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A comparative analysis of disaster mitigation, response, and recovery practices in the northern US and Russian cities

Traditional settlements are rather resilient to disruptions, including natural hazards and wars. In their research on strategic bombing of Japan during World War II and its impacts on the distribution of population and infrastructure, Davis and Weinstein (2001) noted that the country's population, infrastructure, and industries were rapidly restored to their pre-war locations. Similar conclusions were reached by the researches investigating bombing of German and Vietnamese cities (e.g., Brakman et al., 2004; Miguel and Roland, 2011; Reddingy et al., 2011; Kolomak, 2014), which highlighted that no long-term impacts on the spatial distribution of economic activity in these regions has not been revealed. This trend is apparent in countries and regions with high population density.

The trend, however, reverses in the regions with low population density, especially in the Circumpolar North. Historical analysis has revealed numerous episodes of settlement extinctions due to epidemic, as well as depletion of natural and economic resources. Moreover, most northern settlements have undergone a significant transformation at the beginning of the 21 century. In Russia, for example, most northern settlements were formed through forced collectivization and industrialization, while in the US - through the initial militarization and later deactivation of military bases (Kontar et al., 2015; Gavrilyeva et al., 2017). Most northern cities are relatively new settlements rarely older than 90 years. Since their formation and development did not follow gradual paths, northern cities lack resilience to disruptions. Therefore, disaster risk in northern settlements is significantly higher than in older cities that gradually developed over centuries.

As in other parts of the world, vulnerability of northern cities has been increasing due to the rapid population growth, urbanization, migration (UNISDR, 2016). World trends for the past 40 years demonstrate a continuous increase of capital flow into hazard-prone areas, and simultaneously an increase in disasters caused by natural events (Figure1, 2) (Cutter et al., 2015; Munich Re, 2016).

Northern regions in the US and Russia are often regarded only as bases for natural and cultural resources. Due to their low populations, national governments implement limited development policies and practices in the North. According to the analysis of the disaster

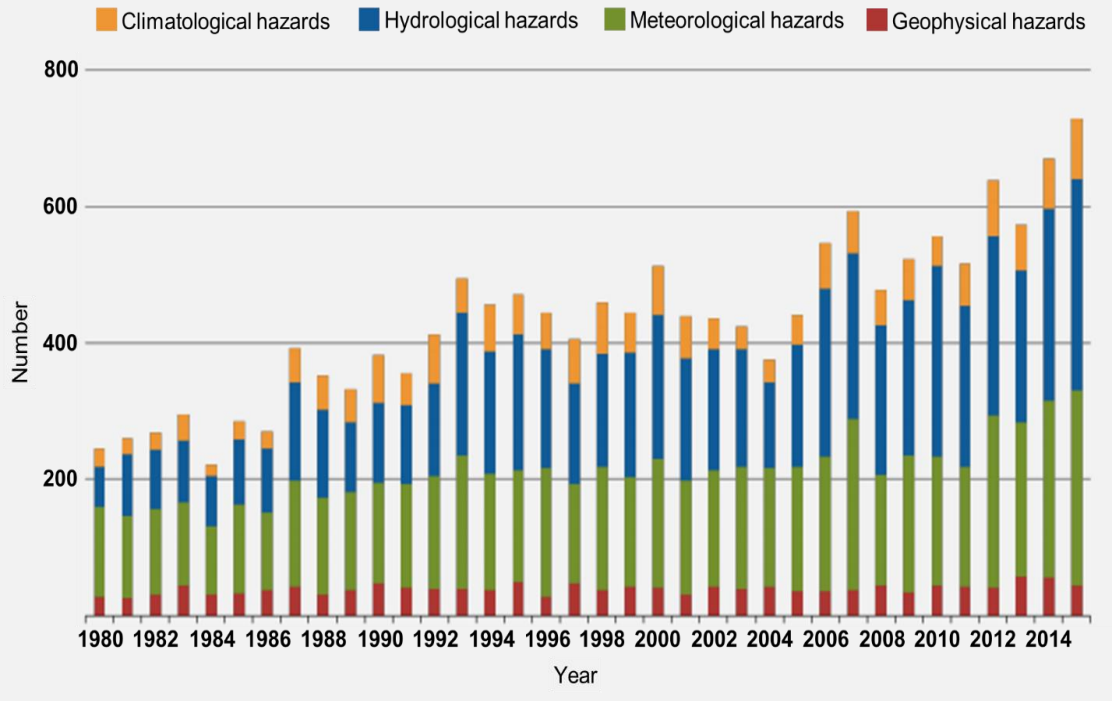
prevention and response statistics collected by the UNISDR, United States and Russia have world leading frameworks in disaster risk and crisis management. Nevertheless, adverse impacts from disasters are still high in both countries.

