The Land and it's River

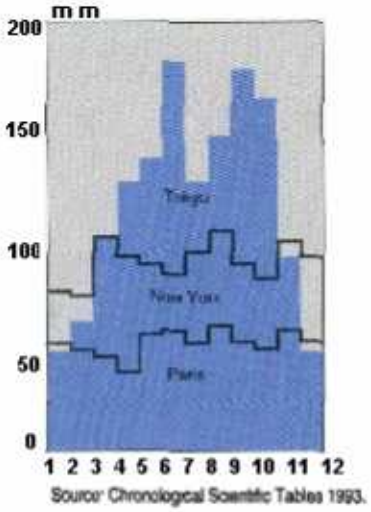
Rivers in Japan are short and steep and flow rapidly and violently. Moreover, the ratio between the normal volume of flow and that during a storm is extremely great.

Seeing the Joganji River in Toyama prefecture, Johannes de Rijke exclaimed, "Rivers in Japan are like waterfalls."

A Dutch engineer hired during the Meiji Era (1868~1911), de Rijke contributed substantially to flood control projects in major rivers in Japan, such as the Kiso, the Nagara, and the Ibi Rivers, known as the "three rivers of Kiso".

De Rijke's statement is an apt description. Rivers in Japan characteristically flow directly from mountain to sea. A great amount of rain falls on the Japanese archipelago during the rainy season (heavy rains of June and July) and typhoon seasons; and during periods of intensive rainfall, even a small stream that usually runs low may become a raging torrent.

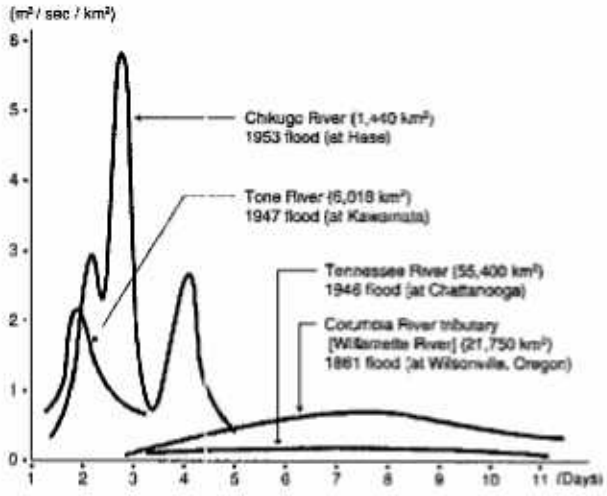
■ **Japanese cities have more precipitation than large cities in other countries.**



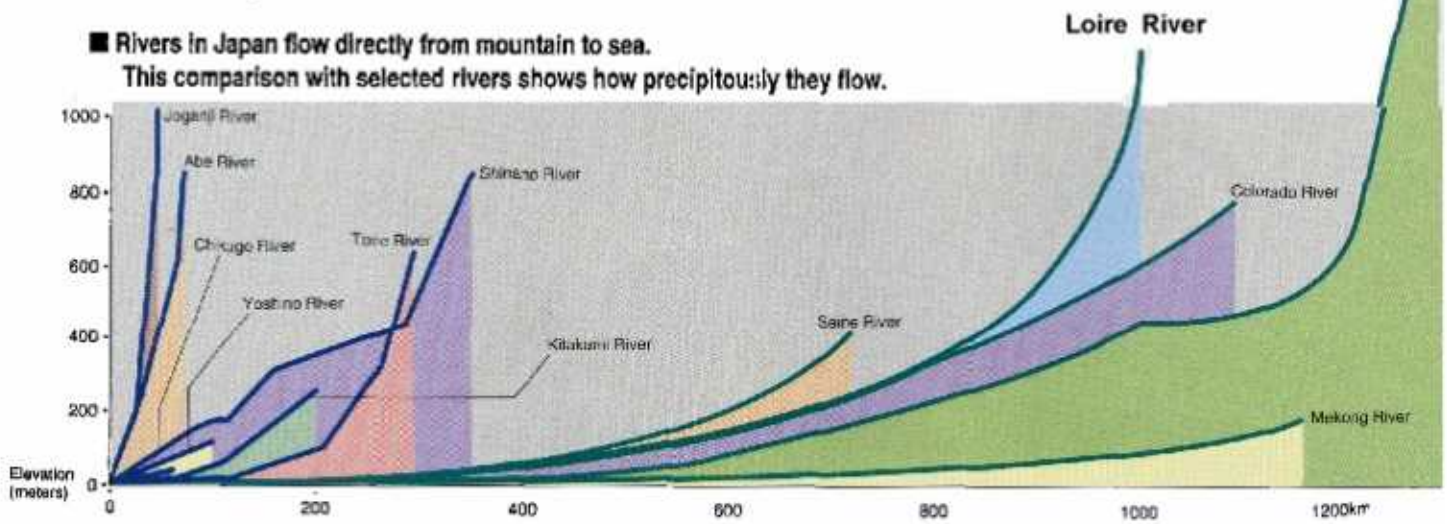
Source: Chronological Scientific Tables 1993.

