# Comparing vulnerabilities: toward charting an historical trajectory of disasters

Bankoff, Greg

Veröffentlichungsversion / Published Version
Zeitschriftenartikel / journal article

*Historical Social Research, Vol. 32 — 2007 — No. 3, 103-114*

# Comparing Vulnerabilities: Toward Charting an Historical Trajectory of Disasters

*Greg Bankoff*[*]

**Abstract**: *»'Verwundbarkeit' vergleichen: Auf dem Weg zu einer Kartierung der historischen Verlaufskurve von Katastrophen«*. Disasters have two historical trajectories, one 'natural' in that they involve one or more physical hazards and the other societal in that they are largely culturally determined. They are 'historical' in the sense that both forces change over time. Charting an historical trajectory of vulnerability allows us to compare how skilfully different communities and societies in the past managed all kinds of climatic and seismic risks. A comparative perspective that does not start with the assumption that any one culture's approach is superior to any other's encourages us to learn not only from what people did previously but from what others do now, how especially non-western societies go about disaster preparedness, mitigation and recovery in the present. Finally, comparing vulnerabilities also encourages us to see disasters as more than purely destructive events in the short term and also to consider them as transformative agents in the longer term.

Contrary to widespread popular usage, there are no such things as 'natural disasters' (BLAIKIE et al. 2004). There are certainly disasters but for one to take place two forces with their own separate trajectories have to come together at the same time and place to create an event. On one side, there is the hazard that can be purely natural like an earthquake, volcanic eruption and typhoon or increasingly more human-induced as in the case of fire, chemical releases and ozone depletion. On the other side are human populations whose social, economic and political organisations are largely culturally determined. The manner in which social systems are structured leaves some people more exposed than others. Critical to discerning the nature of disasters, then, is an appreciation of the ways in which human systems place people at risk in relation to each other

[*] Address all communications to: Greg Bankoff, History Department, University of Hull, Hull, HU6 7RX, United Kingdom; e-mail: g.bankoff@hull.ac.uk.

and to their environment, a causal relationship that can best be understood in terms of an individual's, household's, community's or society's vulnerability. Vulnerability is determined by a combination of factors that include class, gender, age and ethnicity among others (O'KEEFE/ WESTGATE/ WISNER 1976; HEWITT 1983; WISNER 1993; CANNON 1994; LEWIS 1999; TURNER II et al. 2003). This condition, however, should not be confused with poverty (WISNER/ YAPA 1995). Though the poor are much more likely to be affected by disasters, wealth, too, generates its own kinds of risks. One has only to consider how coastal location contributes to the exposure of expensive beach-side properties or how pleasure-seeking tourists are subject to all manner of ocean-borne perils. For example, the largest recorded number of Swedes to die in a single disaster in modern history occurred in Thailand in December 2004 as a result of the Indian Ocean Tsunami (CALGARO 2005, p. 1).

## Natural trajectory of disasters

Disasters, then, have two historical trajectories, one 'natural' and the other societal. They are 'historical' in the sense that both forces change over time. The fact that the nature of hazards varies over the years is perhaps less immediately apparent than the human element though nonetheless important. Geophysical and climatic conditions not only alter in the long term, over hundreds of thousands of years, but also within much shorter time spans that have affected human societies within recorded history (LAMB 1977; BRADLEY/ JONES 1992). The variations in mean average temperatures associated with the Late Medieval Optimum (1100-1400), Little Ice Age (1600-1800) and Modern Optimum (since 1800) not only had (and continues to have) effects on agriculture, human nutrition and population density but also has important bearing on the intensity and frequency with which people were subject to extreme events at any given location on the earth's surface (LE ROY LADURIE 1971; BRAUDEL 1972; FAGAN 2000; DAVIS 2001; FAGAN 2004). More recently, scientific evidence suggests a strong correlation between floods, droughts and related hazards and higher temperatures, the release of heat-retaining gases into the atmosphere, and variations in precipitation levels around the world (IPCC 2007). Even the magnitude of hurricanes and typhoons in the Caribbean and Western Pacific has been linked to rising sea surface temperatures (EMANUEL 2005). Such arguments, however, are still controversial and evidence suggests that floods in the past may have been just as high if not higher than they are today, and that sea-surface temperatures are only one of many factors contributing to the generation of hurricanes and whose teleconnections or manner in which they affect one another are still far from fully understood (STEVENS 1999; LOMBORG 2001, p. 258-323; FLANNERY 2005).

