

Impacts of Natural Disasters in Agriculture: An Overview

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Presentation

- Introduction
- Natural Disasters – definitions and types
- Natural Disasters – the rising trend
- Impacts of Natural Disasters – General Discussion
- Impacts of Specific Natural Disasters
- Natural Disasters – some Methodological Issues
- Environmental Degradation and Natural Disasters
- Mitigating the Impacts of Natural Disasters
- Conclusions

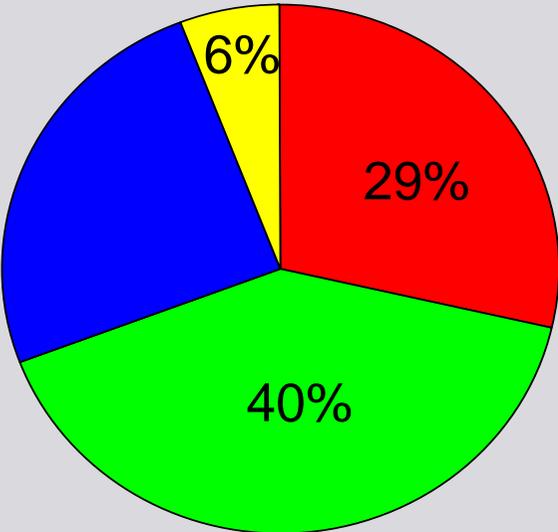
Natural Disasters

- Throughout human history, natural disasters have played a major role in the economic development and survival of humanity.
- The economic cost associated with all natural disasters has increased 14 fold since the 1950s
- Deaths since the 1950s increased 50 percent each decade, whereas the corresponding population growth rate was only 20 percent
- World wide, annual economic costs related to natural disasters have been estimated at about \$ 50 to 100 billion.
- By the year 2050 it is predicted that globally 100,000 lives will be lost each year to natural disasters and the global cost could top \$ 300 billion annually

Great Natural Disasters 1950 - 2005

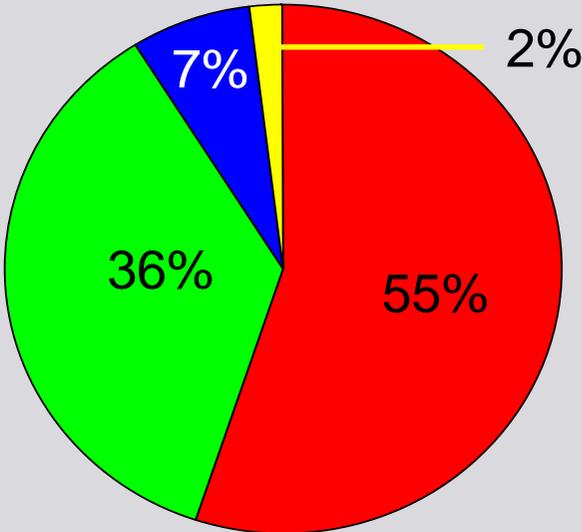
Percentage distribution worldwide

Number of events: 276

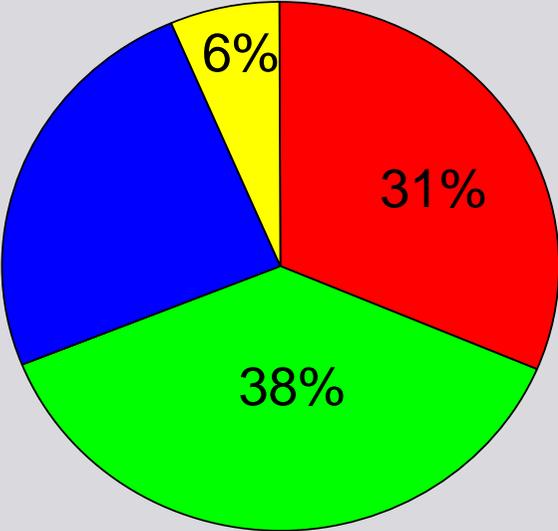


- Geological events**
 - Earthquake/tsunami, volcanic eruption
- Weather related events**
 - Storm
 - Floods
 - Extreme temperatures

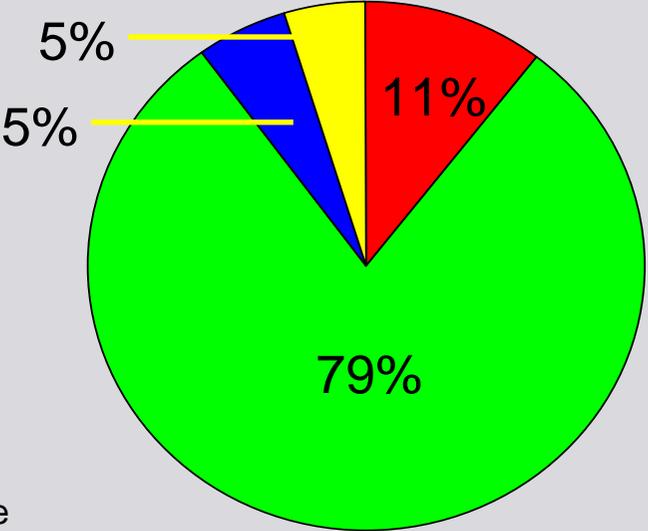
Deaths: 1.75 Million



Economic losses: 1,700 bn. US\$*



Insured losses: 340 bn. US\$*



*2005 values

Agriculture and Natural Disasters

- 70% of the global land use is for agriculture, rangeland and forestry
 - 12% for arable and permanent crops
 - 31% for forest and woodlands
 - 27% for permanent pasture.
- Agriculture is also the essential source of income in most developing countries.
- For example, agriculture accounts for 70 percent of full-time employment in Africa, 33 percent of total GDP, and 40 percent of total export earnings.
- Agricultural production is highly dependent on weather, climate and water availability, and is adversely affected by weather- and climate-related disasters.

Natural Disasters – Definitions

- “an event is classified as a disaster if at least 10 people are killed and/or 100 or more are affected and/or an appeal for international assistance is made or a state of emergency declared” (CRED, 2000).
- “a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the capacity of the affected society to cope using only its own resources” (United Nations)
- “Temporary events triggered by natural hazards that overwhelm local response capacity and seriously affect the social and economic development of a region” (Anderson, 1990).
- “The interface between an extreme physical environment and a vulnerable human population” (Susman et al. 1983) .

Types of Natural Disasters

- Natural disasters include hydro-meteorological disasters and geophysical disasters (World Disaster Report, 2003)
- The hydro-meteorological disasters include landslides/avalanches; droughts/famines; extreme temperatures and heat waves; floods; hurricanes; forest/scrub fires; windstorms; and others (insect infestation and waves/surges).
- The geophysical disasters include earthquakes and volcanic eruptions.