■ **Floods in Japan act like sprinters: short and quick.**

Ratio of flood duration to flood discharge per unit area of catchment discharge. ($m^3/sec/km^2$)



■ **Rivers in Japan flow directly from mountain to sea.**
This comparison with selected rivers shows how precipitously they flow.

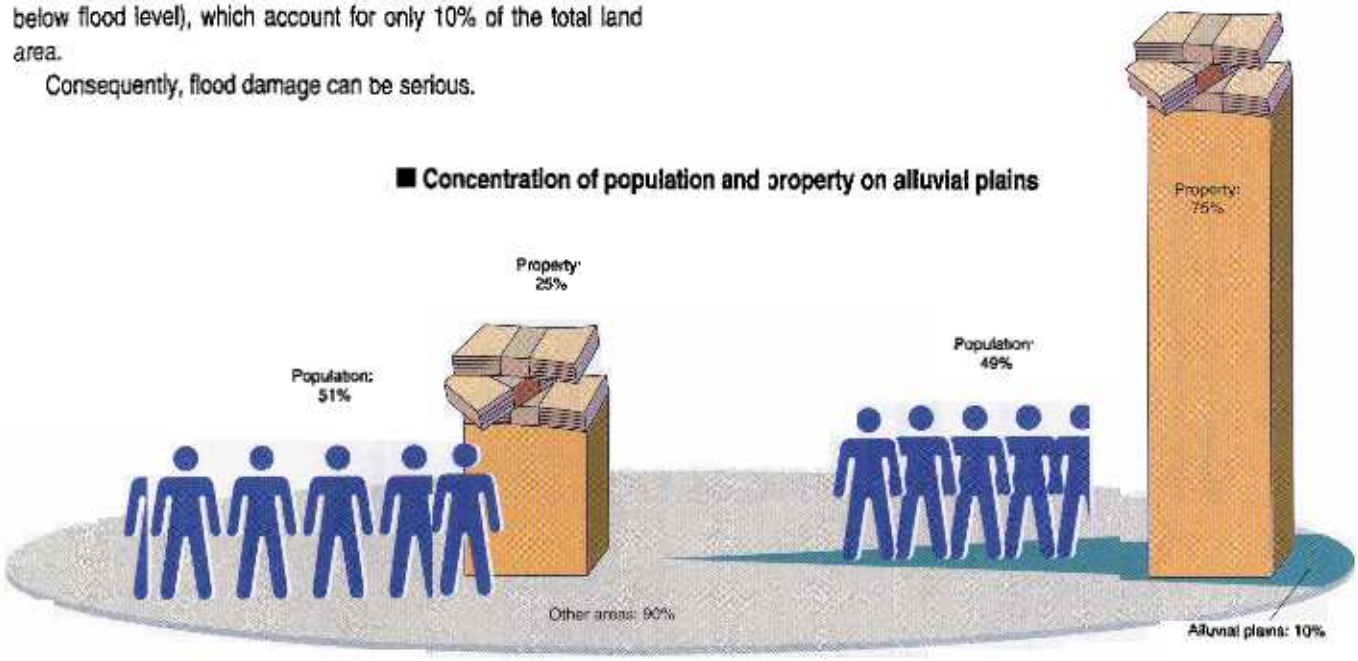


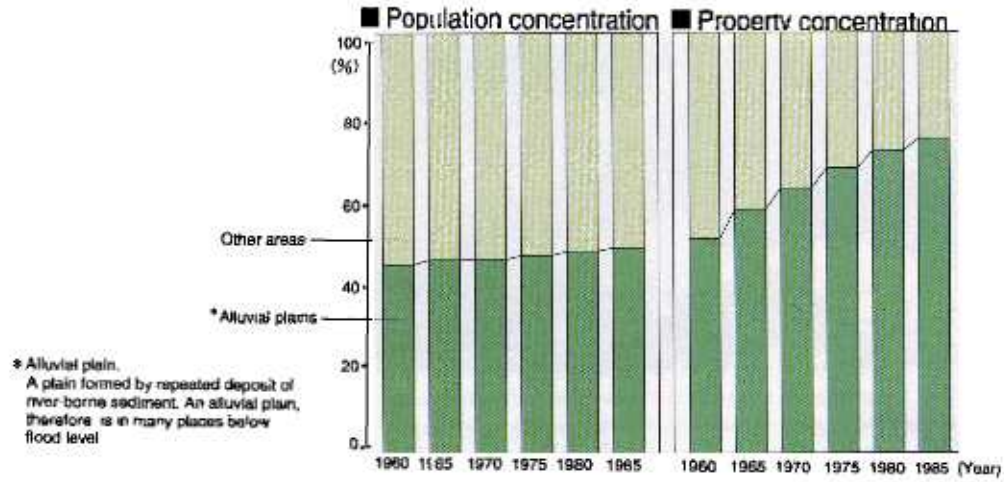
Japanese cities are quite susceptible to floods. Most population and property, and therefore most flood damage, concentrate on alluvial plains.

