to wealthier farmers coupled with problems in getting credit from banks (at interest rates of 1% per month) which forces them to borrow from neighbours at interest rates of 5% per month (Author and Author, 2007).

Typically, small and marginal farmers seek to minimise the risk of food insecurity by sowing all of their land with wheat (winter) and rice (monsoon) for self-consumption. Additional cash for meeting subsistence shortfalls is obtained by selling labour in on- and off-farm labour markets. Off-farm labour opportunities have increased rapidly since the onset of the green revolution and as Allan (2010, p.21) observes, they play a very important role in protecting farmers from the risks associated with 'the brutal uncertainties of the environment and the market'. Indeed, there is a perception amongst small and marginal farmers that landless households face fewer food security risks than themselves as Bulandshahr's booming construction industry has provided plenty of work opportunities, labourers get a fixed daily rate and wages have doubled over the past ten years. For themselves, the labour market is seen as a less familiar and somewhat risky place that may prevent them from completing vital agricultural operations. Some have therefore opted for more permanent off-farm work for selected (usually male) family members that provide a more secure way of diversifying their livelihood portfolios. Good examples of this include migration to the Gulf by Muslim households in Sabdalpur and Chirchita and a widespread shift into animal rearing and milk production in Kurwal Banaras in response to Bulandshahr town's growing demand for meat and dairy products.

Indicating a shift along the risk and epidemiological transitions amongst the medium and large landowners (see figure 4), many villagers spoke of improved health care,

⁸ Landless and near-landless households make up 30-40 % of the population of the study villages; the most numerous being resource-poor Muslims.

education and diet which have increased life expectancy and reduced infant mortality rates along with the incidence of malaria, tuberculosis and night blindness; responses that were confirmed by a local doctor (Author and Author, 2006). Amongst these villagers, the risks associated with communicable diseases and food insecurity have become far less of a worry than concerns about more modern health-, environmental- and market-related hazards. With regard to changing health risks, discussions highlighted a perception that formerly unknown (or unthreatening) ailments such as stress, strokes and heart disease were on the increase in the study villages. A number of villagers from this group, mostly women, also talked about an increase of ‘mystery illnesses’ in children that they attributed to the pollution of water supplies by agro-chemicals (Author and Author, 2007)

Most farmers in this group are able to grow enough food to meet their subsistence requirements and those owning over two hectares typically grow wheat and rice on less than half of their land; the remainder being planted with cash crops such as sugar cane. So while food security is no longer much of a threat, many are becoming increasingly concerned about economic insecurity and environmental degradation. One of the main reasons for this is that agriculture in the district has been suffering from static and declining yields (Author and Author, 2006; Author and Author, 2007). Consequently, farmers find themselves applying increasing amounts of expensive inputs to overcome soil infertility. When combined with falling state subsidies for agricultural inputs, this has made agriculture considerably less profitable for cash-crop growers and more risky for small farmers that rely on agriculture as their prime source of subsistence. Most farmers in the study villages attribute yield decline to increasingly sodic soils and low levels of soil organic matter and accept that years of intensive Green Revolution cropping with increasingly high chemical fertilizer inputs have worsened this problem (Author and Author, 2006; Author and Author, 2007).

Another environmental problem that is causing increasing concern amongst all farmer groups is declining water table levels in non-canal irrigated areas. In parts of Chirchita, some fields have had to be abandoned as wells have dried up and their owners have had to seek off-farm work as they cannot afford deep tube wells. There is a general expectation that this problem will become more pronounced in future, but amongst the wealthier farmers who can, if and when necessary, find the funds for deeper wells, there is a tendency to background this longer-term risk in the face of what they consider more ‘urgent’ problems associated with diminishing economic returns to farming.

Amongst a few of the wealthier and better educated villagers, there was also evidence that late-modern risks associated with biodiversity loss and climate change were starting to be foregrounded along with a more general concern about modern health risks that could not be clearly linked to specific causes (Smith, 2001). Concern about the rise of ‘mystery illnesses’ in children was a good example of this, as was the general feeling, amongst a number of wealthier households, that people in the village ‘are weaker nowadays... more sickly than they used to be’ (large farmers group, Sabdalpur, 12/04) despite widespread evidence to the contrary.

With regard to biodiversity loss, there has been a tendency, as the Green Revolution progressed, for a large number of traditional crop varieties to be replaced by a much smaller number of HYVs with an even narrower genetic base. From data collected in

Sabdalpur, it was evident that small farmers had a narrower cropping base than their larger counterparts and a number of different villagers commented on the fact that they missed growing pulses which they associate with good health. The main reason for the displacement of pulses is that they have a low yield (1500 kg/ha) compared to wheat and rice and are susceptible to disease, pests, salinity and waterlogging. As one farmer in Sabdalpur put it: 'wheat and sugarcane are assured crops, so we can't take the risk of growing pulses' (large farmers group, Sabdalpur, 12/04). But several of the wealthiest farmers in Sabdalpur and Chirchita continue to grow pulses along with a wide range of vegetables as part of an intercropping strategy. This is not a short-term risk minimization strategy to protect against crop failure, but rather a deliberate attempt to increase soil quality and reduce susceptibility to modern health problems by improving household diets and cultivating more organically (using compost rather than chemical fertilizer). Discussions with three large landowners in Chirchita also indicated wider concerns about the longer term risks associated with a low agro-ecosystem biodiversity. In particular, they expressed a strong desire to avoid what happened in the 1970s when stands of monocropped HYVs proved highly susceptible to disease and pest attacks. Amongst most of the other farmers interviewed, however, there was little concern about biodiversity loss as they felt that the frequent introduction of new HYVs had actually improved crop diversity relative to before the Green Revolution. None of the group members expressed concern about the narrow genetic base of HYV crops.