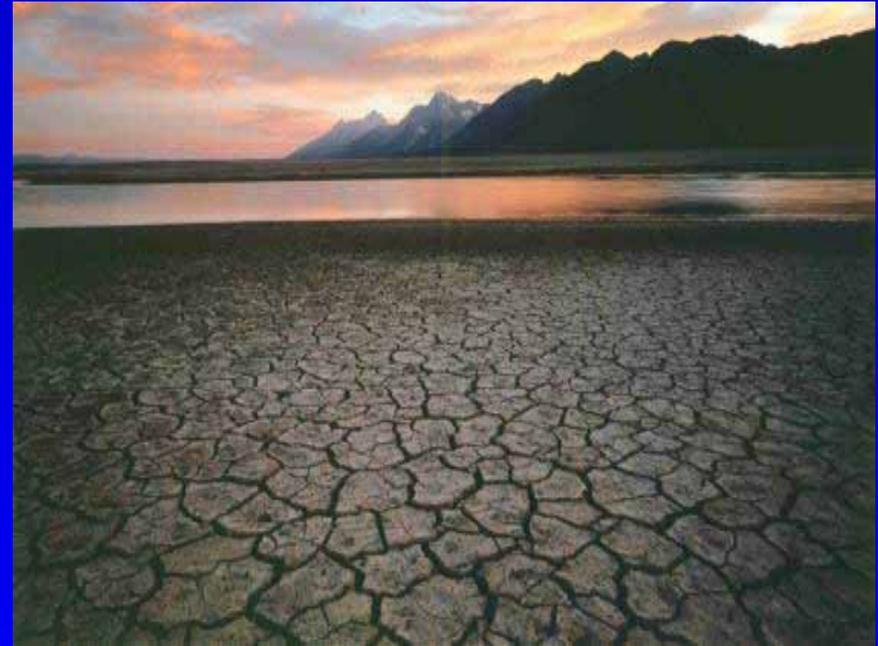
Landslide

- A landslide is a geological phenomenon which includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flow.
- Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors.
- An avalanche is caused when a build up of snow is released down a slope, and is one of the major dangers faced in the mountains in winter.
- An avalanche is a type of gravity current .



Drought

- The consequence of a natural reduction in precipitation over an extended period of time, usually a season or more, often associated with other climatic factors (high temperatures, high winds and low relative humidity) that can aggravate the severity of the event.
- An interplay between natural water availability and human demands for water supply.
- Three types of droughts:
 - Meteorological drought
 - Agricultural drought
 - Hydrologic drought



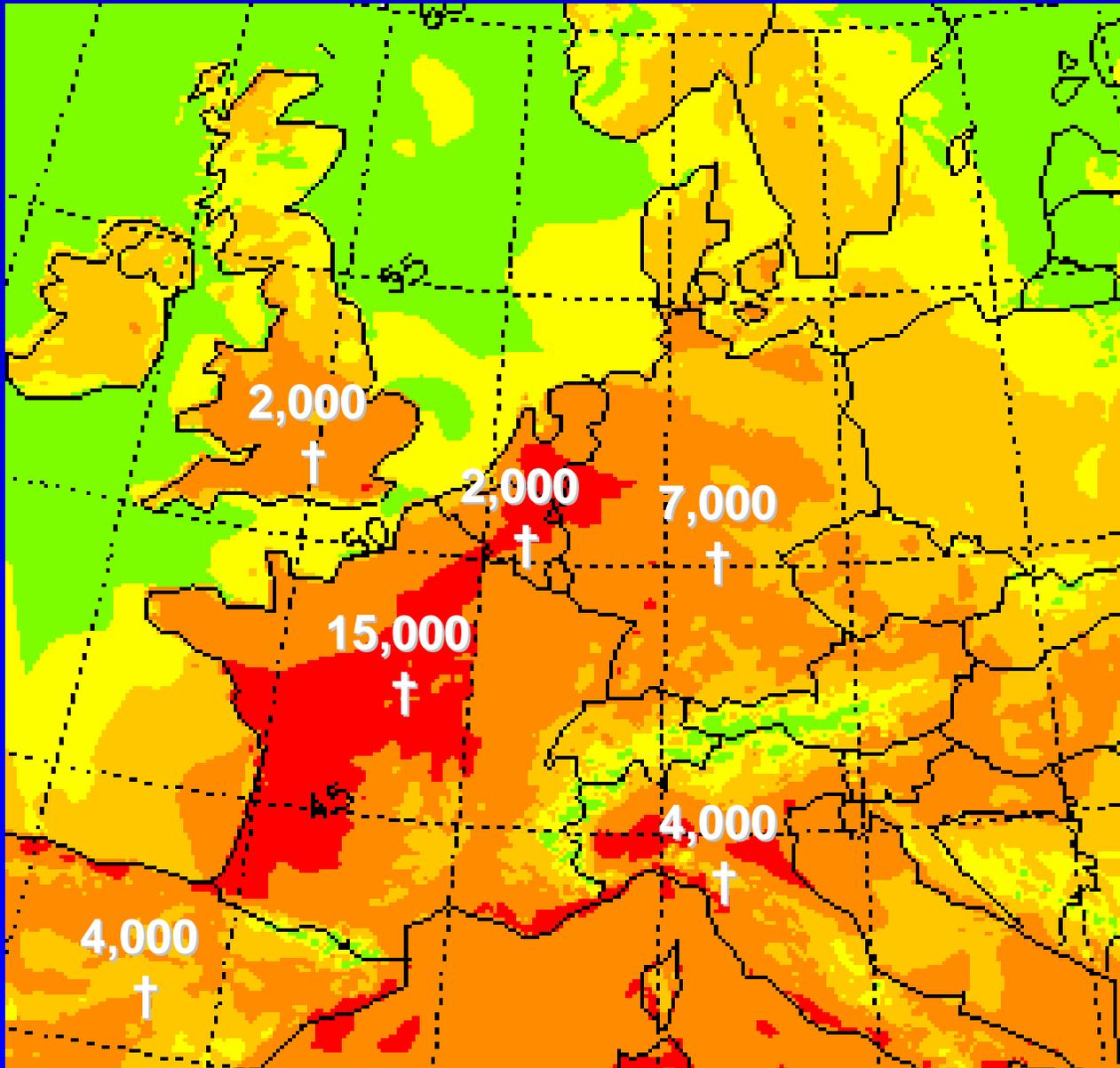
Heat wave

- A heat wave is a prolonged period of excessively hot weather, which may be accompanied by excessive humidity.
- The term is relative to the usual weather in the area, so temperatures that people from a hotter climate find normal can be a heat wave if they are outside the normal pattern for a cooler area.
- The term is applied both to "ordinary" weather variations and to extraordinary spells of heat which may only occur once a century.



Heat wave of 2003, the largest humanitarian natural catastrophe in Europe for centuries

Perceived Temperature on 8 August 2003 and excess mortality



Source: German Weather Service, 2004

Heat stress



Cold stress

UTC
13:00

Flood

- Flood is a condition that occurs when water overflows the natural or artificial confines of a stream or other body of water, or accumulates by drainage over low-lying areas.
- It is a temporary inundation of normally dry land with water, suspended matter and/or rubble caused by overflowing of rivers, precipitation, storm surge, tsunami, waves, mudflow, lahar, failure of water retaining structures, groundwater seepage and water backup in sewer systems.



Forest Fire

- An uncontrolled fire occurring in vegetation more than 6 feet (1.8 m) in height.
- These fires often reach the proportions of a major conflagration and are sometimes begun by combustion and heat from surface and ground fires.