About 50% of the population and about 75% of the real estate of mountainous Japan is concentrated on alluvial plains (areas below flood level), which account for only 10% of the total land area.

Consequently, flood damage can be serious.

■ Concentration of population and property on alluvial plains



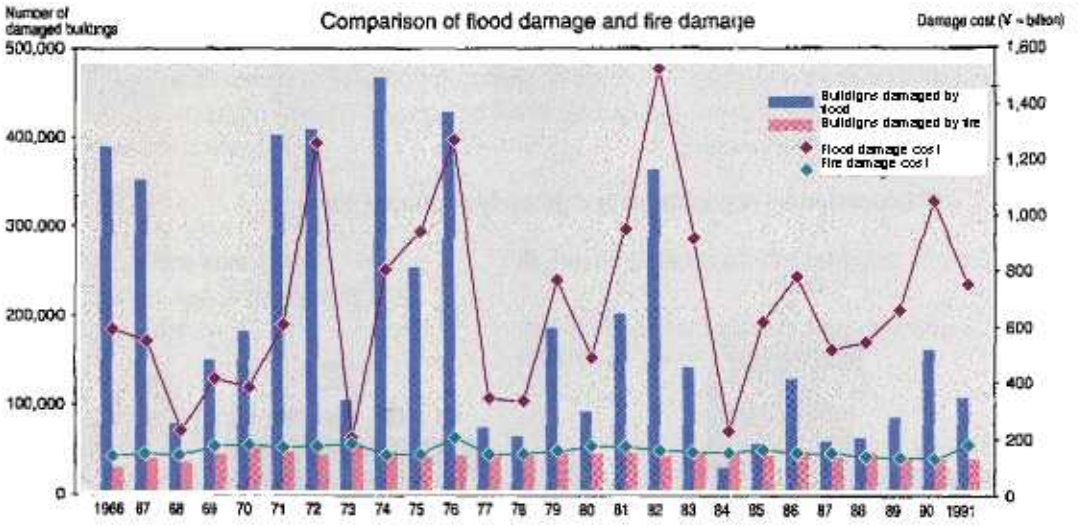


* Alluvial plain.
A plain formed by repeated deposit of river-borne sediment. An alluvial plain, therefore, is in many places below flood level

Flood and sediment disaster

Damage due to flooding is about 4.5 times that due to fire.

