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**University of Surrey  
IIASA**

# **TSUNAMI**

**Project on**

**The Uninsured Elements of Natural Catastrophic Losses**

## **THE 1997 POLISH FLOOD CASE**

**Preliminary Case Study Report**

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## 1997 Polish Flood Case

### Summary

Estimates of direct property damage from the 1997 Polish flood range from about US\$ 2 billion to US\$ 3.7 billion, the latter being 2.9 per cent of Poland's GDP. For purposes of this report, we will use an approximate US\$ 3 billion estimate. These losses were to household property (12%), business property (25%), agriculture (22%) and public buildings and infrastructure (41%). The indirect losses to production and business disruption may also be quite significant.

Private insurers recorded close to US\$ 0.25 billion in claims from the 1997 flood, or from 10 to 15 per cent of total direct losses. Approximately half of these insurance losses were absorbed by international reinsurers.

International aid provided compensation for only about one per cent of the losses. The largest part of the disaster recovery funds was provided by international lending organizations, covering almost a quarter of the losses. The Polish central government was also heavily involved in compensating victims and repairing the damages to public infrastructure. These expenditures were financed through a credit from the National Bank and by diverting funds from other budgeted items. Finally, a large gap remained, which will be absorbed by the private and public victims.

Before 1989, a state natural perils cover was compulsory in Poland. Today, Polish authorities are encouraging a concept of individual responsibility and a viable private insurance market for providing protection. Discussions are underway with respect to the government's role in this system. Residential, commercial and industrial property can be insured against natural perils by endorsement to the fire policy. Agricultural buildings are compulsorily insured (content cover is excluded). Personal and commercial property cover is under 25 per cent (excluding agriculture), and industry cover is around 50 per cent.

In 1997, there were 55 insurance companies operating in Poland (Non-life 30; Life 23; Reinsurers 2). The former state monopolists are usually the industry leaders, although today they tend to be joint stock companies with the state often holding the biggest block of shares. Poland was planning to admit foreign companies with effect from 1 January, 1999 (need information if this went through).

With strong economic growth and a stable government, Poland offers opportunities for natural peril insurance. In addition to private residential and commercial cover, there may be unexplored opportunities for insuring local and provincial governments. Given the high public infrastructure losses, and Poland's fiscal austerity program, governments are at high risk.

In considering the insurability of flood risks in Poland, some important points from this case need to be taken into consideration, including:

- Very high potential loss from floods as Poland's major peril;
- Risk estimates still lacking, although work underway on flood maps;
- Fully privatized system at present, meaning
  - insurance not mandatory, except agriculture (adverse selection potential)
  - no reinsurance cover from government
  - regulatory system in flux;
- Zoning and other mitigation measures underdeveloped

Further work needs to be carried out on:

- Filling data and information gaps;
- Potential design of Polish insurance system;
- Flood mapping
- Models for designing effective insurance portfolios;
- Role of insurance industry and government in mitigation efforts

**Draft**

## **Tsunami Phase One**

### **The 1997 Polish Flood**

#### **1. Description of Disaster**

In the summer of 1997, torrential rains caused several major rivers to break through flood dikes and cause disastrous flooding in southwestern Poland, the Czech Republic and the eastern part of Germany. Poland was the hardest hit with over 100 persons losing their lives and thousands left destitute. Precipitation of this magnitude had not occurred in the country in over 1000 years, and the flood was classified as having less than a 1 in 1,000 chance of occurring despite the possibility that climate change may be playing a role in increased precipitation (Munich Re, 1998).<sup>1</sup>

The rains began on July 5 and lasted for two weeks, flooding 1.5 million acres in south-west Poland. The most devastating surge was along the Oder, ravaging the city of Wroclaw. The floods in all three countries cut road, rail and telecommunication links. Poland suffered the most. The flood affected 6000 square kilometres, including 1,300 towns and villages. Damage was heavy: 45,000 flooded buildings, more than 3,000 kilometers of damaged roads, almost 2,000 kilometers of damaged rail lines, and hundreds of damaged or destroyed bridges. The floods hit heaviest in the provinces of Wroclaw, Walbrzych and Opole. The disaster was extreme and unusual: rainfall four times the July average, floods one-and-a-half times higher than those anticipated by dike builders, rivers two meters above flood warning levels. (International Federation of Red Cross and Red Crescent Societies, 1998).