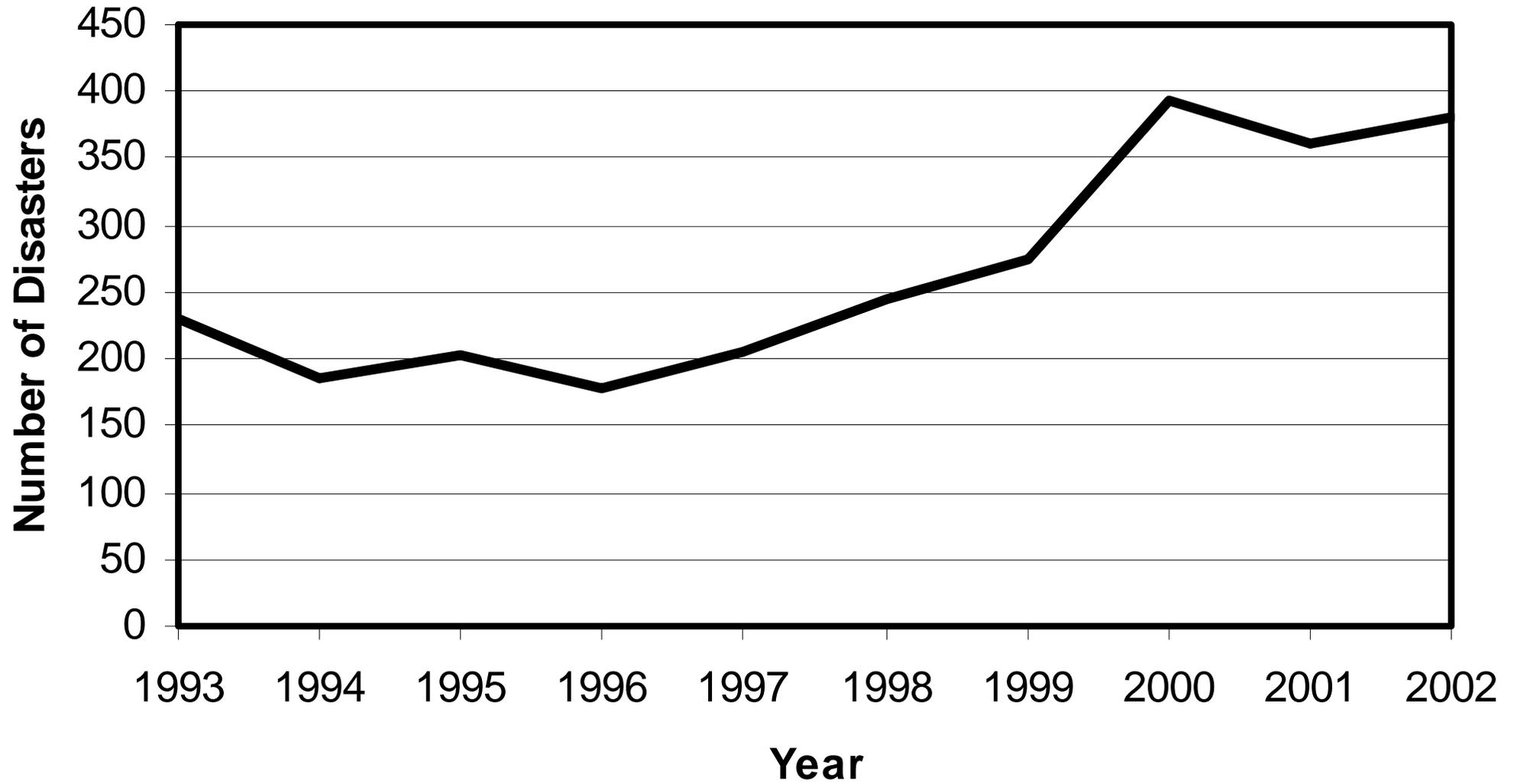


Tropical Cyclones, Typhoons and Hurricanes

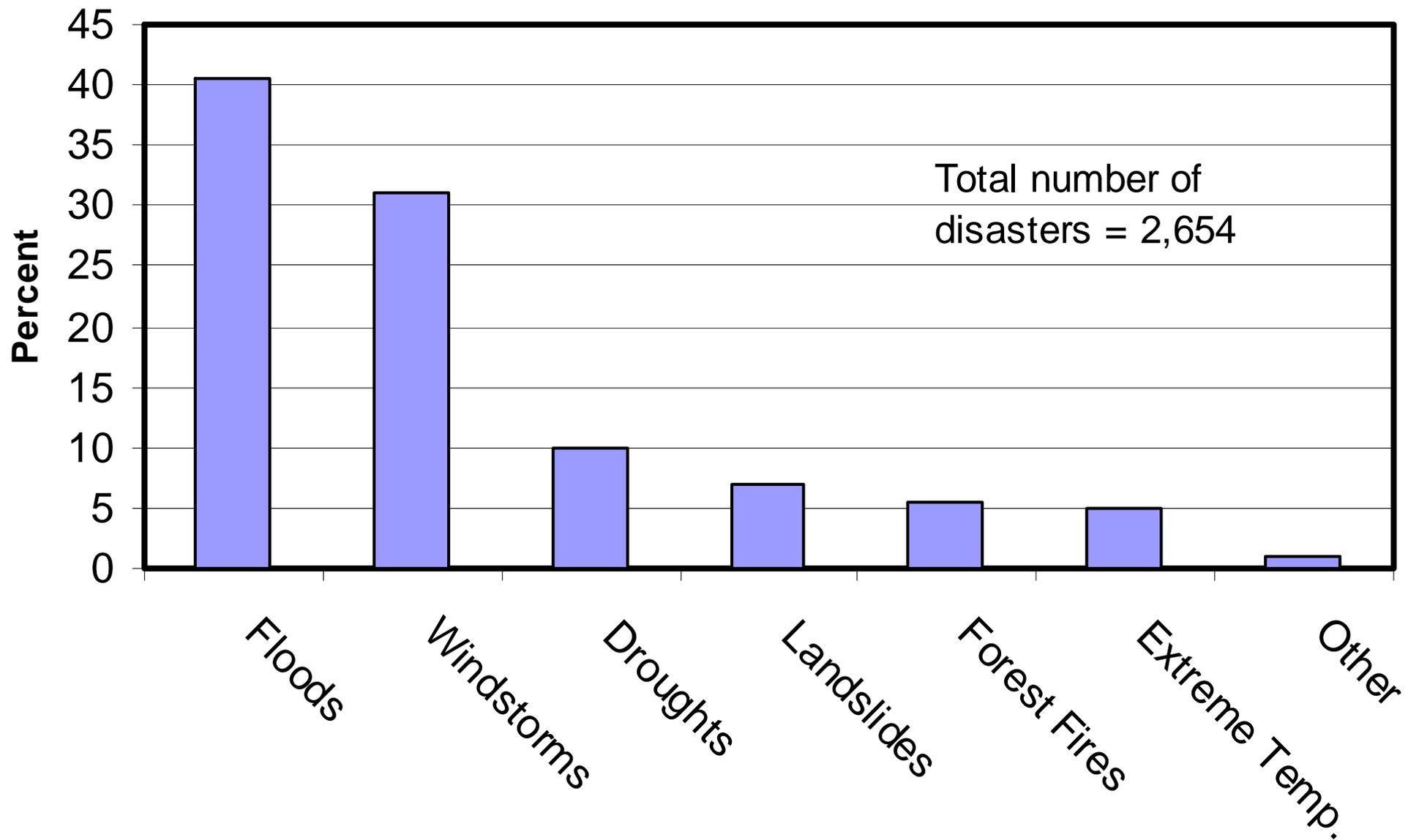
- These are regional names for the same phenomenon.
- Tropical Cyclones - Depressions in the tropics which develop into storms in the south-west Indian Ocean, the Bay of Bengal, and the Arabian Sea, parts of the south Pacific and along the northern coasts of Australia.
- Typhoons - north-west Pacific
- Hurricanes - in the Caribbean, south-east United States and Central America.