Every year severe local rains cause flood damage in early summer and during the rainy season and typhoon season. Total flood damage (direct damage alone) in 1991 was about 4.5 times as much as fire damage.



About 80% of the municipalities and villages in Japan are affected by disaster.

In the past 10 years, about 80% of the municipalities and villages in Japan have suffered some flood or sediment damage. The danger of flood and sediment disasters is ever-present.

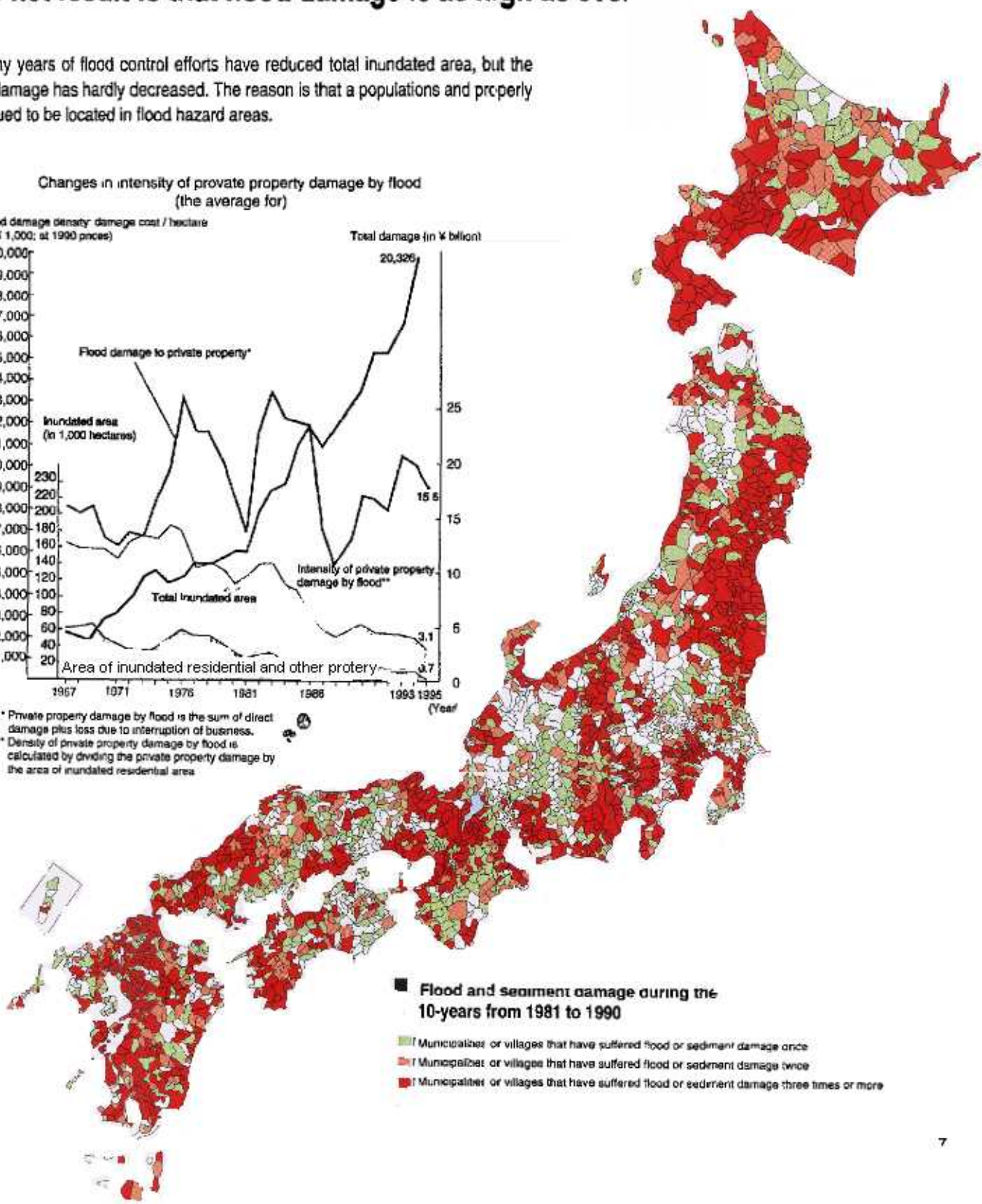
Total inundated areas has been reduced; but property continued to concentrate in flood plains.
The net result is that flood damage is as high as ever