The economic losses have been estimated to be around USD 3 billion, of which some 300 million were insured. According to Swiss Re (1998), the flood gives a realistic idea of the order of magnitude of potential losses. On account of the possible catastrophic flooding of the Vistula River, there is also a considerable loss potential in Warsaw.

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<sup>1</sup> Alternatively, as reported in the *European Insurance Market* (1997), the flood can be classified as a 100 year flood, although other reports have estimated it as a 1000 year flood. In Poland, earliest records are from the year 1309, when a tremendous flood wave destroyed large portions of the city of Szczecin on the Odra. A similar situation occurred in 1497, and again in 1571.

## 2. Economic and Demographic Characteristics of Poland

Table 2.1: Economic and Demographic Characteristics of Poland in 1997

<i>Population (millions)</i>	38.7
GNP (US\$ billions)	138.8
GNP per capita (US\$)	3,590
% annual growth in GDP, 1997	6.9
% inflation 1997	14.9
Current account deficit	-3.2
% population below poverty line	24
% urban population	64
Life expectancy	72
% GDP agriculture	5.1
% GDP services	64.2
% GDP industry	30.7

Source: <http://www.worldbank.com> 9/26/98

Poland's economic growth in 1997 was the highest in Eastern Central Europe. Poland was also the first of the reforming countries to get back to growth – 1n 1992. There is a relatively stable macroeconomic environment in Poland. The current account deficits are manageable, particularly since Poland can rely on high foreign currency reserves.(Swiss Re, sigma No. 7, 1998) However, in 1997 and today, Poland is in a period of fiscal austerity in order to reduce government budget deficits to meet the Maastricht conditions for entering the European Union.

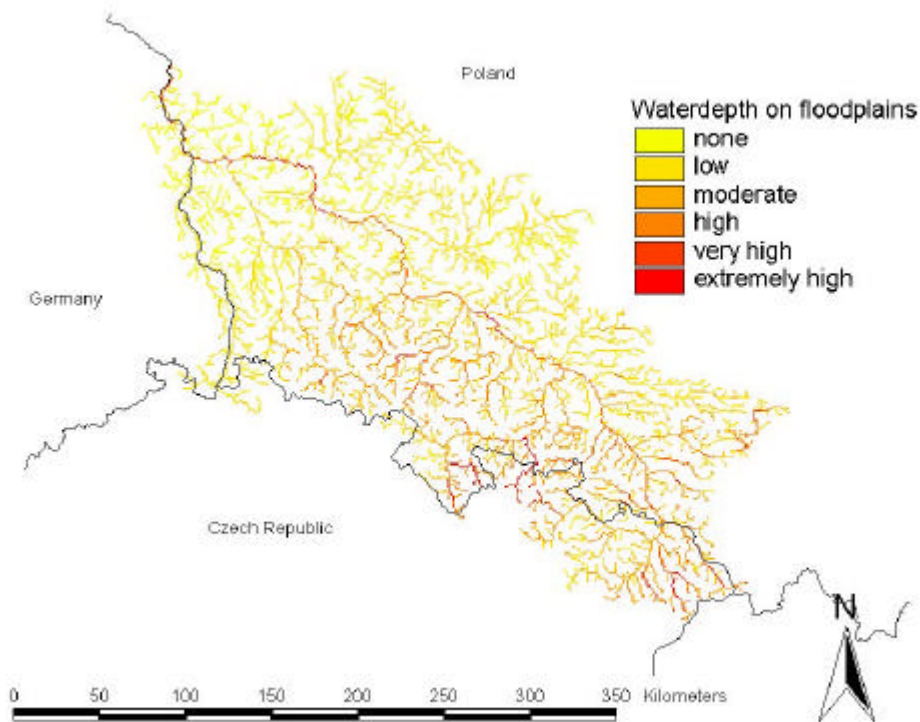
The area of the floods is heavily industrialized. It represents a mix between rural and urban, with about 2/3 of the households on the flooded area located in rural areas and 1/3 in urban areas. The region flooded is shown in Figure 1.