Total Number of Reported Disasters



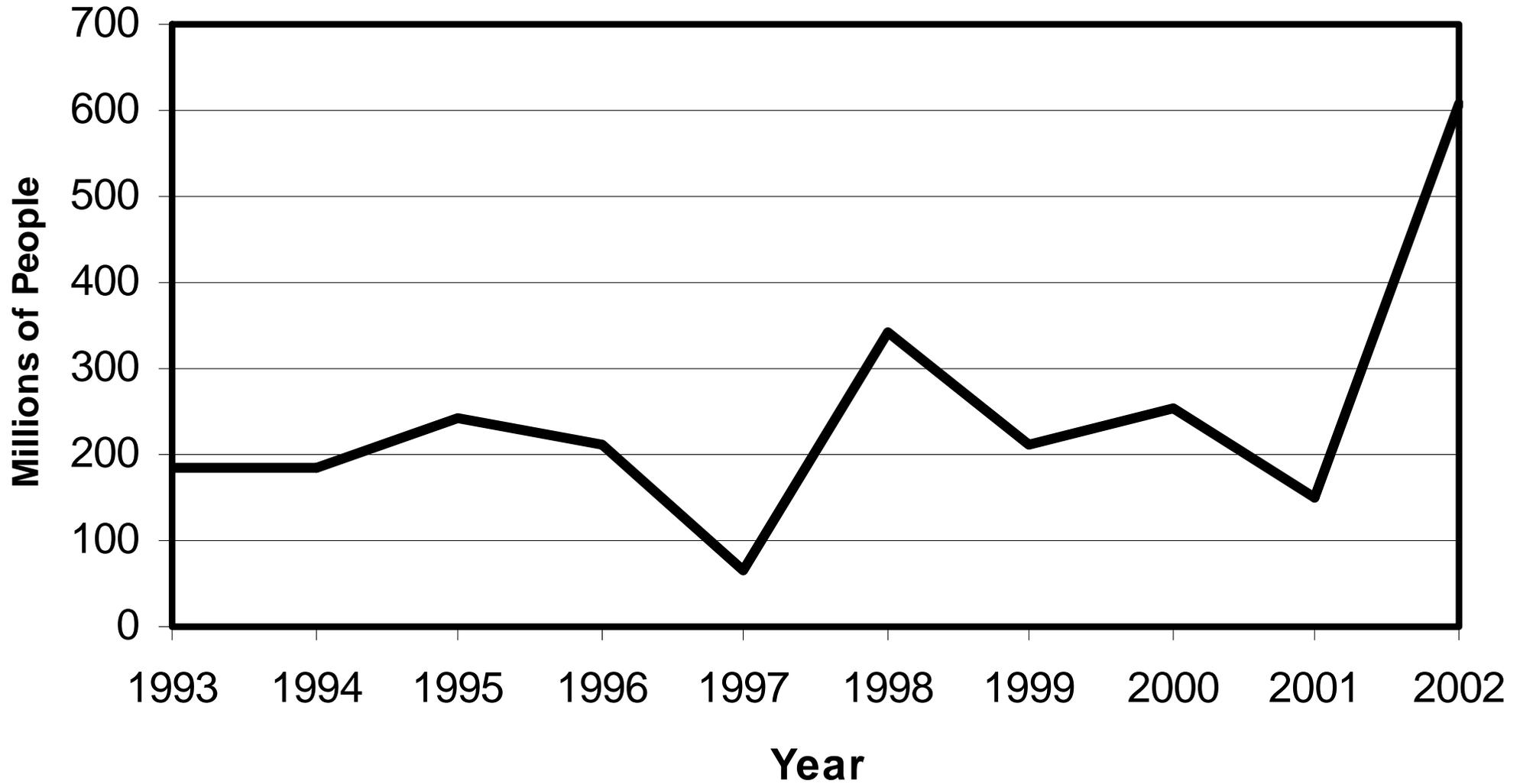
Total Number of Reported Disasters by Type



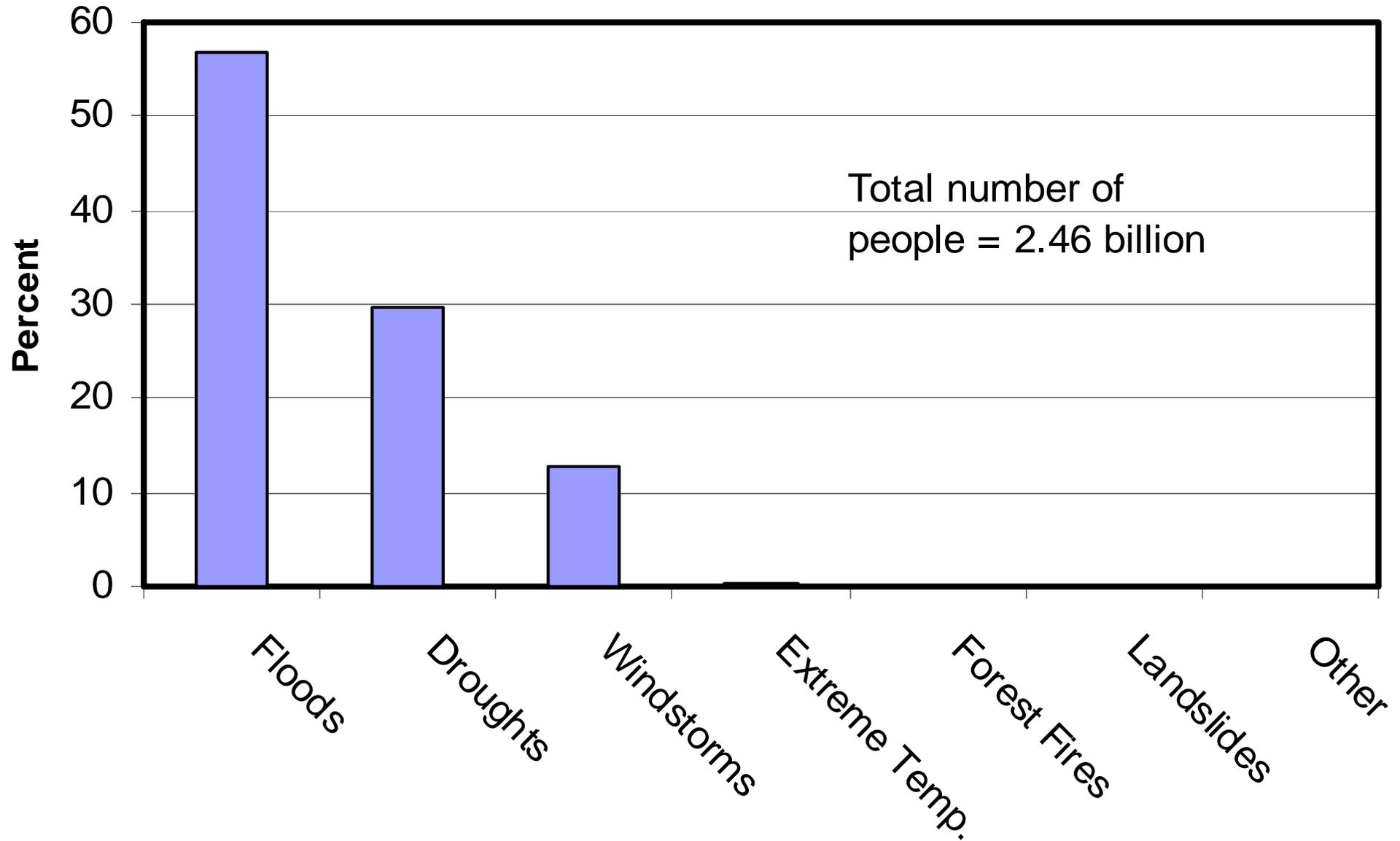
Impacts of Natural Disasters

- Impacts can be direct or indirect in their effect.
- Direct impacts arise from the direct physical damage on crops, animals and trees caused by the extreme hydro-meteorological event.
- Indirect impacts refers to loss of potential production due to disturbed flow of goods and services, lost production capacities, and increased costs of production. These appear progressively as a result of low incomes, decreases in production, environmental degradation and other factors
- Impacts can also be classified as tangible or intangible. Tangible impacts are those that can be easily measured in monetary terms. Intangible impacts are often difficult to measure in monetary terms eg., anxiety or fear of future natural disasters inconvenience and disruption to farm work and stress-induced ill health and human fatalities.

