7th Intercontinental Geoinformation Days

igd.mersin.edu.tr

Preventive measures in disaster management can make the difference

Lucrezia Vittoria Natale[1], Donato Abruzzese [2]

[1]University of Rome "Tor Vergata", Department of Economy and Finance, Rome, Italy
[2]University of Rome "Tor Vergata", Department of Civil Engineering and Computer Sciences, Rome, Italy

Keywords
Natural Disaster
Disaster management
Flooding
Disaster prevention
Economy of Disaster

Abstract

Coping with the consequences and losses caused by natural disasters is one of the most pressing issues that humanity is often facing. Addressing this challenge involves different strategies, from prevention and reaction plans to adaptation and mitigation projects. Preventive measures can be seen as the most effective way to prevent loss of life and damage to property. These encompass building codes, land use, and environmental conservation efforts, as well as less tangible activities linked to education and awareness. The paper shows some of the possible ways to create effective natural disaster management, with a set of ex-ante measures which are particularly focused on prevention methods. Highlighting their importance does not mean denigrating ex-post activities. Rather, an impactful approach should integrate these two typologies of measures and avoid an excessive reliance on insurance alone. Indeed, by investing in prevention, communities can substantially reduce their vulnerability and exposure. Examples drawn from experience with flooding events are also provided for a more concrete understanding.

1. Introduction

The damage caused by natural disasters can be examined from different perspectives: environmental damage, economic repercussions, and the disruption of livelihoods and lives.

The graph below can give insights into the overall damages caused by such phenomena. Indeed, it shows the financial value losses given by natural disasters by GDP (with normalisation) in Europe.

Natural disasters may never be eliminated, but their risk can be reduced or mitigated through risk management. From an ex-ante perspective, risk prevention, financial protection, and preparedness are crucial. Conversely, from an ex-post perspective, what matters most is the possibility of resilient reconstruction, socio-economic recovery, and response.

During the past decades, the intensity of natural disasters appears to have increased with dramatic consequences. In their Global Assessment Report (GAR2022), the United Nations reveal *"…that between 350 and 500 medium-to-large-scale disasters took place every year over the past two decades."* Moreover, the report predicts that, by 2030, this number will reach 560 events a year, meaning a frequency of 1.5 disasters a day. This data shows the urgency surrounding natural disasters management and the paramount importance of learning how to cope with their increasing prevalence and scale.

Decision-makers typically employ two types of approaches when creating public policies addressing these concerns. The first one may be referred to as a "passive" protection for communities which are encouraged to rely on insurance coverage to face natural disaster recovery. The other, which is more comprehensive and complete, includes investing on the territorial assets before the disaster occurs, thus embodying a proactive and preventive approach.

Given the rise in frequency and intensity of natural disasters, coping measures must primarily focus on mitigating potential damages before they occur. Creating an effective risk management strategy implies the use of both approaches, since taking into account that the sole reliance on ex-post measures and insurance is insufficient to address the problem.

2. The Role of Citizens and the Government

2.1. The Impact on Exposure and Vulnerability

In the field of natural disaster prevention, promoting useful preventive practices is one of the main tasks of governments, at the national and at the local levels. Their overall objective is to reduce the vulnerability and the exposure of communities. The

* **Corresponding Author**
(lucrezia.natale@icloud.com) ORCID 0009-0004-7160-9232
(abruzzese@uniroma2.it) ORCID ID 0000-0003-0798-5239

Cite this study
Natale, L. V. & Abruzzese, D. (2023). Preventive measures in disaster management can make the difference. Intercontinental Geoinformation Days (IGD), 7, 275-278, Peshawar, Pakistan

latter element of risk can be defined as the people and elements which are present in hazard zones, and which are, therefore, subject to potential losses. As stated by the World Health Organisation (WHO), "*Populations and societies need to be exposed to a hazard to be affected by it.*" Moreover, vulnerability must also be considered: according to the United Nations Office for Risk Reduction (UNDRR), *vulnerability* refers to *"…the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.*" Ultimately, understanding the role and level of vulnerability and exposure in each area is key to envisaging the right type of preventive measures to implement.

Vulnerability depends on a range of factors. As affirmed by the WHO, these include physical, social, economic, and environmental elements such as the proximity to a potentially hazardous event, public education and awareness of the hazard, building codes and land use, and public infrastructures. This is why it is the responsibility and duty of public authorities to enforce measures and laws that prevent, as for instance thinking to the floodings and earthquakes, the misuse of land and resources while promoting natural disaster education.