Many years of flood control efforts have reduced total inundated area, but the flood damage has hardly decreased. The reason is that a populations and properly continued to be located in flood hazard areas.

Changes in intensity of provate property damage by flood
(the average for)

* Private property damage by flood is the sum of direct damage plus loss due to interruption of business.

** Density of private property damage by flood is calculated by dividing the private property damage by the area of inundated residential area



■ **Flood and sediment damage during the 10-years from 1981 to 1990**

- Municipalities or villages that have suffered flood or sediment damage once
- Municipalities or villages that have suffered flood or sediment damage twice
- Municipalities or villages that have suffered flood or sediment damage three times or more

Flood and sediment disaster

Disasters occur during the rainy season and typhoon season almost every year.

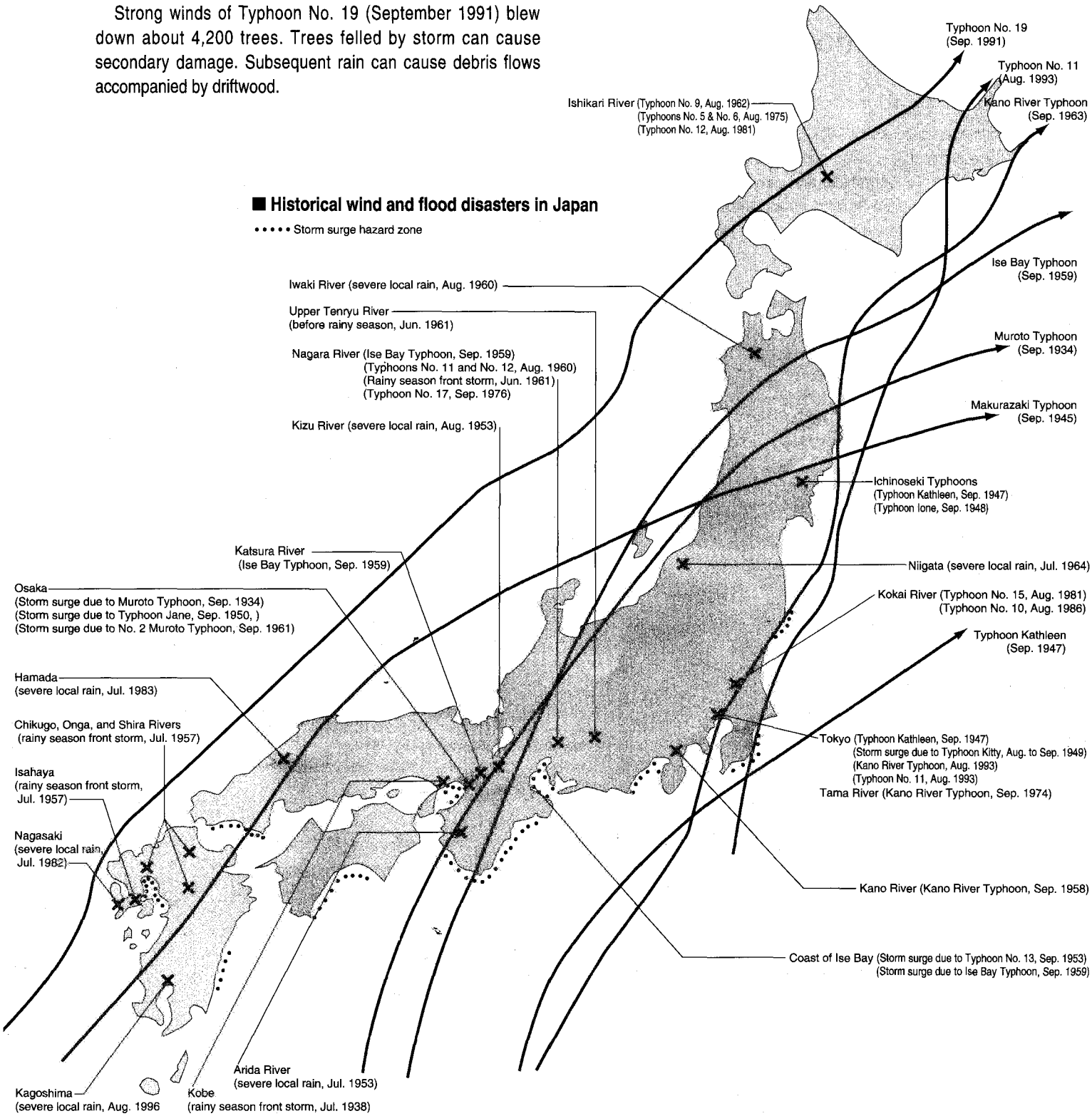
Records of natural disasters during and since the Meiji Restoration (1868) show that long rains and severe local rains during the rainy season and typhoon season are major causes of flood and sediment damage. 30 typhoons, affect Japan and, on average, three typhoons hit the country directly each year, causing serious damage.