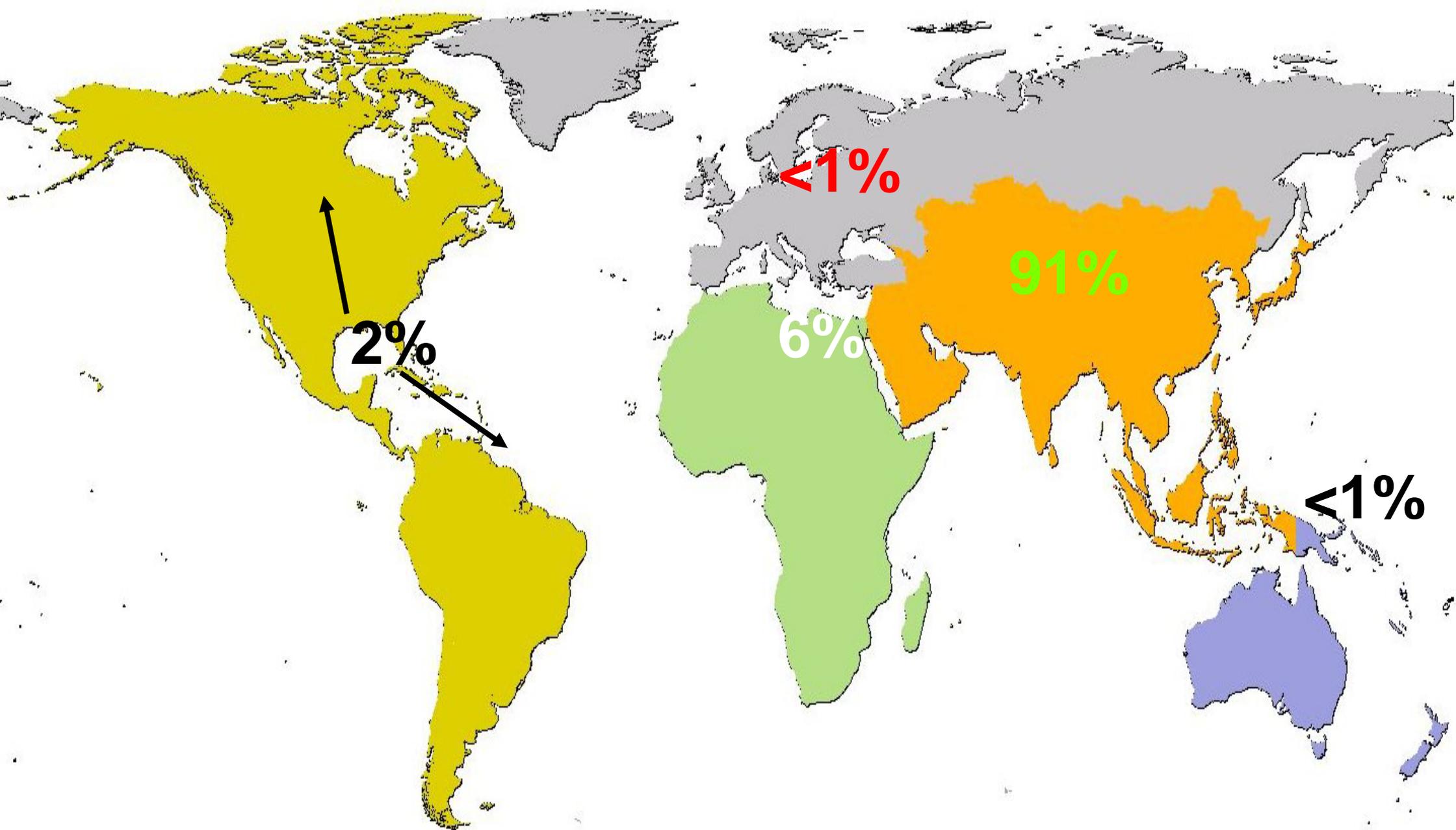
Total Number of People Reported Affected by Hydro-Meteorological Disasters



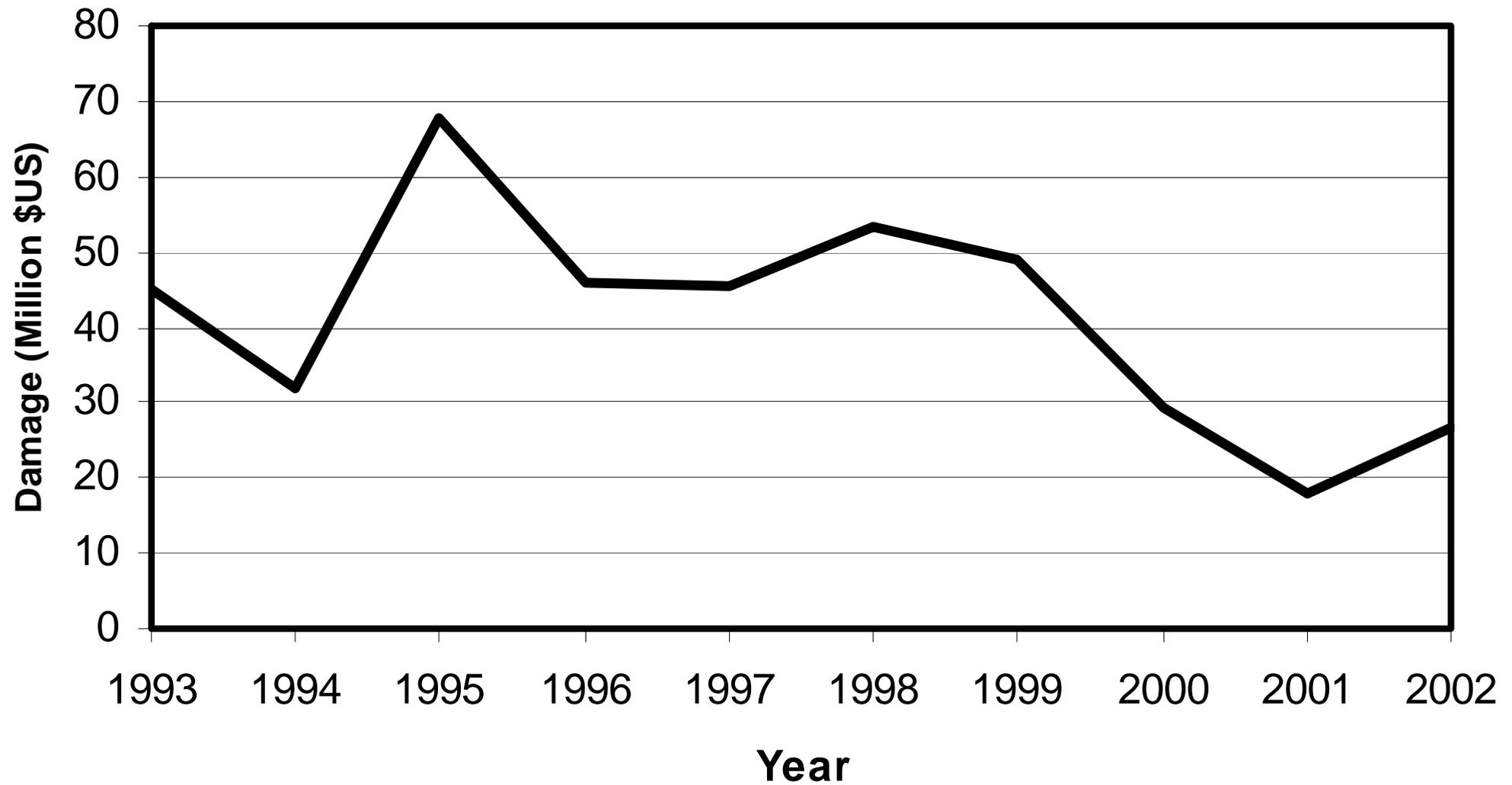
Percentage of People affected by different Hydro-Meteorological Disasters