## 3. Institutional Aspects

### 3.1. Public sector institutions

Neglect of flood control measures under the communist regime contributed to vulnerability of the region to a flood disaster. In 1994, Poland's Supreme Board of Inspection reported to the government that 2,000 of the country's 9,000 kilometers of dikes required modernization (cost about US\$ 850 million). Flood Control Committee lacked adequate equipment to analyse rainfalls and monitor tributaries. In addition, over exploitation of highland forest reportedly contributed. Critics claimed also that government relied too heavily on large and expensive reservoir projects. Early warning systems deficient (On July 10, head of National Civilian Defense, declared that the wave that inundated Ople was not dangerous to Wroclaw, but 48 hours later Wroclaw was swamped). Some flood victims believed their villages were recklessly sacrificed by officials who destroyed retaining wall to divert water away from large communities downstream. Other villages blocked gaps to be blown in upstream dykes, contributing considerably to damages in Wroclaw.

Figure 1: Map of Water Depth of Flooded Area in the Oder Basin



Source: Ad de Roo, et.al (1999)

The inefficiencies in the response have been blamed on the centralized institutional structure existing still in Poland. Local authorities did not know what could be done without consulting higher authorities, and no funds existed for them to respond adequately. Local government had access to only 14 per cent of total state income.

Moreover, with plans to join the European Union, the flood caught Poland in a tight fiscal austerity program. For all these reasons, the central government declared that for the future it would transfer at least partial responsibility for disaster relief to new regional authorities. The second-level administrative authorities (provinces or voivodeships) have since been consolidated from a total of 49 to 17, and they have been given more financial resources. A third-level authority, the district, has been established to link the *voivodeships* with the communities. These regional authorities may play a more significant role in implementing risk management strategies for dealing with floods and other natural disasters (Makowski, 1999).

### 3.2 Insurance Institutions

In communist Poland, insurance was nationalized, and flood cover was almost universal. All premiums went back into state funds, claims were paid from the state budget and any gaps were met by the state controlling resource allocations. After the

transition, new institutions, such as regulatory and support structure for private insurance, have yet to be put into place.

In Poland, today, a concept of individual responsibility and a viable private insurance market for providing protection is being encouraged. Before 1989, a state natural perils cover was compulsory. This has now been replaced by a private, voluntary arrangement. Residential, commercial and industrial property can be insured against natural perils by endorsement to the fire policy. Agricultural buildings are compulsorily insured (content cover is excluded). Personal and commercial property cover is under 25 per cent (excluding agriculture), and industry cover is around 50 per cent.

As shown in Figure 2, only about 10-15 per cent of the losses from the 1997 flood were covered by insurance (International Federation of Red Cross and Red Crescent Societies, 1998; Swiss Re, 1998). Prior to 1997, the Polish General Insurance Company (Powszechny Zakład Ubezpieczeń PZU) was offering an insurance package covering natural disasters, including the flood risk (Kindler, 1999). However this coverage was rather expensive, and most households and firms in the region did not purchase insurance.<sup>2</sup>

One hindrance to the private insurance market in Poland and throughout much of Europe is the lack of a concept of individual responsibility for the risks and losses. People increasingly expect protection from government against floods and hold the public sector responsible for compensating the victims. Floods are only partially seen as natural disasters or "Acts of God" and are often framed as policy disasters, e.g., failures of effective public policies for prevention and mitigation (Rosenthal, et al., 1998). In Poland, the public viewed the central government as largely responsible for the 1997 flood damage, mainly through its neglect in maintaining the system of dikes and preventing excessive exploitation of the forests (International Federation of Red Cross and Red Crescent Societies, 1998). Indeed, as the Polish flood waters rose, the Prime Minister made a public statement that uninsured victims had only themselves to blame for their financial losses and should not expect government help. This remark raised such a public outcry that the Prime Minister was forced to apologize (Stripple, 1998).

Still, insurance premium volume (generally) in Eastern Central Europe has increased continuously since the transition (particularly in motor liability, little increase in life, no information at this writing on property and catastrophe). In 1997, Central and Eastern Europe (CEE) generated a total premium volume of USD 14.9 billion, equivalent to just under 1% of premium income worldwide. Poland represents a market share of 25.2. % of this premium volume. Still insurance premiums account for only 2 to 3 percent of GDP, compared to 13 percent in Britain. The insurance markets of CEE are generally highly concentrated, but this is declining due to the loss in market shares of former state monopolists, mainly to local but also to foreign companies. The state monopolists are usually the industry leaders, although today they tend to be joint stock companies with the state often holding the biggest block of shares. (Swiss Re, sigma No.7, 1998)

