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Article *in* Risk Analysis · July 2003

DOI: 10.1111/1539-6924.00337 · Source: PubMed

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# European River Floods in a Changing World

James K. Mitchell\*

Whereas the verdict is undecided about the effects of global warming on Europe's flood risks, it is clear that Europeans are becoming more exposed and vulnerable to floods. Losses are increasing dramatically, mainly because of population and capital moving into harm's way and also because of human-driven transformations of hydrological systems, including river basins and floodplains.

**KEY WORDS:** Risk; vulnerability; context; urbanization; flood policy; Europe

## 1. INTRODUCTION

Loss of life and injuries due to flooding have generally been declining in Europe<sup>1</sup> during the past two centuries but there is now renewed worry about this hazard. Unusually severe floods during the 1990s and early 2000s affected much of the continent and have been the most obvious spur to attention (e.g., western Russia, Ukraine, Poland, Czech Republic, Germany, the Netherlands, France, Switzerland, Spain, and the United Kingdom, among others). But the shift in opinion has also been propelled by many other factors. Prominent among these are concerns about possible atmospheric warming and marked changes in European land cover and land use.<sup>(1,2)</sup> Taken together, these semi-global processes may exacerbate future flooding by altering river regimes in the direction of larger runoff volumes and shorter low water to flood peak intervals.<sup>(3-5)</sup> In addition, there exist flood-forcing factors of more specific European provenance. Many of these are connected with pow-

erful shifts in Europe's political-economic and socio-cultural systems as well as the specifics of society-environment relations in different parts of the continent. Sorting out the relative contributions of these varied factors is an important scientific and public policy challenge for the new millennium.

## 2. HISTORIC TRENDS OF EUROPEAN FLOODING

Historic data on flood losses are neither comprehensive nor standardized throughout Europe and it is only in recent years that anything like a complete catalog of floods has begun to be maintained. But, for all its limitations, the available evidence permits drawing some conclusions about flood trends. Although annual numbers of flood disasters have shown no consistent trend during the most recent period (1987-1998),<sup>(6)</sup> throughout the 20th century as a whole flood-related deaths have been either stable or decreasing while economic burdens of flooding and related societal disruptions have become decidedly worse.

Large-scale loss of life from individual floods predate the 19th century (Table I). These have nearly always been associated with coastal storm surges, mostly around the North Sea littoral. Twentieth-century flood disaster death tolls have been much lower—typically averaging fewer than 250 per year during the 1940s, 1950s, 1960s, and 1970s. Although

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<sup>1</sup> Here Europe is interpreted broadly to include territory between the Ural Mountains in the east and the Atlantic Ocean in the west, and from the Arctic Ocean in the north to the Black Sea and the Mediterranean Sea in the south. Turkey (part of which falls within these boundaries) is also a potential member of the European Union.

**Table I.** Flood Disaster Deaths in Europe 1099–1829 (730 years)\*

Year	Location	Flood Type	Deaths
1099	East Anglia, UK	storm surge	100,000
1219	Jutland, Denmark	storm surge	"thousands"
1228	Netherlands	storm surge	100,000
1287	Waddenzee, Netherlands	storm surge	50,000
1362	Schleswig, Germany	storm surge	30,000
1421	Dort, Netherlands	storm surge	10,000
1530	Netherlands	rivers/storm surge	400,000
1570	Netherlands	river/storm surge	50,000
1634	Cuxhaven, Germany	storm surge	6,000
1717	The Hague, Netherlands	storm surge	11,000
1824	St. Petersburg, Russia	ice jam	10,000
1829	Gdansk, Poland	ice jam	1,200

\*Deaths are reported for significant large floods only. Due to disputes among sources, the accuracy of these totals cannot be established. Especially before 1600 they are best regarded as approximate indicators of loss.

Sources: References 7–11.

there has been an upsurge of concern about flood deaths in Europe during the 1990s, available data suggest that the annual aggregate numbers have been significantly smaller than earlier in the century.

Economic losses associated with flooding are up sharply in recent years. By the end of the 1990s, many flood events were imposing multi-million U.S. dollar losses to structures and other property. The 1997 floods in Poland and the Czech Republic are believed to have inflicted losses on each country in excess of \$1 billion.<sup>(11,12)</sup> Not all losses represent material impacts. Costs of disruption to farms, industries, and transportation systems are substantial and precautionary evacuations are also growing. Although the losses fall well short of those in the United States, they are unprecedented for European river floods. In a related trend, the geographical spread of disastrous flooding also appears to be increasing, though whether this is a function of fuller and more transparent reporting, including improved data from behind the former Iron Curtain, is difficult to gauge.