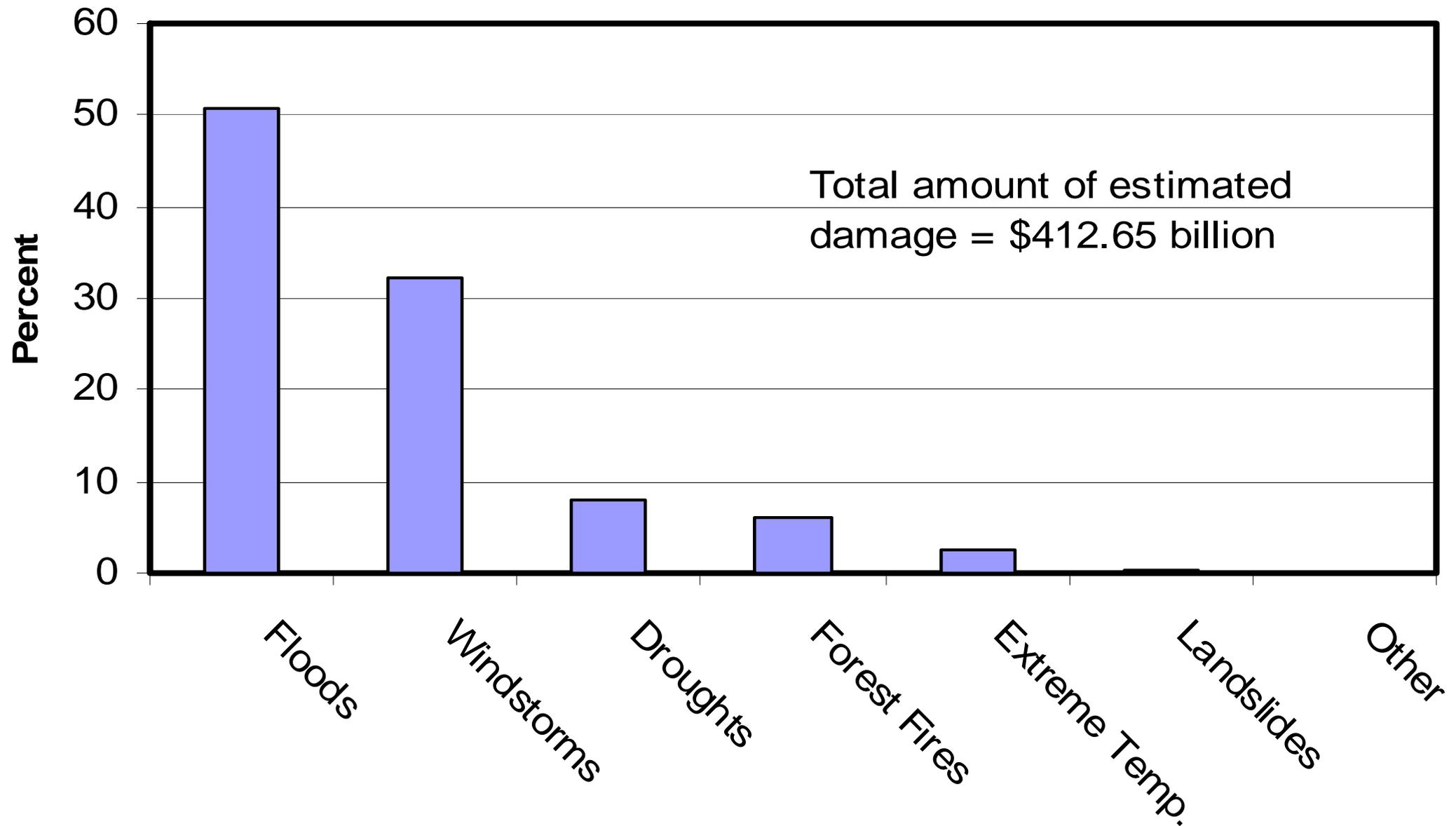
Percentage of Total Number of People Reported Affected by Hydro-Meteorological Disasters by Region



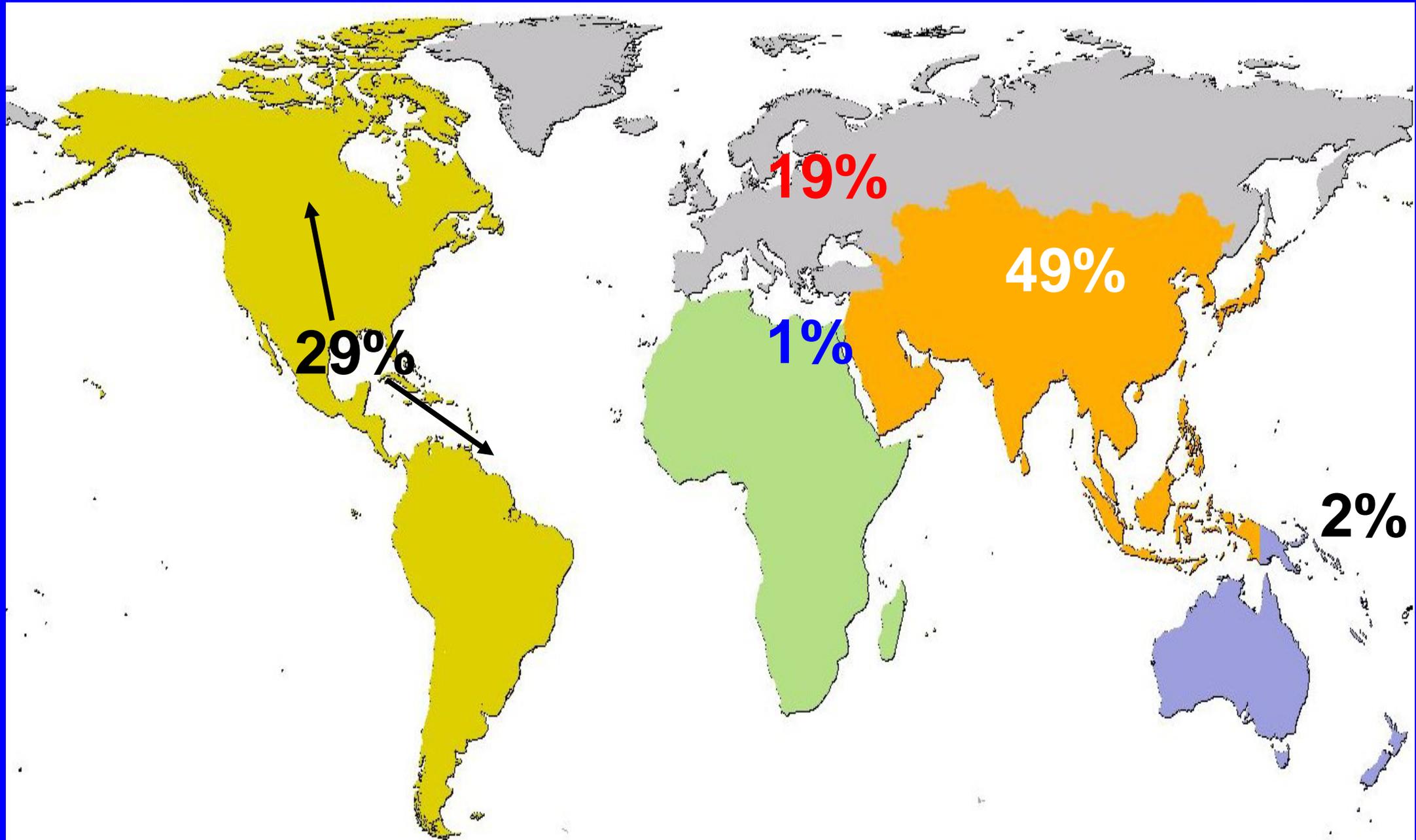
Annual Variations in the Estimated Damage due to Hydro-meteorological Disasters



Percentage of Damage caused by different Hydro-Meteorological Disasters



Percentage of Total Amount of Disaster Estimated Damage by Region



Impacts of Natural Disasters (contd.)