Nor can hazards be seen purely as calamities: One only has to consider the relationship of the annual flooding of the Nile River to the prosperity of Egypt or of the passing of seasonal typhoons to precipitation levels in places like the Philippines to realise their long term significance to human settlement and history. All in all, however, there are now impressive data series based on descriptive documentary (archival) and proxy documentary (indirect) sources for certain world regions that shed light on what occurred in the pre-instrumental age. Much of this evidence has been collated into large data series such as EURO-CLIMHIST that contains 600,000 entries on weather-related events in Europe between 750-1850 CE, or the massive Japanese compendiums on earthquakes that chronicle such events since the seventh century (PFISTER et al. 1999; GLASER / STANGL 2004; ISHIBASHI 2004).

## Societal trajectory of disasters

The historical trajectory of societies is much more apparent to perceive. Quite evidently people and the cultures they create have changed over time, and indeed are changing even in our own lifetimes. The question in relation to natural hazards, however, is to what extent these alterations made populations more or less vulnerable and what, if anything, they did about that vulnerability. Vulnerability recognises that certain people in the past may have been situated in more perilous settings than others as a result of a particular configuration of political, economic, social, ideological and environmental factors (OLIVER-SMITH 1994; BANKOFF 2003). Attempting to view the course of recorded history from this perspective requires focusing on certain key elements in any society's relationship to its environment: the number and distribution of its people, how they housed and fed themselves, and the level and 'appropriateness' of their technological know-how.

### People

The accelerated pace of change especially over the last century has transformed the nature and degree to which societies are exposed to hazards though arguably the adoption of agriculture still remains the single biggest alteration affecting people's vulnerability (DIAMOND 1998, p. 85-191).[1] The European conquest and settlement of the Americas with its concomitant drastic reduction in population levels and its subversion of indigenous cultural adaptation also left the ensuing societies far more exposed to risks that persist to this day and that was replicated, to a greater or lesser extent, in parts of Africa, Australasia and

[1] For a review of the literature on domestication of plants and animals, see Diamond's bibliographical notes: DIAMOND 1998, p. 434-439).

the Pacific (CROSBY 1986; GRIFFITHS/ ROBIN 1997; COOK 1998). Nonetheless, there is no denying the impact of recent changes. While the Industrial Revolution increasingly had important implications on people's vulnerability from the second half of the eighteenth century, the size of the population affected in world terms was initially not large and its influence felt only indirectly outside of a local or, at the most, a regional scale. Nor should the impact that traditional societies had on their environments be minimised: perhaps more forests, for example, were cleared prior to 1950 than have been felled since and flood, drought and localised climatic change were very much features of the pre-industrial age as they have become subsequently (WILLIAMS 2003, p. 324). Clearly, however, the exponential increase in world population from approximately a billion and a half people in 1900 to over six billion by 2000 and the increasing demands of a mass production and consumption world market have created unprecedented environmental strains and magnified or generated new forms of risk consequent upon climate change, rising sea-levels, toxins in the food-chain and the generation of waste products among others (IPCC 2001). The scale of this human explosion must also be considered in conjunction with the mass migration of peoples, whether willingly or by force, from one part of the world to another. More than mere numbers, the European, Chinese and African diasporas over the past five centuries involved tens of millions of people leaving environments they were familiar with to settle in new ones whose ecological processes they poorly understood (BOLTON 1981; CRONON 1983; RICHARDS 2003; ELVIN 2004). The ensuing encounters created their own forms of hazard: rampant species colonisation such as the proliferation of rabbits in Australia and the 'plague' of sheep in central Mexico or the widespread soil erosion associated with the twentieth-century Dust Bowl in the mid-western USA (ROLLS 1969; CROSBY 1972; WORSTER 1979; MELVILLE 1994).