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<sup>2</sup> Poland is not an exception in this regard. Globally, only about 8 per cent of flood losses are insured, mainly in countries, such as the United States or France, with public insurance programs. (Swiss Re., 1999)

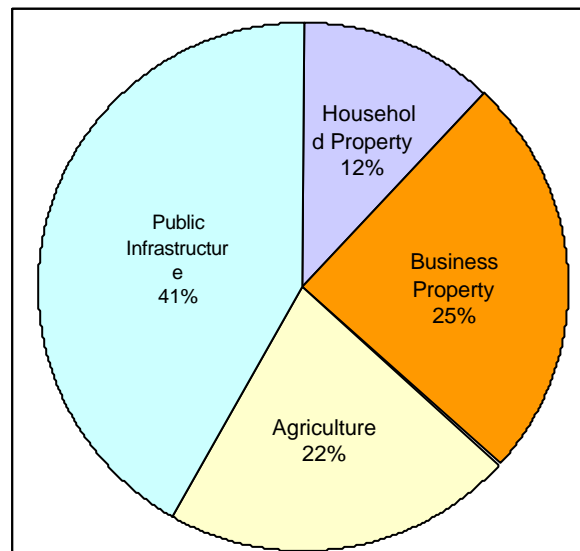
In 1997, there were 55 insurance companies operating in Poland (Non-life 30; Life 23; Reinsurers 2). The three largest non-life insurers were PZU (former monopolist), Warta (former monopolist) and Polisa, with market shares of about 65%, 10%, and 5%, respectively. The three largest life companies in 1997 were PZU Zycie, commercial Union na Zycie, and Amplico Life. Poland was planning to admit foreign companies with effect from 1 January, 1999 (no information if this went through). In 1997, Polish companies with majority stakes of foreign companies were about 25% of Poland's market share. (Swiss Re, sigma No.7, 1998)

In 1997, Poland did not have a national insurance program, nor did it have emergency reserves. With regard to catastrophe cover, at this writing, we have no knowledge of legislation or legislation pending. Authorities are, however, reviewing different types of institutional arrangements, including pooling solutions, such as those used in France and Spain (Kirk, 1997).

#### 4. Total Losses

Estimates of direct property damage from the 1997 Polish flood range from about US\$ 2 billion (Swiss Re, 1998) to US\$ 3.7 billion (Polish Statistical Bureau, 1998), the latter being 2.9 per cent of Poland's GDP. For purposes of this report, we will use an approximate US\$ 3 billion estimate. As shown in Figure 1, these losses were to household property (12%), business property (25%), agriculture (22%) and public buildings and infrastructure (41%) (Polish Statistical Bureau, 1998).<sup>3</sup> These damage figures do not include indirect losses in production and business disruption, which can be quite significant.

Figure 1. Direct losses from 1997 Polish Flood.



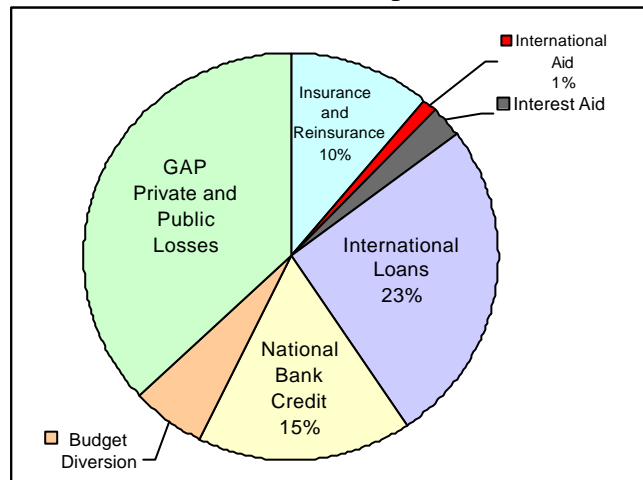
Source: Kunreuther and Linnerooth-Bayer, 1999

<sup>3</sup> These figures taken from Kunreuther and Linnerooth (1999) are very close, but not entirely consistent with the data reported in the following sections. Data sources and consistency needs further investigation.