- Loss of perennial crops such as banana trees or forests has long-term consequences on the ability to generate income.
- Floods make land unsuitable for agricultural production until waters recede, while hurricanes might wash out arable land or permanently increase its salinity through storm surges and flash floods.
- Localized disasters tend to produce limited aggregate impacts, unlike countrywide natural events such as Hurricane Mitch (Charveriat, 2000).
- Recurrent disasters in the same geographical area might lead to reduced investment due to the perceived risk of asset loss or emigration from stricken areas.

Impacts of Natural Disasters (contd.)

- Poor people are more exposed because they tend to live in marginal areas and depend on high-risk, low return livelihood systems such as rainfed agriculture and face many sources of economic vulnerability including little physical infrastructure.
- 24 out of 49 least developed nations face a high risk of natural disasters.
- At least 6 of them have been hit by between 2 to 8 major disasters per year in the last 15 years, with long term consequences (UNDP, 2001).
- While damages related with natural disasters are greater in absolute value in developed countries, loss/GDP rates are 20% higher in the developing countries
- Hurricane Andrew in 1992 caused a total damage of \$26.5 billions in the United States, but it was a mere 0.4% of GDP.

Impacts of Natural Disasters (contd.)

- Economic consequences of natural disasters are of major importance given the repercussions they have on the economic development (GDP, public finances, foreign trade, price indices).
- Because of the important role it plays considering the creation of national wealth and the population needs, the agricultural sector appears as a highly vulnerable one.
- In Honduras, the rate of unemployment in the immediate aftermath of Hurricane Mitch had reached an estimated 32%
- Activities related to international trade eg., export agriculture, tourism, crafts and industrial activities are affected
- Free zones can be affected by cyclones and floods, with greater probability as they are situated in the coastal plains and on the principal deltas.

Positive Impacts of Natural Disasters

- Increased rainfall to inland areas from tropical cyclones along coastal areas (Ryan, 1993)
- Fixing of atmospheric nitrogen by thunderstorms
- Germination of many native plant species as a result of bushfires and the maintenance of fertility of flood-plain soils due to flooding (Blong, 1992).
- The influx of funds into disaster-relief activities after the occurrence of natural disasters can sometimes be positive to local communities, as was shown for the city of Mobile, Alabama after Hurricane Frederic (Chang, 1984).

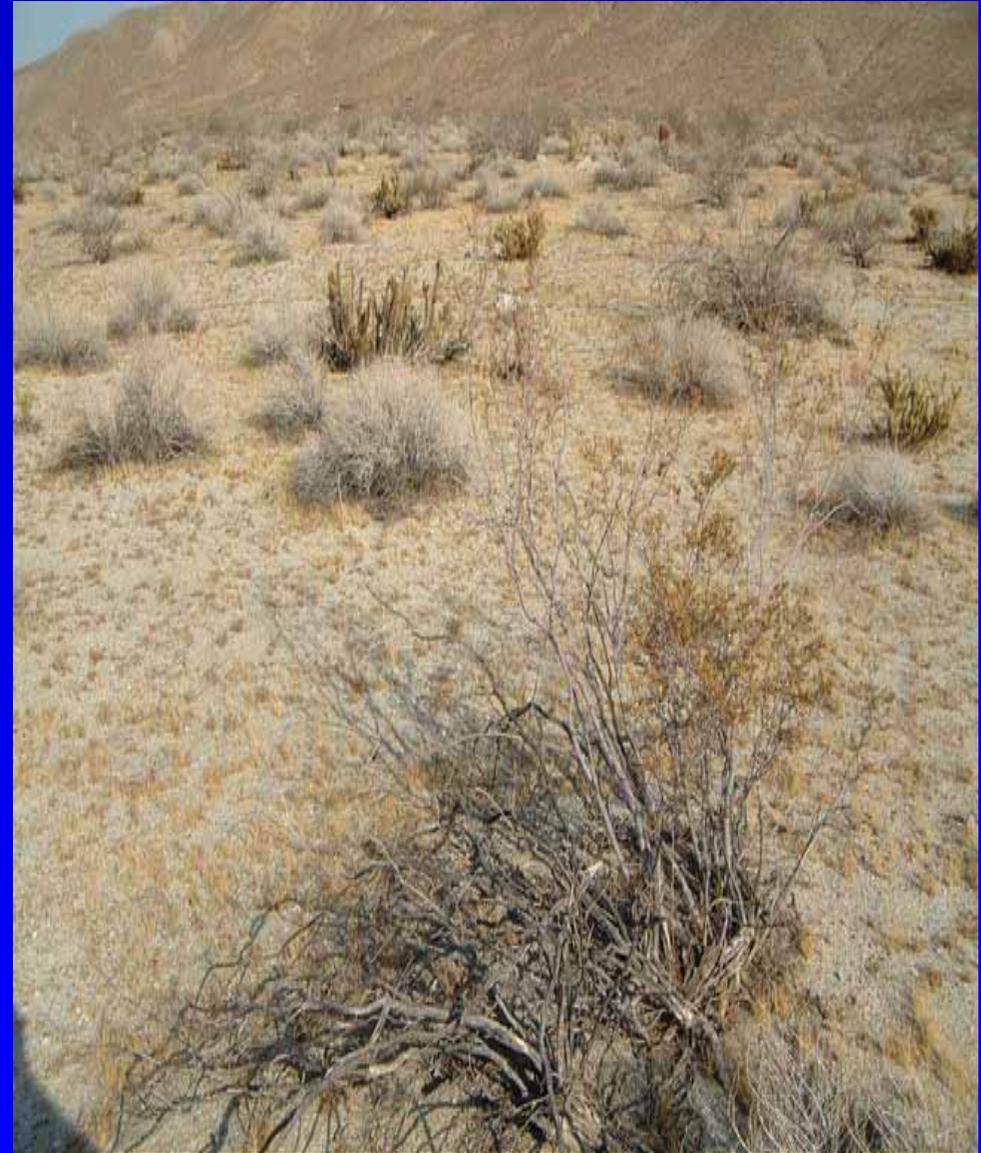
Impacts of Droughts

- Drought impacts crop growth and development at different levels including soil moisture uptake, root growth, shoot growth, various plant processes such as photosynthesis, respiration, plant water uptake and final yield
- The impacts of drought likely to become more severe as a result of development processes and population increases.
- Droughts often stimulate sequences of actions and reactions leading to long-term land degradation.



Impacts of Droughts (contd.)

- The most prolonged and widespread droughts occurred in 1973 and 1984, when almost all the African countries were affected.
- In 1973 alone, drought killed 100,000 people in the Sahel.
- Hundreds of thousands of people died. Nearly half of the entire livestock herds and two million heads of wild animals were killed.
- More than six million ecological refugees were forced to emigrate from their homeland to other regions.