## Cities

But, perhaps, the single most significant factor affecting global social vulnerability today is urbanisation with the number of people living in towns and cities expected to exceed those living in rural areas at any moment (DAVIS 2006). There is no straight correlation, however, between increased urbanisation and heightened vulnerability. The concentration of population in urban areas rather than dispersed in smaller numbers across an extensive countryside means that people are increasingly less likely to experience a hazard but that many more people are adversely affected when they do. In developed countries where it is more likely that building and zoning codes are enforced, older buildings retrofitted to withstand particular hazards, emergency services better equipped and early warning systems more fully developed, the number of fatalities has declined dramatically in proportion to the total population even if

the cost in material terms may have increased as much as eightfold in real terms since the 1960s (DOSWELL 2003, p. 137, 144).

The same, however, cannot be said of developing countries where the dynamics of urban growth are putting more people at risk faster than ever before in human history. Cities like Dhaka, Kinshasa and Lagos are approximately 40 times larger today than they were in 1950; while more than 200 million people in China alone have moved to urban centres in the last thirty years and a further 300 million are expected to follow in coming decades, raising the spectre of a 'planet of slums' in the not too distant future (DAVIS 2006, p. 2-11). Many of these cities are fast becoming potential disaster zones through the sheer size of population, unmindful modification of the natural environment or expansion into areas unsuited for such purposes (MITCHELL 1995; IFRCRCS 1998, p. 9-19). Again, it is the poorer members of society, particularly recent rural migrants who are unduly put at risk. Not only are they forced to live in the most perilous surroundings – along eroding river banks, atop unstable slopes or beneath mountains of waste – but they stand to lose disproportionately most in a disaster that can strip them of all their assets in a moment (MITCHELL 1999; SANDERSON 2000; PELLING 2003, p. 46-67).

The past, however, challenges are notions that contemporary and western ways are always better. An indigenous earthquake-resistant architecture evolved among the Inca in Peru, during the Byzantine and Ottoman periods in north-western Turkey, and in the Spanish Philippines where the style even came to be known as 'earthquake baroque' (OLIVER-SMITH 1994; DEGG/ HOMAN 2005; BANKOFF 2007). These were attempts to minimise losses of life and property by constructing buildings that took account of regularly occurring hazards. An alternative approach, an 'Asian way of coping' with the constant threat of fire favoured in urban areas of Qing China, Tokugawa Japan and Mughal India, was to erect 'ephemeral cities', where people accepted the periodic loss of their dwellings and allowed for the easy dismantling and removal of costly interior features that could be reused in cheaply constructed new structures (KELLY 1994; FROST 1997).

## Food

A rapidly expanding and increasingly urbanisation world population 'daily' runs the risk of not being able to feed itself. While harvest failure has been intrinsic to all forms of agricultural endeavour throughout recorded history, more traditional farming practices tended to favour techniques that reduced the likelihood of famine (SCOTT 1976). Crop diversification and land fragmentation are important mechanisms for ensuring food security in communities as far apart as the Ivatan of the South China Sea or Swiss farmers on the slopes of the Alps (NETTING 1993, p. 34-41; BLOLONG 1996). In societies exposed to the constant threat of hazard, such strategies make good sense from the perspective

of local farmers who are mainly engaged in minimizing risk rather than maximizing surplus. Unfortunately, the increased commercialization of agriculture and the adoption of high yield and otherwise modified varieties of seed while increasing production enormously have adversely affected these types of adaptive strategies (SEN 1981, 'RÈZE/ SEN 1990-1991).

Moreover, the intensification of commercial farming has rendered livestock far more susceptible to risks especially in western nations (HEATH 1999). As small farms have been increasingly replaced by large industrialised agro-pastoral enterprises over the last fifty years, the exposure of intensively confined animals to hazards such as failed structures, non-functioning automated systems, and the spread of diseases have resulted in widespread fatalities (HSUS 2006). The extent to which intensive farming practices makes national food markets more vulnerable to the impact of hazards was graphically illustrated when Hurricane Floyd hit the south-eastern seaboard of the USA in 1999. North Carolina, the state worst affected is also the second largest hog producer in the country with 90 per cent of its farms located on a floodplain and over 80 per cent of its ten million animals concentrated in facilities housing more than a thousand stock (TAYLOR 2001). In the event, up to 28,000 hogs, 750,000 turkeys and two million chickens were lost in the subsequent floodwaters (SCHMIDT 2000, p. A74).