As shown in Figure 2, about 10 per cent of these losses were absorbed by insurance and reinsurance companies. International aid provided compensation for only about one per cent of the losses. The largest part of the disaster recovery funds was provided by international lending organizations, covering almost a quarter of the losses. The Polish central government was also heavily involved in compensating victims and repairing the damages to public infrastructure. These expenditures were financed through a credit from the National Bank and by diverting funds from other budgeted items. Finally, a large gap remained, which will be absorbed by the private and public victims.

Figure 2: The 1997 Polish Flood: Response as Percent of Losses



Source: Kunreuther and Linnerooth-Bayer, 1999

## 5. Direct Losses

### 5.1 Corporate/Business Losses

Total	735 mln US\$
Buildings	431
Machinery	113
Transport equipment	7
Storage	65
Investments in process	52
Other	67

Source: Polish Statistical Office, 1998

Note: These figures are quoted in replacement value (figures on assessed value also available). As of July, 1998, about 20% of the assets had been replaced. The information is also available by provinces, of which 24 were affected.

Many companies (estimates show about 50%) are insured against flood damage, although sums are far from adequate. In contrast to Germany, where insurance covers the replacement value of property, insurance in Poland is often based on assessed book value (Kirk, 1997). Few firms hold business interruption cover, and use of risk managers and insurance brokers is negligible. The National Insurance Institute estimates that businesses cover only 25 per cent of assets. (International Federation of Red Cross and Red Crescent Societies, 1998).

Example: ZEW Kohlelektroden A.G., and energy company in Raciboz, suffered insured losses expected to reach 14.4 million US\$ (Kirk, 1997).

## 5.2 Public Sector Losses

<b>Total losses</b>	<b>1,754 mln US\$*</b>
Public Buildings and contents	
Hospitals	27
Public Housing	93
Cultural Buildings	56
Infrastructure	
Roads and railways	438
Water/sewage facilities (inc. dikes, weirs)	663
Communication	439
Pipelines and electric	16
Start-up Investments	22

\*Assessed value was 631 mln US\$, and only about 17% had been replaced in July, 1998

Water facilities include dikes, weirs

Source: Polish Statistical Office, 1998

Note: These figures do not include losses to churches, government emergency response, or the construction costs of the planned 1000 replacement apartments. A detailed breakdown on these losses, e.g., to water treatment plants, etc., is available.

### 5.3 Private Residential Sector Losses

**Total Losses 418 mln US\$**

Table 5.3.1 : Characteristics of Households on Flooded Area

	<b>Total 1000s</b>	<b>Urban 1000s</b>	<b>Rural 1000s</b>
<b>Households on flooded area</b>	697.7	218.9	460.8
<b>Persons on flooded area</b>	2346.1	636.5	1709.6
<b>Households with damage</b>	328.7	119.2	209.5
<b>Households with asset losses</b>	246.2	114.4	131.8
<b>Value of asset losses (mln US\$)</b>	418.0	210.7	207.3
<b>Households receiving aid</b>	146.2	50.3	95.9
<b>Insured households (waiting compensation)</b>	48.9	21.9	27.0

Source: Polish Statistical Office, 1998

As shown on Table 5.3.1, of those households with asset damage, approximately 20% have received or expect (as of July 1998) compensation from private insurance companies. In a sample of households in the flooded area, 36.5% were insured against flood (25.1% urban; 42.0% rural). A problem arose whether to award compensation to the occupant or to the owner.

Data is also available on household losses in the 24 affected provinces.

In addition to insurance, compensation was offered by the central government. Each severely flooded household received \$840 compensation, and low-interest credits were also provided for rebuilding. Aid was provided by numerous voluntary organizations. National Societies and volunteers in local branches packaged and distributed emergency aid items. Staff and volunteers helped evacuate citizens to shelters, and later these societies supported reconstruction efforts.

### 5.4 Agricultural Losses

**Total Losses 809 mln US\$**

Crops	491
Animals	29
Buildings, machines	231
Forestry	58

Source: Polish Statistical Office, 1998

Further breakdown of these numbers by type of crops, animals, buildings, etc., and also by provinces is available.