National-level flood data are informative, but they do not necessarily reflect trends in individual communities. This is especially true of large cities that have historically been disproportionately well protected against hazard as a function of their power to affect the political priorities of national governments. Typically, urban flood disasters had declined to low levels by the beginning of the Industrial Revolution. For example, all but two of the 56 major floods that affected Florence since 1177 occurred before 1844.<sup>(13)</sup> However, as urban areas have grown

and become more complex during the 20th century, a gap has begun to appear between the capabilities of existing flood defenses and the potential for larger urban flood disasters.

### 3. CONCERN ABOUT FLOODING IN EUROPE

In Europe, concern about flooding has grown rapidly in recent years and has resulted in significant public policy responses by transnational organizations as well as national ones. (See, e.g., the 20-year "Action Plan on Flood Defence" adopted in Rotterdam on January 22, 1998 by the 12th Conference of Rhine Ministers at a projected cost of 12 billion ECU.) These actions have been partly propelled by a general heightening of flood awareness that was facilitated by improved environmental surveillance and monitoring technologies, as well as by enhanced telecommunications systems. The European Space Agency<sup>(14)</sup> now supplies user groups with remotely sensed images of flooding in real time, and comprehensive data sets that record the location, extent, and duration of floods are beginning to become available on a global basis.<sup>(11)</sup> The result is quicker, more reliable, and more complete provision of data to flood scientists. At the same time, there has been an acceleration in natural science and social science research on European flooding, which has led to more informed public debates about flood issues.<sup>(15–19)</sup>

More effective and widespread reporting of events by the mass media have also contributed to growing awareness of floods. Newspapers, television, and radio have undergone their own transformations, both technologically and organizationally. The news horizons of Europeans have expanded in step with the increasing mobility of European populations and the evolving Euro-consciousness of institutions that were formerly focused on more parochial issues. As a result, Ukrainian and Iberian floods that might once have been obscure events for British and German audiences are now likely to feature on nightly news reports beamed throughout the continent to people whose jobs and vacations are increasingly part of a common European social space.

Moreover, the types of flood disasters that are featured in media reports often touch on deep-seated contemporary anxieties about human security: victims caught in unfamiliar surroundings; children and young people without experience of hazard; sites that were assumed to be protected but proved otherwise! Scenes of Mediterranean tourist towns and vacation

campgrounds inundated by flash floods pose worrying questions about safety for northern European vacationers. Reports of young canyon-runners drowned in sudden Swiss thunderstorms tap the fears of parents and older family members. The occurrence of record-setting floods in cities like Lisbon and Cologne is unsettling for populations that have come to regard such places as well buffered against natural extremes. Water lapping at the tops of Rhine dikes that had been assumed to possess comfortable safety margins reinforces the notion that the floods themselves are becoming more extreme—although a more careful analysis suggests that the human component of the hazard is changing more dramatically.

Recent news reports tend to suggest that European flood problems are increasingly ubiquitous and that existing flood-management systems are operating close to their limits of effectiveness. These media judgments are reinforced by assessments of European-based reinsurance companies like Swiss Re (Geneva) and Munich Re, which have pointed out the growing toll of economic losses and issued cautions about overreliance on insurance as a tool for managing flood hazards.<sup>(20)</sup> Together with academic analysts, media and insurance sources have raised questions about the adequacy of European flood-warning systems, especially for flash flooding.<sup>(21,22)</sup> Unlike the United States, where forecasting and warning systems are highly important components of flood-mitigation strategies, they are less well developed in most parts of Europe, and public confidence in them is correspondingly weaker.<sup>2</sup> A series of well-publicized prediction failures has also highlighted both the technical difficulties of forecasting floods in Europe and the underdeveloped role of warnings in Europe's national hazard management systems.<sup>(23,24)</sup> Taken together, these factors convey the impression that floods are increasing objects of concern in Europe and that at least some of their effects are growing worse. A casual observer might be tempted to look to climate change for an explanation of these trends, and part of the answer may lie in that direction. Since there has not been a thorough investigation of climate change effects on European flooding (see Bromstedt, this issue), the question must remain open. But there is ample reason for con-

<sup>2</sup> The Netherlands—which has had a long history of severe flooding up through the mid-20th century—is something of an exception. Large-scale evacuations continue to follow in the wake of flood warnings that forecast water heights above dike levels. For example, during one period of high water in 1995, a quarter of a million people were evacuated from the lower Rhine region (*The Times*, December 28, 1999).

cluding that other factors are of equal or greater importance than climate change. The next section takes up this theme.