Impacts of Droughts (contd.)

- Aggregate impacts of droughts significant in terms of growth.
- A 50% fall in agricultural GDP would translate into a 10% decrease in GDP for an economy in which agriculture accounted for 20% of total activity in the pre-drought year.
- In Northeast Brazil, when the agricultural GDP decreased between 17.5 and 29.7%, the fluctuations were explained almost entirely by the occurrence of droughts. For example, the estimated GDP per capita in the Northeast was \$1,494 in 1993, compared with \$3,010 in the rest of the country.
- Some times droughts do carry positive impacts. Moderate droughts in the post flowering maturity stage of sugar cane, for instance, helps to increase the sucrose content.

Impacts of Cyclones

- Tropical cyclones are among the most destructive of all natural disasters, causing considerable damage in about 70 countries.
- Off-spring of ocean-atmosphere interactions, powered by heat from the sea, driven by the easterly trades and temperate westerlies, the high planetary winds and their fierce energy.
- 80 tropical cyclones form annually over the tropical oceans, of which 30 occur in the typhoon region of the western North Pacific



Hurricane Mitch

- One of the most powerful Atlantic Hurricanes, with 290 km/hr winds and a minimum storm pressure of 906 mb.
- Long life span (14.5 days) and the deadliest of the century. It caused loss of life, destruction of property, damage to food production, food reserves and transportation system as well as increased health risks.

Impacts of Cyclones (contd.)

- The losses can be due to direct destruction of vegetation, crops, orchards and livestock, damage to infrastructure such as canals, wells and tanks and long term loss of soil fertility from saline deposits over land flooded by sea water.
- In southern Hainan on 2 October 1999, some 25 million timber and rubber trees were blown down (WMO, 1994).
- In small islands such as Antigua and Barbuda where fisheries constitute the backbone of the economy, the impact could be quite significant. After Hurricane Hugo in 1989, 47 per cent of the losses occurred in fisheries, but crop losses still represented almost 40 per cent of the total damage (OSRO, 1989).
- Hurricane Georges caused \$ 2.1 billion in damages in the Dominican Republic and Hurricane Mitch produced damages of \$2.4 billion in Honduras and Nicaragua (Charveriat, 2000).
- Positive Impact: Increased water availability in water-critical regions makes agricultural production less susceptible to the dry period.

Impacts of Floods

- Floods are among the greatest natural disasters known to mankind.
- The number of people affected by floods during the world during 1991 to 2000 was reported to be around 1.5 billion.
- More than three quarters of natural disasters in the Americas are high wind and floods.
- Bangladesh floods revealed that 62% of all micro finance clients had lost their homes, nearly half had lost their every day possessions and over 75% had their ability to generate income at least suspended



Impacts of Floods (contd.)

- Impacts during the non-growing season include loss of top soil; loss of soil nutrients; soil compaction; soil erosion; permanent damage to perennial crops, trees, livestock, buildings, and machinery; and permanent cessation of farming in floodplains.
- Impacts during the growing season include waterlogging of crops; lodging of standing crops; loss of soil nutrients; loss of pasture use; soil erosion; greater susceptibility to diseases and insects; interruptions to farm operations; permanent damage to perennial crops, trees, livestock, buildings and machinery etc.,
- Flood plains are the areas of highest productivity. Some of the most flourishing ancient civilizations were in the flood plains as proximity to rivers enabled them to enhance agricultural productivity.

Impacts of Forest and Bush Fires

- During and 1994/95 El Nino events, South-East Asia experienced severe smoke and haze episodes associated the forest and bush fires due to reduced rainfall and drought conditions. Transboundary pollution compromised the health of downwind populations.
- Early-2003 wild fires (bushfires) in Australia were "the worst environmental disaster in the history of Australia ... responsible for over three million hectares of destruction, the greatest extent of environmental ruin on record in the nation's history"



Environmental Degradation and Natural Disasters

- Environmental degradation is one of the major factors contributing to the vulnerability of agriculture, forestry and rangelands to natural disasters
- Poverty and environmental degradation are closely linked, often in a self-perpetuating negative spiral in which poverty accelerates environmental degradation and degradation results in or exacerbates poverty.
- While poverty is not the only cause of environmental degradation, it does pose the most serious environmental threat in many low-income countries.
- Forest fires in Indonesia in 1997-98 were deliberately set, went completely out of control and turned into wildfire surpassing any nation's fire fighting capabilities.

Natural Disasters – some Methodological Issues

- One of the major problems in dealing with natural disasters in agriculture, rangelands and forestry is the lack of systematic and standardized data collection from disasters.
- There is no recognized and acceptable international system for disaster-data gathering, verification and storage.
- One good example of the methodological issue is the definition of natural disaster itself.
- Definitions of natural disasters are based on the need to respond to development and humanitarian agenda.
- Different disasters can be classified as different types by different databases. For example, a flood which was a consequence of severe wind storm, may be recorded as one or the other.

Natural Disasters – some Methodological Issues

- Estimating the total impact of disasters in monetary value is quite difficult. Governments and international agencies use different methodologies.
- Many existing estimates of the impacts of disasters are based on damage assessments undertaken in the immediate aftermath of individual disasters.
- Such assessments are typically undertaken without the use of comprehensive guidelines and by untrained assessors.
- Standard methodologies for estimating economic damage from disasters remains an area where much research is still needed.
- Governments, insurance companies, or other agencies involved in relief generally estimate economic damage according to varying criteria and standards. This presents serious difficulties, not only in comparisons across countries but also over time.

Mitigating the Impacts of Natural Disasters

- World Summit on Sustainable Development (WSSD) - the need to mitigate the effects of droughts and floods through improved use of climate and weather information and forecasts, early warning systems, land and natural resource management, agricultural practices and ecosystem conservation.
- New technologies have brought about an accelerated increase in our knowledge of the climate system.
 - Satellites
 - Ocean buoys and expendable bathythermographs
 - Hundreds of specially equipped commercial aircraft,
 - Manned and automatic weather stations on land

Mitigating the Impacts of Natural Disasters

- Planning, early warning and well-prepared response strategies are the major tools for mitigating the losses.
- The scientific understanding, the accuracy and timeliness of weather and flood warnings have significantly improved over the last few decades.
- Today the accuracy of forecasts of large-scale weather patterns for seven days in advance is the same as those for two days in advance only 25 years ago.
- The accuracy of tropical cyclone track forecasts and the timeliness of warnings have been steadily improving in the past few years.
- The evolving Internet has proven to be an invaluable tool in facilitating the exchange of global and regional climate monitoring and prediction information.

CONCLUSIONS

- Natural disasters are on the rise and they continue to target the world's poorest and least-developed.
- There must be greater investment in disaster reduction rather than high-profile response efforts.
- Improved data on past disasters would help inform investment and policy decisions and thus help secure more appropriate levels and forms of disaster prevention, mitigation and preparedness.
- It is important to develop mechanisms for more efficient assessment and documentation of natural disaster impacts in agriculture.

CONCLUSIONS

- A comprehensive assessment of impacts of natural disasters on agriculture requires a multi-sectoral and integral approach involving key organisations
- Priority should be given to supporting research with practical applications since research is needed to understand the physical and biological factors that contribute to disasters.
- Since major impact of the natural disasters is on poor farmers with limited means in developing countries, community-wide awareness and education programs on natural disasters should be a priority.
- Programs for improving prediction methods and dissemination of warnings should be expanded and intensified. Efforts are also needed to determine the impact of disasters on natural resources.

Thank you very much for your attention