### ***5.5 Loss of Life***

Estimates of lives lost during the flood are around 100. There was also a raised incidence of suicides in this region after the flood (International Federation of Red Cross and Red Crescent Societies, 1998). Estimates are not available on the extent of life insurance losses; however, there is little life insurance cover in Poland (although this is changing rapidly with new legislation on pension systems) (Swiss Re,

## **6. Indirect Economic Losses**

### ***6.1 Corporate/Business Disruption***

<b>Total losses</b>	<b>150.9 mln US\$</b>
Short-term business disruption	95.6
Net profit losses in 1998	55.3

Source: Polish Statistical Office, 1998

### ***6.2 Public Sector Disruption***

By October, 1997, the Polish government had spent 404 million US\$ in relief and repairs. Much of this went to immediate cleanup (International Federation of Red Cross and Red Crescent Societies, 1998).

### ***6.3 Household Disruption***

### ***6.4 Agricultural Disruption***

<b>Total losses</b>	<b>9.3 mln US\$</b>
Clearing debris	2.4
Replanting	5.9
Loss in forests	1.0

Source: Polish Statistical Office, 1998

Agriculture Ministry stated that production losses could reach 7.2 to 8.7 billion US\$ (International Federation of Red Cross and Red Crescent Societies, 1998).

## 7. Insurance Summary

In Poland, private insurers recorded close to US\$ 0.25 billion in claims from the 1997 flood. Approximately half of these insurance losses were absorbed by international reinsurers (Swiss Re., 1997). No breakdown of data on insurers or types of insurance cover.

## 8. Ex Post Financial Compensatory Measures

The Polish public budget financed the 1997 post-disaster recovery and rehabilitation in three main ways: emergency response and cleanup; direct compensation or subsidized loans to the victims; and repair of damage to public property and infrastructure (Stripple, 1998). In the summer of 1997, the Polish government responded to the flood with more than a half billion US dollars in flood relief, which included compensation grants, subsidized loans and the rebuilding of infrastructure. Another half a billion dollars was allocated for flood relief in the 1998 budget. Poland's government rushed a package of emergency measures through the parliament, including a pledge to give \$840 compensation to every family whose home was severely flooded and \$6,200 to everyone who lost a spouse in the deluge. The government also committed to building 1,000 inexpensive houses for the poorest flood victims and to providing inexpensive credits to others who wanted to rebuild (Polish-American Journal, 1 Sep. 1997).

The government was not prepared, however, for these financial outlays. In the absence of a catastrophe reserve, funds were initially diverted from other budgeted expenses resulting in the freezing of public construction projects (International Federation of Red Cross and Red Crescent Societies, 1998). The government also increased its borrowing limit from the central bank by \$740 million and increased its foreign borrowing limit. As shown in Figure 2, the central government provided funds to cover approximately 15% of the total losses with a credit from the Central Bank. This credit has been repaid at the market rate of interest (Kuc, 1999).

Even after borrowing from the National Bank, the Polish government was not able to fulfill all its promises and obligations for relief and infrastructure repair in a timely manner (Stripple, 1997). For example, it was estimated that due to lack of funds it would be several years before all the roads and bridges were repaired (Swiss Re, 1997). Limited financial assistance was provided from outside the country. For Poland and the Czech Republic, the United Nations Disaster and Humanitarian Aid agency recorded US\$ 10.3 million in relief assistance. Assuming that half of this sum was allocated to Poland, this covered only about one per cent of the total direct losses (see Figure 2).<sup>4</sup>

There was considerable voluntary aid, however, not recorded in these figures. The Red Cross and the Anti-Flood Task Force Units provided immediate relief and later helped persons return to their homes.

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<sup>4</sup> Throughout the developing world, international aid for natural disasters is relatively small. In 1996, for instance, catastrophe aid on the part of OECD countries was considerably less than US\$ 3 billion (International Federation of Red Cross and Red Crescent Societies, 1998).

Aid also came in the form of low-interest loans from other countries, which amounted to about 23 per cent of the losses (see Figure 2). The European Investment Bank and the World Bank each approved US\$ 300 million to repair public infrastructure (roads, railways, bridges, water facilities). In addition, the European Bank for Reconstruction and Development offered ECU 100 million in loans to damaged Polish and Czech cities. (International Federation of Red Cross and Red Crescent Societies, 1998).

## 9. Issues of Insurability

In comparison with other disaster cover, the price of flood insurance depends greatly on the particular circumstances of the property in individual cases. As a rule, flood insurance can be offered only with an adequate deductible, normally .05% of insured sum. Limits of indemnity generally begin at 10%. Precondition is that the policy only cover freak floods, no adverse selection takes place, and insurance is provided on a full value basis with a deductible (Discussions with Thomas Loster, Swiss Re).