#### 4. DRIVING FORCES OF FLOOD HAZARD IN CONTEMPORARY EUROPE

Like other natural hazards, floods are not simply extreme physical events that inflict losses on unsuspecting human populations and their property. They are interactive processes that involve inputs from both nature and society. Some analysts have expressed the general relationship in terms of a simple formula: Hazard = Risk × Vulnerability, where Risk is roughly equal to the natural contributions and Vulnerability to the human ones.<sup>(25)</sup> That expression captures the interactive and uncertain character of hazard, but it also grossly oversimplifies the natural and human inputs, especially by conflating several distinctly different human dimensions, namely, exposure, resistance, and resilience. All these dimensions are also strongly contextual.<sup>(20,26)</sup> In particular, they are affected by the combined effects of powerful, pervasive, and often destabilizing forces, such as the burgeoning electronic information revolution; new technologies of environmental surveillance and transformation; widespread human modifications of river-basin landforms, land cover and land use; the globalization of economic relations; marked shifts in the composition and distribution of populations; rampant urbanization; and the restructuring of political ideologies or governmental systems as well as public reactions to those changes.

Findings from a recent study that focused on a wide range of natural hazards in 10 international mega cities<sup>3</sup> are also useful for understanding the changing human ecology of European floods.<sup>(27)</sup> Briefly stated, they suggest that changes in exposure and vulnerability are disproportionately important causes of increasing hazard losses in major cities. Though not unimportant, increasing natural physical risks are less significant contributors to the rising toll of losses. Existing responses to hazards are being pushed to their limits with consequent pressures not only to develop new alternatives but also to redefine acceptable thresholds of loss. Although only one European city (London) was included in the study, there is evidence that the findings also apply

<sup>3</sup> London, Lima, Mexico City, Miami, Los Angeles, San Francisco, Sydney, Tokyo, Seoul, and Dhaka.

to places like Florence, the interconnected Utrecht-Rotterdam-Hague-Amsterdam complex known as Randstad, and many other European cities.<sup>(28)</sup>

At the outset it is worth pointing out that absolute population growth is not usually a major contributor to the increasing flood disaster potential of Europe. Whereas invasion of floodplains by humans in search of new land for farming or homes is one of the most important drivers of flood losses in places like Bangladesh and throughout much of Africa or Latin America, Europe's total population is increasing only very slowly and in some states may actually be declining. More important is the concentration and redistribution of population that accompanies urbanization, although rates of urban expansion in Europe are again lower than in many developing countries. The spread of low-density suburbs and ex-urbs is a particularly significant factor in the conversion of rural lands near European cities, including floodplains. But far more important than any of these are shifts in the location of industries and homes impelled by economic factors and lifestyle choices.

The invasion of downstream floodplains by export-oriented businesses and industries, especially along navigable waterways that connect with deepwater international ports, is one example of increasing exposure to flood risks that reflects economic stimuli. This process is marked in London where there has been a decided shift of the locus of flood hazard during recent decades, as new investments crowd into the Thames estuary and the lower Thames valley seeking superior access to European and world markets. Similar processes can be observed in the lower Rhine valley (e.g., the massive Europort facility near Rotterdam and the Hague) and to a lesser extent along the lower Elbe and the lower Seine (e.g., Le Havre port complex). Even the outer fringes of Europe are not exempt from floodplain invasions by export-oriented businesses. Norwegian furniture manufacturers locate factories on flat sites beside fjords where they can import desirable cherry and maple woods from North America and reship the finished products to transatlantic consumers.

It has become conventional to apply the term "economic globalization" to the process driving these changes, but that simple label should not disguise the fact that many different interlocking—and sometimes countervailing—subsets of human activity are involved. For example, the burgeoning emphasis on port locations for industries is facilitated by changes in a complex web of factors that includes, among other things, marine transportation, navigation, and

dredging technologies; shipboard labor practices; vessel registration and regulation rules; the acquisition of new electronic skills by mariners; the profitability of the shipping industry; and the state of competition between different transportation modes. In turn these components are embedded in a dominant consumer-oriented economy that is made possible by fluid supplies of investment capital and preferences for entrepreneurial risk-taking, coupled with precisely segmented and targeted marketing strategies that rely on vast quantities of timely and comprehensive information about consumer tastes and surplus income. The foregoing itemization only begins to scratch the surface of an economic process that is amplifying flood hazards in Europe and elsewhere, but it is sufficient to illustrate that hazards analysts and managers must look beyond the obvious elements of high water and unwise location decisions for effective responses to the flood-hazard conundrum.