Japan is still very prone to major flood damage.

Major flood disasters occur every year in many parts of the country. For example, in August 1993, heavy rains that hit the Kyushu region, particularly Kagoshima prefecture and Miyazaki prefecture, left 79 people either dead or missing. In the same year, Typhoon No. 11 caused a major flood which affected about 27,000 houses in the Tokyo metropolitan area. This flood also severed transportation networks and greatly affected urban functions.

Great destructive power of trees felled by storms.

Strong winds of Typhoon No. 19 (September 1991) blew down about 4,200 trees. Trees felled by storm can cause secondary damage. Subsequent rain can cause debris flows accompanied by driftwood.



Flood and sediment disaster

About 70 % of Japan is mountains, many of which are volcanoes. The country is also rainy and seismically active. These conditions predispose the land to sediment disasters.

Mountains cover about 70% of the land area of Japan. The Japanese archipelago is also one of the world's very seismically active regions. Topographical and geological factors, such as steep mountains, fast-flowing rivers, and unstable and soft ground, combine with the rainy climate and frequent earthquakes to make Japan very disaster-prone.

Consequently, sediment disasters of one kind or another, such as debris flows, landslides, and slope failures, occur throughout the country every year.

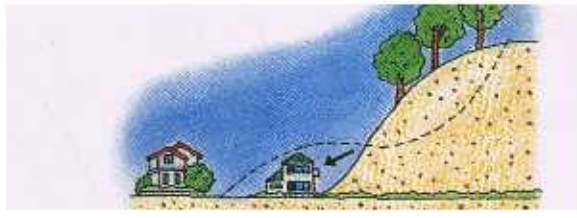
• Debris flows

A debris flow is a washout of stones and sand that had been deposited on hillsides or in river beds due to long or heavy rain. Debris flows can instantly bury houses and farmlands.

• Landslides

A landslide is a downslope movement of a block of earth, loosened by, for example, rain. Damage caused by a landslide can be extensive.

• Slope failures



A slope failure is a downslope movement of wet, loose rock or soil that is triggered by rain or an earthquake. Because of the rapid movement, slope failures often cause many casualties.