## Technology

Technology has often been seen as the appropriate response to hazard and as the most effective means of minimising risk. The extensive flood protection systems erected by the Chinese, Vietnamese and especially the Dutch over the centuries allowed agriculture and industry to flourish on hitherto marginal lands but at the cost of intensifying their exposure to hazard. Nor should the scale of these enterprises be underestimated despite the fairly rudimentary nature of the technology available to effect their realisation or the limitations encountered in organising large labour forces in the past (TeBRAKE 2002; ELVIN 2004, p. 115-164). Still the violent storm that breached the Netherlands' sea defences on St Elizabeth's Day 1421 inundated 500 square kilometres, drowned 10,000 people, and turned central parts of the country into the inland sea that it remains to this day (LAMBERT 1971, p. 117-125; SCHAMA 1991, p. 31-34).

Serious attempts to predict such hazards began in the latter half of the nineteenth century with the development of the new sciences of meteorology and seismography. Great advances in weather forecasting were made during the next century as balloons, aircraft and then satellites added enormously to the quantity and quality of data available, eventually allowing for the formulation of computer-generated models of both immediate and more seasonal climatic conditions. However, the ability to accurately project the onset of the

1997/1998 ENSO (El Niño Southern Oscillation) event, the most powerful in recent history, did little to alleviate its deleterious effects on nearly 111 million people or prevent it from causing over US$ 34 billion in direct losses (NICHOLLS 2001, p. 137-139). Even the ability to forecast smaller-scale phenomena remains problematic. A severe hailstorm that struck Sydney one day in April 1999 left behind AU$ 1 billion in damages (NICHOLLS 2001, p. 146). Most early warning provisions, moreover, remain hazard-specific and national in character and so lack a truly comprehensive outlook. One of the few exceptions is the Pacific Tsunami Warning System based in Hawaii that is composed of 26 international member states (TITOV et al. 2005).

Today's developing nations are still mainly incapable of finding the necessary funds to underwrite the appropriate programmes of disaster preparedness, mitigation, relief and recovery. Small-island nation states like those in the Caribbean are particularly vulnerable to hazards such as hurricanes or volcanic eruptions that may overwhelm their entire resource base like in St Pierre in 1902 (BRIGUGLIO 1995; ZEBROWSKI 2002). However, as Hurricane Katrina that devastated large parts of the southern USA in August 2005 proved, technological know-how and scientific expertise have their limits and western developed countries may have as much to learn about disaster preparedness, management and recovery from non-western developing countries as the latter do from the former (BANKOFF 2006). In fact, a country's response to natural hazard may depend more on its social and organisational practices than on its wealth or resources. Through public education, national training exercises, a comprehensive early warning system, an integrated civil defence structure and firm government leadership, Cuba is better able to protect its citizens and resources than most other states in the world (SIMS/ VOGELMANN 2002). Hurricane Jeanne that cut a swathe of destruction through the Caribbean in 2004 left over 3,000 dead in neighbouring Haiti but passed without loss of life over Cuba (BERMEJO 2006, p. 14). Cuba now serves as a model for the United Nations and its government has even organised special medical brigades to provide assistance overseas in the case of disasters (SIMS/ VOGELMANN 2002, p. 396). However, an offer made by Cuba to provide 1,500 doctors and medical supplies to the USA in the wake of Hurricane Katrina apparently went unanswered (BERMEJO 2006, p. 19).