Late-modern risks associated with climate change also seemed to be of minor concern within the study villages as only one particularly wealthy and well-educated farmer talked about global warming as a significant issue. This was explained in part by the scientific uncertainty surrounding climate change and the fact that most villagers felt that they had more pressing things to worry about than something that may or may not affect them in some as yet unspecified way. Most farmers expressed a strong belief in the power of technology to ameliorate the impacts of climate change with emphasis being placed on the need to breed new varieties of seed that would adapt to any change in environmental conditions. Significantly, genetic modification was seen as having important potential in this adaptation process and nobody mentioned the wider environmental risks associated with this technology. Instead, there was a strong feeling that GM could help to reduce the problem of yield stagnation as well as having scope to address existing problems associated with sodic soils and falling water table levels and the need to use excessive quantities of chemical fertiliser. Given their experience of the benefits brought by technological advances within agriculture, it is quite understandable that these children of the Green Revolution background late-modern risks surrounding GM and foreground those associated with food and economic security; especially given their concern with material rather than 'post-material' needs (Inglehart, 1977) and the short time that has elapsed since most were at the center of the risk transition.

4. Conclusions

World 'risk society' approaches have played a crucial role in highlighting the dangerous uncertainty surrounding late-modern risks such as climate change in a world that is changing rapidly both physically and culturally. And while the hazards of 'risk society' are undoubtedly real and affect the rich and poor alike (Beck, 1992), there are significant spatial variations in the extent to which these risks are prioritised. Following Inglehart's (1997) argument, late-modern 'post-material' societies that have secured their material needs can afford to foreground global environmental problems. For many of the 1.1 billion dollar poor in the global South, by contrast, low levels of education coupled with severe food insecurity and exposure to high levels of communicable disease restrict their capacity to mitigate traditional hazards or be reflexive about late-modern risks. Although many villagers in Ranchi District are broadly aware of global risks such as the greenhouse effect, climate warming, and the meltdown of nuclear reactors, the fact that that they are usually 'delayed and non-specific' (Smith, 2001, p.151) makes them easier to 'background'. Instead, villagers prioritise the minimisation of risks to their everyday survival and the avoidance of unattractive household survival strategies such as migration.

The Bulandshahr case study, meanwhile, demonstrates how increased socio-economic status and food security has brought many villagers greater freedom from traditional hazards (Beck 1992) but has exposed some to an increased risk of modern health problems. In addition, most individuals in the study villages have been exposed to a growing range of 'non-health risks' (Smith, 2001) associated with environmental degradation and increased exposure to market-based risks (Allan, 2010). But in contrast to late-modern concerns in Europe about the environmental risks of GM foods, most farmers in the Bulandshahr study villagers view GM as an important future solution to ecological problems created by intensive modern farming methods. Put simply, they, background the risk of future environmental problems in favour of increased livelihood benefits now: a situation that may reflect their rapid progress along the risk transition (Smith, 2001) which has not given them time to process the importance of these new risks relative to older, more familiar hazards.

Echoing the views of Michael Lipton, (1999; 2007) there is a strong recognition amongst the study villagers that in the absence of agricultural intensification, many people alive now would be dead. The rapidity of population increase coupled with fragmented land holdings meant that a shift to double cropping, particularly irrigated winter cultivation, literally represented a life-saving option for some Ranchi households and a substantial increase in annual food security (not to mention better nutrition) for many more. In Bulandshahr, the Green Revolution is not regarded as an environmental catastrophe (Shiva, 1989; 1991) but as an important means of improving resource (land, labour and water) productivity in the face of land fragmentation and reducing the risk of food insecurity. By helping villagers in both districts to satisfy their physiological needs and escape many traditional health risks, agricultural intensification has allowed them to progress (quite a long way in the Bulandshahr villages) along the 'needs hierarchy' (Maslow, 1970) as well as the risk transition.

As farmers such as these will play an important role in managing the future global risks associated with food production, water security and environmental degradation, a better understanding of how they prioritise and manage the interactions between late-modern risks and more traditional everyday hazards is important at a wider scale. According to Kasperson et al (2005, p.192), there is a danger that trajectories of change in the global South are 'are rapidly outpacing societal responses' as a desire for economic development results in the backgrounding of risks associated with environmental degradation and delayed responses to these problems. In a more optimistic vein, Allan (2010, p.20) argues that over the past century, farmers have delivered adaptive solutions to demographically imposed demands for food that were 'much greater than anything climate change will bring in the current century' and will continue to manage the risk of food insecurity if given appropriate economic and social incentives.

To help them achieve this, he argues that it is necessary to protect them from the risk of market uncertainties because 'farmers combine available inputs most effectively if the rural economy and rural social infrastructures are favourable' (p.19). Drawing from Allan's analysis of water security, risk and governance, an important 'macro scale' message is that there are important relationships between global food and water security and success in reducing risks to farmers in the global South. Farmers make key decisions regarding whether inputs to farming systems are combined in sustainable ways or not, so they 'need to be protected from the extreme risks of the environment and the global market' (ibid., p.29) if resource poor farmers in the global South are to escape from poverty with more sustainable methods of farming. Exactly how this should be achieved will rely heavily on more place-sensitive analyses that can explore the intersection between late-modern and traditional hazards in communities living closer to the center of the risk transition whose basic needs are far from secure.

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