Tab. 1. - Ranks of the USA and Russian Federation in Disaster Risk Integrated Operational Risk Model

	OVERALL PREPAREDNESS	INSTITUTIONAL FRAMEWORK	DISASTER RISK REDUCTION POLICY, PREPAREDNESS AND RESPONSE	ECONOMIC RESILIENCE	SOCIETAL RESILIENCE	RESILIENCE OF THE PHYSICAL ENVIRONMENT
Russia	Developed	Mature	Mature	Developed	Developed	Developed
USA	Mature	Mature	Mature	Mature	Developed	Developed

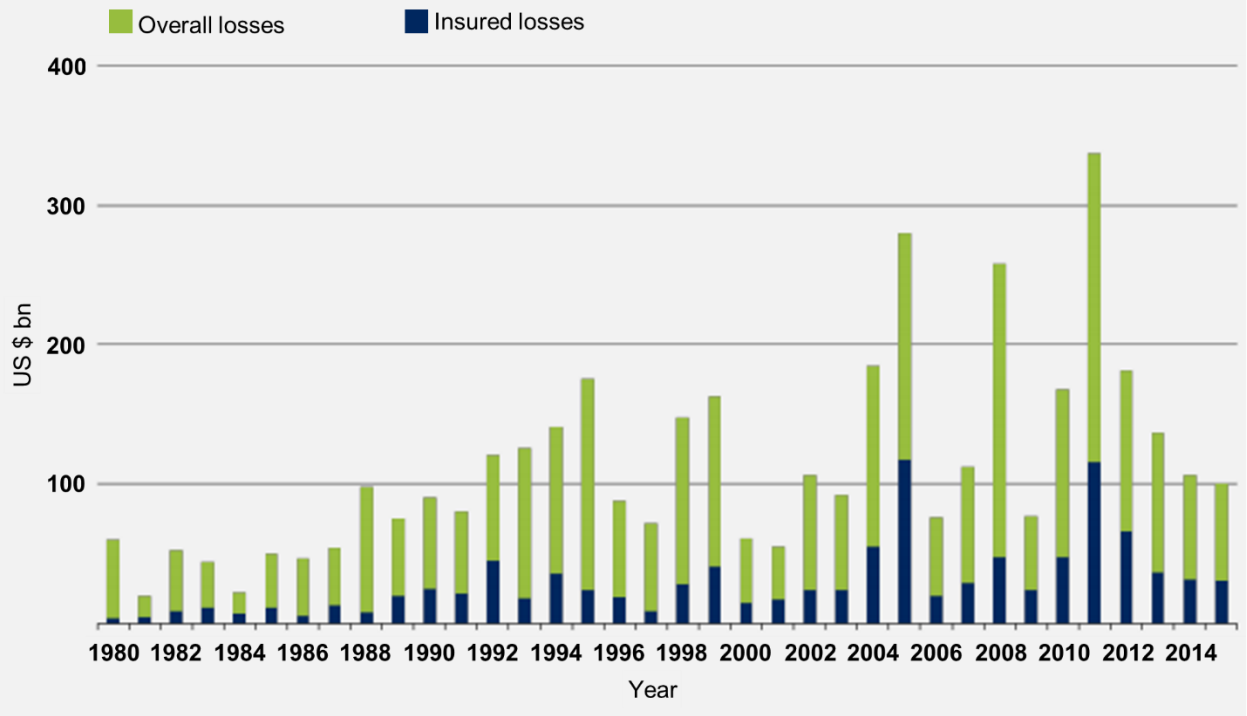
Source: UNISDR, 2016, https://www.eiu.com/home.aspx

Figure 1. The number of disasters caused by natural events has more than doubled since 1980



Accounted events have caused at least one fatality and/or produced losses ≥ US$ 100k, 300k, 1m, or 3m. Adapted from MünichRe.

Figure 2. Overall and insured losses have been increasing steadily since 1980, reaching an annual average of US$200 bn in 2012



Adapted from MünichRe.