## Charting vulnerabilities

By drawing attention to the processes that put people at risk and how they deal with that consequent vulnerability, disasters provide a measure by which to assess how successfully societies adapt to their environment. Vulnerability, however, is not just a way to determine unsafe conditions in the present but it is also an important means of assessing how exposed people were in former times. By charting an historical trajectory of disasters, some communities and

societies in the past are revealed to have been skilful managers of all kinds of climatic and seismic risks, an ability that may have little to do with their apparent cultural sophistication, level of technological knowledge or degree of military prowess. Moreover, it may even point to alternative ways in which to mitigate such events in the future. As a conceptual framework, vulnerability reminds us that though natural hazards may be physical processes, disasters are quintessentially historical ones, that is they are the outcome of processes that change over time and whose geneses lie in the past. As with any historical process, a better understanding of their origins, realisations and outcomes will benefit from a comparative perspective that does not start with the assumption that any one culture's approach is superior to any other's. There is much to learn not only from what people did previously but from what others do now, how especially non-western societies go about disaster preparedness, mitigation and recovery in the present.

Finally, comparing vulnerabilities also encourages us to see disasters as more than purely destructive events in the short term and also to consider them as transformative agents in the longer term. In fact, disasters may be significant catalysts of change in their own right, causing political, economic and social adjustments, triggering needed adaptations in human behaviour and the built environment, as well as perhaps contributing to the overthrow of dynasties, economic systems and even civilisations (TAINTER 1988; DIAMOND 2005).

## References


BANKOFF, Greg (2003): Constructing Vulnerability: The Historical, Natural and Social Generation of Flooding in Metro Manila, in: Disasters 27, p. 224-238.

BANKOFF, Greg (2006): The Tale of Three Pigs: Taking Another Look at Vulnerability in the Light of the Indian Ocean Tsunami and Hurricane Katrina, Understanding Katrina. Perspectives from the Social Sciences, Social Sciences Research Council, (http://understandingkatrina.ssrc.org/Bankoff/ last accessed 18.5.2007).

BANKOFF, Greg (2007): Fire and Quake in the Construction of Old Manila, in: The Medieval History Journal 10/2 [forthcoming 2007].

BERMEJO, Pedro (2006): Preparation and Response in Case of Natural Disasters: Cuban Programs and Experience, in: Journal of Public Health Policy 27, p. 13-21.

BLAIKIE, Piers M. et al. (ed.) (2004): At Risk. Natural Hazards, People's Vulnerability and Disasters, London/ New York.

BLOLONG, Raymundus (1996): The Ivatan Cultural Adaptation to Typhoons: A Portrait of a Self-Reliant Community from the Indigenous Development Perspective, in: Aghamato 8, p. 13-23.

BOLTON, Geoffrey Curgenven (1981): Spoils and Spoilers. Australians Make Their Environment 1788-1980, Sydney.

BRADLEY, Raymond S./ JONES, Phillip D. (eds.) (1992): Climate Since A.D. 1500, London.
BRAUDEL, Fernand (1972): The Mediterranean and the Mediterranean World in the Age of Philip II, London.
BRIGUGLIO, Lino (1995): Small Island Developing States and Their Economic Vulnerabilities, in: World Development 23, p. 1615-1632.
CALGARO, Emma (2005): Paradise in Tatters. An analysis of the vulnerability of the tourism community of Khao Lak, Thailand to the 2004 Indian Ocean Tsunami, Stockholm.
CANNON, Terry (1994): Vulnerability Analysis and the Explanation of 'Natural' Disasters, in: VARLEY, Ann (ed.): Disasters, Development and Environment, Chichester et al., p. 13-29.
COOK, Noble David (1998): Born to Die. Disease and the New World Conquest, 1492-1650, Cambridge.
CRONON, William (1983): Changes in the Land. Indians, Colonists, and the Ecology of New England, New York.
CROSBY, Alfred W. (1972): The Columbian Exchange. Biological and Cultural Consequences of 1492, Westport.
CROSBY, Alfred W. (1986): Ecological Imperialism. The Biological Expansion of Europe, 900-1900, Cambridge.
DAVIS, Mike (2001): Late Victorian Holocausts: El Niño Famines and the Making of the Third World, London/ New York.
DAVIS, Mike (2006): Planet of Slums, London/ New York.
DEGG, Martin/ HOMAN, Jacqueline (2005): Earthquake Vulnerability in the Middle East, in: Geography 90, p. 54-66.
DIAMOND, Jared M. (1998): Guns, germs and steel. A Short History of Everybody for the Last 13,000 Years, London.
DIAMOND, Jared M. (2005): Collapse. How Societies Choose to Fail or Succeed, London.
DOSWELL, Charles A. (2003): Societal Impacts of Severe Thunderstorms and Tornadoes: Lessons Learned and Implications for Europe, in: Atmospheric Research 67, p. 135-152.
'RÈZE, Jean/ SEN, Amartya Kumar (eds.) (1990-1991): The Political Economy of Hunger, 3 vols., Oxford (Studies in development economics).
ELVIN, Mark (2004): The Retreat of the Elephants. An Environmental History of China, New Haven/ London.
EMANUEL, Kerry (2005): Increasing Destructiveness of Tropical Cyclones Over the Past 30 Years, in: Nature 436, p. 686-688.
FAGAN, Brian M. (2000): The Little Ice Age. How Climate Made History, 1300-1850, New York.
FAGAN, Brian M. (2004): The Long Summer. How Climate Changed Civilization, New York.
FLANNERY, Tim (2005): The Weather Makers. How Man is Changing the Climate and What It Means for Life on Earth, New York.
FROST, Lionel (1997): Coping in Their Own Way: Asian Cities and the Problem of Fires, in: Urban History 24, p. 5-16.