In Poland, flood is regarded as the main natural peril. Flood risk assessment in Poland is only in preliminary stages, although some efforts are now being put forward to prepare flood maps. There is also some evidence that flooding in Poland, and Europe generally, may not be the independent, random phenomenon usually assumed. Recent research at IIASA, and elsewhere, is linking European precipitation with ocean temperature cycles (Kazmarek, 1999; MacDonald, 1999). This implies a clustering of flood events over time.

If flood cover continues to be voluntary, adverse selection will continue as a problem. Moreover, for many insurers, capital requirements will be prohibitively high. In light of high reinsurance costs, catastrophe bonds might be worth considering.

Insurers would probably benefit from what many are proposing as a partnership of policy holders, insurers, reinsurers and the state, in which each party assumes a portion of the overall risk for some costs of the precautions taken (perhaps similar to the French system or to the U.S. NFIP). Governments and insurers can help by identifying high-risk communities, fostering scientific analyses and mapping flood exposure and motivating mitigation through financial incentives. Governments can monitor environmental conditions and enforce land use policies, zoning and river regulation. Insurers can contribute loss analysis and risk inspections.

The World Bank has recently given Poland a loan aimed at preventing future losses from flooding. Part of this loan will be used to investigate insurance policy options. IIASA will be one bidder on this section of the loan.

## References

- News from Central/Eastern Europe, *European Insurance Market*, Issue 148, December 5, 1997, 324-26.
- International Federation of Red Cross and Red Crescent Societies (1998). European Floods Bring Pressures for Change, *World Disasters Report 1998* (N. Cater and P. Walker, eds.), Oxford: Oxford University Press, 122-131.
- Kaczmarek, K. (1999). The Risk of Flood Events over Time, Paper presented at the conference on "Global Change and Catastrophe Risk Management: Flood Risks in Europe", IIASA, Laxenburg, Austria, June, 1999.
- Kindler, Janusz (1999), Personal Communication, June.
- Kirk, D.L. (1997). Floods in Europe Highlight Need for Prevention Efforts, *Business Insurance*, [http://businessinsurance.com/global/oct\\_1997/article113.htm](http://businessinsurance.com/global/oct_1997/article113.htm)
- Kuc, Anna (1999). Personal Communication, Polish Ministry of Finance, June 2.
- Kunreuther, Howard and Joanne Linnerooth-Bayer (1999). The Financial Management of Catastrophic Flood Risks in Emerging Economy Countries, Paper Presented at Conference on Global Change and Catastrophe Risk Management, IIASA, Laxenburg, Austria, June 6-9.
- MacDonald, G. (1998). Climate and Catastrophic Weather Events, Paper presented at the Engineering Academy of Japan, 17 Apr. 1998. International Institute of Applied Systems Analysis, Laxenburg, Austria.
- Makowski, Marek (1999). Personal Communication, International Institute of Applied Systems Analysis, Laxenburg, Austria, June 5.
- Munich Re. (1998). Annual Review of Natural Catastrophes 1997, Munich, Germany: Munich Reinsurance Co.
- Polish Statistical Bureau (1998). Approximate Effects of the Flood of 1997, *Government Review*, Warsaw.
- Polish-American Journal (1997). Poland's Watery Ordeal, Sept 1.
- Rosenthal, U., M. Bezuyen, M. van Duin and P. 't Hart (1998). Flood Response Dynamics: Local Resilience and Administrative Flexibility, in *Flood Response and Crisis Management in Western Europe: A Comparative Analysis* (U. Rosenthal and P. 't Hart, eds.), Berlin: Springer Verlag.
- Strippel, J. (1998). Securitizing the Risks of Climate Change: Institutional Innovations in the Insurance of Catastrophic Risk, IIASA Interim Report IR-98-

12/13/99

098/December, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Swiss Re (1997). Learning from Disaster: The Floods in the Czech Republic, Poland and Germany in the Summer of 1997, Zurich: Swiss Reinsurance Company.

Swiss Re (1998). Floods – An Insurable Risk? A Market Survey, Zurich: Swiss Reinsurance Company.

World Bank (1998). Poland at a Glance, <http://www.worldbank.com> 9/26/98