River ice breakup is an annual spring time phenomenon in the North. Depending on regional weather patterns and river channel morphology, breakups can result in catastrophic floods (Beltaos, 2003). Breakup floods put hundreds communities at risk every spring, yet remain a largely ignored hazard in the global disaster arena. To identify best practices in breakup flood risk mitigation, response, and recovery, we conducted a comparative analysis between two flood-prone communities, Galena in Alaska, USA and Edeytsy in Yakutia (Northeast Siberia), Russia. It was the main goal of the project «Reducing spring flood impacts for wellbeing of communities of the North», which is a part of the U.S.-Russia Peer-to-Peer Dialogue Initiate 2015-2016.

In May 2013, a series of breakup floods ravaged multiple communities along the Yukon and Lena Rivers in Alaska and Yakutia respectively. The floods did not result in fatalities, but caused significant negative ecological and socioeconomic impacts. The most severe flood in Alaska took place in Galena. Within three days, the floodwaters and ice debris destroyed nearly 90 percent of Galena's infrastructure and residences, and forced over half of its residents into tow-year long evacuation (Kontar et al., 2015). Limited infrastructure and the short rebuilding season slowed response and recovery in Galena.

A week earlier, a major breakup flood took place in Edeytsy, a Native village located approximately 50 kilometers north of the region's capital, Yakutsk. Similar to Galena, Edeytsy sustained severe flood damage to its infrastructure and private residences. Over 30 percent of the families lost their homes, and their means of livelihood. Edeytsy is an agricultural and cattle-raising society. Floodwaters inundated nearly all farms and pasturelands. Due to the well-established line of command across agencies responsible for flood risk management, disaster response and recovery were conducted in a timely manner. Key infrastructure was rebuilt in six months.

In Alaska and Yakutia, multiple stakeholders from federal, state, and local agencies, NGOs, volunteers, and private companies engage in flood risk management. In Yakutia, communication and coordination between stakeholders are organized at the federal level. A unified state system for spring flood prevention, preparedness, response and recovery efforts has been in place since the end of the twentieth century. It includes three main stages. The first, *preparation stage*, takes place approximately four months prior to the breakup onset. An interagency working group forms in late January. It includes representatives from key agencies involved in breakup flood risk management, including the Lena Basin Water Management Agency (LBWM); Ministry for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters (MchS); and Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet). Based on the breakup predictions from Roshydromet, the working group allocates the necessary financial and technical resources for the potential floods.

The second, *operational stage*, begins two months prior to the breakup onset. The working group develops a detailed flood prevention and response plan. The plan specifies locations for ice jam mitigation efforts. Roshydromet monitors ice jam locations and provides up-to-date forecasts to local and regional administration. State government issues advisories regarding potential floods.

The third, *preventative stage*, takes place from four to two weeks before the breakup. Federal and state emergency managers conduct mitigation efforts. Local administrations establish emergency response posts, inform the public about potential flooding and prepare for evacuation. Evacuation of elders and children and relocation of cattle, cars, and farm equipment begin two-three days prior to the flood.

After floods, an interagency commission evaluates the damage and determines individual and public compensations. The reconstruction begins in mid-August. Quickly approaching winter decreases the rebuilding period to three months, thus often pushing it to the next year. Residents assists in the reconstruction of public infrastructure, thus expediting the rebuilding process.

There is no unified state system for spring flood risk management in Alaska. Instead, each community at risk carries out its own hazard assessment or strategic community plan for spring floods. Once a flood overwhelms community resources, local administration requests state's support. The governor requests a federal disaster declaration and support after the flood exceeds state's resources. Federal support arrives two months after the flood.

Federal assistance was crucial in Galena's recovery. However, it also led to interagency conflicts and frustrations (Kontar et al., 2013). Additional damage assessments, regulations and paperwork adjustments, and approvals took much of the valuable rebuilding time. These delays could have been avoided if unified state guidelines for flood risk management had been followed.

The overall satisfaction levels of flood response and recovery were significantly higher among the Edeytsy than Galena residents. In both communities, the majority of respondents evaluated the efforts of the local administration during the flood as good or very good, and better than assistance from other stakeholders.

The Russian flood risk management system appears to be better coordinated and more effective, especially during disaster preparedness and response phases. Nevertheless, there are problems. Every spring, federal and state agencies allocate funds for flood mitigation. However, floods still result in catastrophic damage. Although the Russian spring flood mitigation efforts are proactive, they are not necessarily effective. Hydrological models have been developed to guide mitigation efforts, such as ice cover cutting and dusting. However, criteria for the effectiveness of these efforts have not yet been established. Thus, there is no published evidence of their effectiveness. Further detailed comparison of breakup flood mitigation measures are needed.

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