GLASER, Rüdiger/ STANGL, Heiko (2004): Climate and Floods in Central Europe Since AD 1000: Data, Methods, Results and Consequences, in: Surveys in Geophysics 25, p. 485-510.
GRIFFITHS, Tom/ ROBIN, Libby (1997) (ed.): Ecology and Empire. Environmental History of Settler Societies, Carlton South.
HEATH, Sebastian E. (1999): Animal Management in Disasters, St Louis.
HEWITT, Kenneth (1983): The Idea of Calamity in a Technocratic Age, in: HEWITT, Kenneth (ed.) Interpretation of Calamity from the Viewpoint of Human Ecology, Boston (The risk and hazard series, 1), p. 3-32.
HSUS/Humane Society of the United States (2006), Stranded, Starving, and Suffering: Farm Animals in the Wake of Katrina (<http://www.hus.org/farm/news/ournews/farm_animals_after_katrina_2.html> last accessed 18.05.2007).
IFRCRCS/ INTERNATIONAL FEDERATION OF THE RED CROSS AND RED CRESCENT SOCIETIES (1998): World Disaster Report 1998, Oxford.
IPCC/ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2001): Climate Change: Impacts, Adaptations and Vulnerability, Cambridge.
IPCC/ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2007): Climate Change 2007: The Physical Science Basis. Summary for Policymakers, Geneva.
ISHIBASHI, Katsuhiko (2004): Status of Historical Seismology in Japan, in: Annals of Geophysics 47, p. 339-368.
KELLY, William (1994): Incendiary Actions: Fires and Firefighting in the Shogun's Capital and the People's City, in: McCLAIN, James L./ MERRIMAN, John M./ UGAWA, Kaoru (eds.) Edo and Paris. Urban Life and the State in the Early Modern Era, Ithaca/ London, p. 310-331.
LAMB, Hubert (1972-1977): Climate. Present, Past and Future, 2 vols., London.
LAMBERT, Audrey M. (1971): The Making of the Dutch Landscape. An Historical Geography of the Netherlands, London/ New York.
LE ROY LADURIE, Emmanuel (1971): Times of Feast, Times of Famine. A History of Climate since the Year 1000, Garden City, N. Y.
LEWIS, James (1999): Development in Disaster-Prone Places: Studies of Vulnerability, London.
LOMBORG, Bjørn (2001): The Skeptical Environmentalist. Measuring the Real State of the World, Cambridge/ New York.
MELVILLE, Elinor G. K. (1994): A Plague of Sheep. Environmental Consequences of the Conquest of Mexico, Cambridge (Studies in environment and history).
MITCHELL, James K. (1995): Coping with Natural Hazards and Disasters in Megacities: Perspectives on the Twenty-First Century, in: GeoJournal 37, p. 303-311.
MITCHELL, James K. (ed.) (1999): Crucibles of Hazard. Mega-Cities and Disasters in Transition, Tokyo/ New York.
NETTING, Robert McC (1993): Smallholders, Householders. Farm Families and the Ecology of Intensive, Sustainable Agriculture, Stanford.
NICHOLLS, Neville (2001): Atmospheric and Climate Hazards: Improved Monitoring and Prediction for Disaster Mitigation, in: Natural Hazards 23, p. 137-155.
O'KEEFE, Phil/ WESTGATE, Ken/ WISNER, Ben (1976): Taking the 'Naturalness' out of 'Natural Disaster', in: Nature 260, p. 566-567.