The movement of exporting industries to waterside locations is one kind of regional shift that is affecting the distribution of flood-hazard potential in Europe. Another is the phenomenon of north to south industrial migration, which is occurring in countries like Britain, France, and Germany. Probably best seen in Germany, where it is described as a "descent to the south," this process is characterized by the relocation of high-technology, service-oriented industries from older decaying manufacturing cities in northern parts of the continent (that had been hearths of the Industrial Revolution), to small cities and villages with the kinds of climatic, recreational, and cultural amenities that are preferred by affluent business managers and highly mobile workforces. A byproduct of this movement is a net transfer of land-development pressures away from the big river systems of northern Europe to smaller upland watersheds on the fringes of the Alps, Apennines, and Massif Central or to maritime locations in France, northern Italy, and southern Portugal.<sup>(29)</sup> When the boom in vacationers, who frequent the mountains and coasts of southern Europe, is added to the influx of new industries, the aggregate southward shift in patterns of flood-hazard potential is clearly marked.

Meanwhile, the old river cities of northern Europe are experiencing their own changes in flood-hazard potential as a result of urban clearance and redevelopment projects that are designed to improve the attractiveness of waterfront areas to existing residents and new investors. Along the Thames in London, the Manchester Ship Canal, the Seine in Paris, the Rhine in Rotterdam, the Spree in Berlin,

and the Elbe in Hamburg, old docks, crumbling warehouses, derelict train terminals, and outdated power stations are being replaced by new upscale apartments, cultural facilities, government offices, parks, shopping and entertainment complexes. Low-value investments at risk to flooding are disappearing and higher value ones are taking their place. This trend is not confined to old industrial Europe as growing European affluence is multiplying the value of buildings, infrastructures, services, and amenities all across the continent. In other words, the basis for even larger future flood disasters is being laid down.

In many places, transportation infrastructure, watershed protection and water supply, nature conservation, and recreation are becoming more important floodplain land uses than traditionally dominant agriculture. Historically, much riverside land in Europe has been used for agriculture, and demands for additional agricultural acreage frequently gave rise to large-scale wetland drainage and river-straightening schemes.<sup>(30,31)</sup> But now the need for locally produced farm goods is declining as cheaper substitutes become available from other continents, including North America. An early retreat from floodplain agriculture was sounded in the Netherlands during the 1960s and 1970s when Dutch officials cancelled plans for agricultural reclamation of new polders near the IJsselmeer and turned them over to water supply, forest park, and urban uses instead. Road, rail, and waterborne transportation routes now thread the floodplains of western European rivers to a remarkable degree. The redesign and extension of transportation infrastructures has already played a large part in the project for a single European market (e.g., tunnels under the English Channel and through the Alps; road bridges across the Kattegat/Ore Sund and the Bosphorus; improved links between the Rhine and Danube waterways; high-speed intercity passenger trains; ongoing efforts to connect and pivot the continent's freight rail network around newly reunited Berlin). Even more so than inundation of fields and homes, the disruption of commuting and freight services for vast regions is often the economic impact that is most at stake during floods. It is too early to tell whether similar changes in flood exposure and vulnerability will occur in eastern Europe, but there the picture is complicated by possible regional shifts in agricultural production that may accompany expansion of membership in the European Union. We may see more investment in floodplain agriculture along the rivers of Poland, Romania, and the Ukraine rather than less. In any event, it is likely that Europe's flood-

hazard patterns will be shaped by global as well as local forces.