OLIVER-SMITH, Anthony (1994): Peru's Five Hundred-Year Earthquake: Vulnerability in Historical Context, in: VARLEY, Ann (ed.): Disasters, Development, and Environment, Chichester/ New York, p. 3-48.
OLIVER-SMITH, Anthony (1999): 'What is a Disaster?' Anthropological Perspectives on a Persistent Question, in: OLIVER-SMITH, Antony/ HOFFMAN, Susanna M. (eds.) (1999): The Angry Earth. Disaster in Anthropological Perspectives, New York/ London, p. 18-34.
PELLING, Mark (2003): The Vulnerability of Cities. Natural Disasters and Social Resilience, London/ Sterling.
PFISTER, Christian et al. (1999): Documentary Evidence on Climate in Sixteenth-Century Europe, in: Climate Change 43, p. 55-110.
RICHARDS, John (2003): The Unending Frontier. An Environmental History of the Early Modern World, Berkeley/ Los Angeles/ London.
ROLLS, Eric Charles (1969): They All Ran Wild. The Story of Pests on the Land in Australia, Sydney.
SANDERSON, David (2000): Cities, Disasters and Livelihoods, in: Environment and Urbanization 12, p. 93-102.
SCHAMA, Simon ($^{4}$1991): The Embarrassment of Riches. An Interpretation of Dutch Culture in the Golden Age, London.
SCHMIDT, Charles (2000): Lessons from the Flood: Will Floyd Change Livestock Farming? in: Environmental Health Perspectives 108/2, p. A74-A77.
SCOTT, James Cameron (1976): The Moral Economy of the Peasant. Rebellion and Subsistence in Southeast Asia, New Haven/ London.
SEN, Amartya Kumar (1981): Poverty and Famines. An Essay on Entitlement and Deprivation, Oxford/ New York.
SIMS, Holly/ VOGELMANN, Kevin (2002): Popular Mobilization and Disaster Management in Cuba, in: Public Administration and Development 22, p. 389-400.
STEVENS, William Kenneth (1999): The Change in the Weather. People, Weather, and the Science of Climate, New York.
TAINTER, Joseph A. (1988): The Collapse of Complex Societies, Cambridge et al.
TAYLOR, David A. (2001): From Pigsties to Hog Heaven? in: Environmental Health Perspectives 109/7, p. A328-331.
TeBRAKE, William (2002): Taming the Waterwolf. Hydraulic Engineering and Water Management in the Netherlands During the Middle Ages, in: Technology and Culture 43, p. 475-491.
TITOV, Vasily et al. (2005): Real-Time Tsunami Forecasting: Challenges and Solutions, in: Natural Hazards 35, p. 35-41.
TURNER II, B. L. et al. (2003): Science and Technology for Sustainable Development Special Feature. A Framework for Vulnerability Analysis in Sustainability Science, in: Proceedings of the National Academy of Sciences of the United States of America, 100/14, p. 8074-8079.
WILLIAMS, Michael (2003): Deforesting the Earth. From Prehistory to Global Crisis, Chicago/ London.
WISNER, Ben (1993): Disaster Vulnerability. Scale, Power and Daily Life, in: GeoJournal 30, p. 127-140.
WISNER, Ben/ YAPA, Lakshman (1995): Building A Case Against Economic Development in: GeoJournal 35, p. 105-118.

WORSTER, Donald (1979): Dust Bowl. The Southern Plains in the 1930s, New York.
ZEBROWSKI, Ernest (2002): The Last Days of St. Pierre. The Volcano that Claimed Thirty Thousand Lives, New Brunswick, New Jersey/ London.