One of those forces is the growing power of humans to shape natural landscapes and biogeophysical processes. By the beginning of the 20th century, the landscapes and ecosystems of Europe may have been more extensively modified by humans than those of any other continent, and the past 100 years have seen a further acceleration in these activities.<sup>(32)</sup> Although the clearance of forests and the conversion of wetlands for agricultural purposes are no longer major forces in much of Europe, they have been replaced and surpassed by other equally effective agents of environmental transformation. These include, among others, demands for tourism, recreation, and amenity services (ski slopes, marinas, resort developments); the degradation of natural ecosystems by air pollutants and other complex products of affluent societies (e.g., toxic contamination of wetlands by mine spoil and other wastes; so-called forest death, or *Waldsterben*); increased demands for water (e.g., supply reservoirs); and low-density residential sprawl. Many of these changes have direct implications for flooding. For example, throughout the Alpine regions environmentalists have argued in support of a connection between deforestation of mountain slopes, on the one hand, and increased runoff with shorter times to peak flows at downstream flood gauges, on the other.<sup>(33)</sup> But here a word of caution is in order. Although a general relationship between watershed conversion and increased flooding has been established in many parts of the world, the mix of contributory factors and the operating parameters seems to vary considerably from place to place. Thus the combined interaction of human and natural factors may have different flood-related consequences in, say, China, Great Britain, and the United States.<sup>(34–36)</sup> In summary, without a great deal of additional field data and analysis, it is premature to conclude that human-driven changes in river-basin landforms, land-cover, and land uses are universally contributing to increased flood vulnerability in Europe but the possibilities are suggestive of such a connection.

Flood vulnerabilities are also changing in Europe. The continent's population is aging; almost 15% of Europe's citizens are now over 65 years old—up from 12% in 1980.<sup>(37)</sup> Since the aged tend to want—and need—more assistance during or after extreme events, this places a heavier burden on public services and raises anxiety levels among potential flood victims. Much of Europe's population is also becoming more affluent—though there are major contrasts

between the richer states of the European Union and the poorer ones of the former USSR, which suffered grave economic crises during the collapse of Communist economies. Greater wealth confers some additional security on groups that might once have lived close to the margins of economic survival, but wealth also tends to drive up the economic costs of natural disasters because more people occupy larger and more costly houses and are often willing to sustain bigger disaster losses. Vulnerability is also increasing among Europe's recent immigrants. Newly arrived poor populations and local itinerant or homeless populations increasingly have begun to occupy marginal sites in and around major cities, including some river floodplains. Though the trend is detectable in places like Frankfurt am Main and some inner neighborhoods of London, it is nowhere as pronounced as in the third-world shantytowns of Latin America and Asia, nor even in the riverside embankments of Tokyo or certain districts of Los Angeles.<sup>(38,39)</sup> Given the fact that: (1) many of the most flood-prone parts of European cities lie close to their historic cores; (2) these places are valued for a mixture of tourism, amenity, and heritage reasons; and (3) the demand for inner-city residential properties is usually strong, it is unlikely that urban flood vulnerability differentials in Europe will be as wide as those of North America or elsewhere but the trend bears watching nonetheless.

Levels of urbanization vary widely among the states of Europe, but tend to be highest in northern countries and lowest in periphery states of the Balkans, Switzerland, Austria, Ireland, and Portugal.<sup>(29)</sup> Urban growth is disproportionately occurring in the hinterlands of existing large cities and in the medium-sized and smaller cities of the European "Sunbelt." These are the places where one would tend to expect additional flood problems in the future. But the relationship between urbanization and flood potential is by no means simple and is strongly affected by trends toward increasing functional specialization of cities. A recent study identified 11 different types of European urban units, ranging from global cities like London and Paris through specialized high-technology service centers, such as Bristol and Munich, to declining port cities (e.g., Genoa, Marseilles), planned new towns (e.g., Evry), monofunctional satellites (e.g., Roissy), and tourism centers (e.g., Salzburg, Venice).<sup>(29)</sup> The combination of economic and noneconomic forces that is driving flood potential affects these places differentially and in ways that call for careful assessment on a case-by-case basis.

It is important to note that flood-loss potential in Europe is affected by certain situational characteristics that influence vulnerability and complicate the task of choosing appropriate public policies. Among others, these include high population densities in most river basins and large numbers of historic buildings and culturally valued sites. For example, it can be argued that Europe's generally high population densities hamper the enactment of floodplain land-use controls, but this overlooks the fact that it is in (high density) urban areas where the demand for controls is greatest and where they have historically been most effective. Europe's generally long history of human occupancy also confers some distinctive emphases on flood policy. Simply because there are so many of them, the protection of historic communities and historic buildings looms disproportionately large as a European policy issue. Inasmuch as "zero damage" is an acceptable flood-protection criterion for historic buildings that are irreplaceable, thresholds of acceptable loss are often set quite low and are therefore highly sensitive to small-scale fluctuations of flood regimes.

Issues of flood protection for historic buildings are but one facet of a larger and more complex subject: European practices for assessing flood risks and for setting thresholds of acceptable risk as well as acceptable flood hazard management practices. Although the human dimensions of flood-risk assessment are attracting hazards researchers in Europe,<sup>(40-43)</sup> this subject has not yet received sufficient scrutiny. In the United States and Japan it has been observed that risks that were once tolerated under one set of socioeconomic conditions can become unacceptable when circumstances change. One of the best examples of this phenomenon is the shift in thresholds of acceptable natural risks that followed a substantial growth of national wealth in Japan during the decades after World War II. High death rates from floods, typhoons, and earthquakes that were tolerated during the 1930s, 1940s, and 1950s became unacceptable in a country that was rapidly moving into the upper echelons of developed states by the 1960s. A national commitment to reduce disaster deaths was accepted by the Japanese government after the Ise Bay (Nagoya) typhoon of 1959 and successfully implemented during the 1960s, 1970s, and 1980s. European parallels have not been so dramatic, but it is nonetheless clear that many people in Europe have become increasingly adverse to imposed risks. Though there have been few prominent European advocates of a "zero-risk society," public opinion seems to be shifting

toward greater risk sensitivity. Hence, there may be less willingness to tolerate floods than previously.

In much the same manner, willingness to accept conventional engineering flood-management practices or technologies appears to be changing in Europe. Dikes, reservoirs, and concrete walls are increasingly viewed as ugly or environmentally damaging and sometimes—as in the case of large dam failures—a source of catastrophic hazard in their own right. Whereas the range of choice among adjustments to floods is relatively large in the United States, in Europe the dominant preference seems to be for fewer alternatives but more conservatively designed ones.

Various pieces of evidence support a judgment that Europeans and Americans may hold different perspectives on environmental risk. Differing design risk thresholds are one example. Flood-protection works in Europe are often designed to provide what American engineers would regard as very high thresholds of safety. Along the Rhine, many river works are designed to accommodate 1 in 1,250-year floods, whereas the typical standard on U.S. rivers is 100–200 years (<http://www.sare.org/san/htdocs/hypermail/html-home/15-html/0424.html>). Other engineering examples might be cited, such as the exacting construction standards for the Thames Flood Barrage or for European buildings in areas exposed to high winds. Sensitivity to catastrophic environmental risks was elevated in Europe by the experience of the Chernobyl nuclear disaster and by fears about the failure of similar power stations in eastern Europe. Perhaps because of this, Europeans have been quick to embrace social theories that privilege (environmental) risk as a fundamental new organizing concern of post-modern societies. (i.e., the so-called risk society paradigm).<sup>(44–46)</sup> Though not unreceptive to arguments that would elevate the social importance of risk, American hazards scholars have been more reluctant to endorse a similarly expansive view. Of course, countervailing notions have been voiced by some Europeans to the effect that Americans demand unrealistically high standards of safety against a vast range of risks. One of these is Alexander Solzhenitsyn—a shrewd judge of human foibles—who in a commencement address at Harvard University argued that Americans have an exaggerated sensitivity to what Russians would regard as minor environmental threats!

These observations are meant to remind readers about the complexities that attend environmental policy making at the beginning of the third mil-

lennium. To the age-old realities of a world where the assemblage of physical and biological factors that make up specific environments is immensely variable from place to place and subject to sharp temporal discontinuities, we must add the realization that humanity possesses both vastly expanded capabilities to modify environmental risks and rewards as well as a burgeoning propensity for fundamentally restructuring the institutions and practices of daily living. This is the thoroughly dynamic, uncertain, and ambiguous context within which the selection of appropriate European flood policies and programs will take place.

## 5. CONCLUSIONS

There is ample reason to be concerned about the growth of flood-disaster potential along the rivers of Europe even without taking climate change into account. Clearly, Europeans are facing a serious hazard challenge that is continentwide in scope. As inheritors of a long and complex history of flood experience—the lessons of which have too often been ignored—Europeans have the advantage of already knowing a good deal about environmentally sustainable flood management. As pioneers of new institutions of government and new systems of decision making that were shaped by the political fallout from wars both hot (1939–1945) and cold (1945–1989), they have faced—and will continue to face—a unique suite of flood-policy challenges. As citizens of governments that continue to pursue more interventionist public policies than their recent transatlantic counterparts, they may be able to “reinvent” government along somewhat different lines from the United States. And as members of societies whose perspectives on environmental risk may not be the same as those of the United States, Japan, and other places that have heretofore dominated much of the international discourse on hazards, they have the opportunity to fashion creative alternatives that will enrich the storehouse of techniques by which humans come to terms with uncertain and hazardous environments in ways that commend themselves to people in other parts of the world.

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