2.2. The role of citizens: choosing where to build and where to live

Since some areas are more vulnerable than others, it is crucial that citizens carefully select the places where they build and live. Recently, increased urbanisation has become ever more evident. According to The World Urbanisation Prospect, in their 2014 revision, 54% of the world population lives in urban areas, and the United Nations estimate this number to increase to between 60% and 70% by 2050. Also, according to the World Bank, urbanisation is one of the factors increasing exposure and vulnerability to natural disasters.

The first reason is the case is that urban sprawl does not always consider the vulnerability and exposure of certain areas. Indeed, some towns may be near rivers prone to flooding in case of heavy rain or on steep slopes subject to landslide risk. It is important for citizens to be informed about the specific risks and the types of disasters affecting a given territory, opting for safe areas where to work and live.

However, people do not always have the privilege and the chance to choose where to live. This is the case especially in low-income countries, where, according to the European Commission, one billion people live in hazardous areas, equivalent to 42% of the total population. These findings highlight the need for enhanced public awareness campaigns and government incentives to prevent the persistence of this situation.

2.3. The Role of the Government: Regulate Urbanisation and Spread Awareness

While completely avoiding disasters may not always be possible, citizens can take action to be ready for when disasters strike. These preparatory measures significantly contribute to limit the negative aftermath of disasters, containing injuries and casualties.

Governments have a central role in this: they should provide adequate knowledge and tools to prepare for disasters. Without their resources, the efforts of individual citizens would not have enough impact to make a difference.

The most evident field in which their role can have an impact is urbanisation and urban planning. Indeed, while it is true that citizens should be conscious when choosing where to reside, governments should also forbid to building in areas which are defined as risk-prone by experts such as geologists. According to a paper published by UNDRR, "*Weak regulation, for instance the lack of enforcement of building codes, planning permission and regulatory investment, often linked to corruption, allow the transfer of risk from construction companies to those who live and work in the buildings*." The same paper reveals alarming figures relating to this problem: 90% of low-income families in urban areas live in unsafe and exposed housing.

Governments can actively coordinate and take action in the urban planning process, which involves a diversified series of actors, including investors, landowners, and regulators. The development of an adequate urban project, documentation and analysis of sites, and post-completion maintenance are key. Laws regulating and setting limits to soil consumption and building are essential.

3. The Role of Excessive Urbanisation

3.1. The Risks Linked to a Misuse of Soil

The soil has the capacity to store CO^2 and absorb water. This is why artificially changing soil characteristics is risky and can exacerbate the negative outcomes of natural disasters. Urbanisation needs to replace natural land cover with impermeable materials such as asphalt, reducing the soil's capacity to store water. This is how floods can take place: either due to a stagnation of water or due to the destructiveness of excessive water runoff in steep slopes.

Pakistan is an example of this dramatic tendency: only 5% of land is currently covered in forests (Shahbaz et al., 2007). Just as worrying is the fact that, according to The World Bank, this country has the highest deforestation rate in South Asia.

3.2. A New Approach to Urban Contexts

Despite the alarming data regarding urbanization and deforestation, some innovative solutions to reduce natural disaster risk in urban contexts are possible. In particular, when it comes to geo-hydrological risk, Nature-Based Solutions (NBS) can have a positive impact. These integrate natural elements into urban water management. Typical examples of NBS alternatives are green roofs, gardens, dry retention ponds, and permeable pavements (Vojinovic et al., 2021). Governments may be reticent to this kind of approach and may want to invest in interventions that generate

shorter-term results. Since their adoption is not widespread, further research on the topic is needed

However, there are some studies have already been made which highlight their benefits. To this regard, the SaferPaces project is an interesting global platform that can be used as a model. Co-funded by the EIT Climate-KIC, a European Innovation and Technology Institute section, and coordinated by different entities, universities, GECOsistema srl, and other private companies, it is already working in Milan (Italy), Pamplona (Spain), Cologne (Germany), and Rimini (Italy).

This project has contributed to the creation of the project "Parco del Mare", based on NBS, on Rimini's coasts, whose building works have started in autumn 2023. The pictures, which show the impact the Parco del Mare will have in preventing town flooding, clearly demonstrate the potential of this innovation.

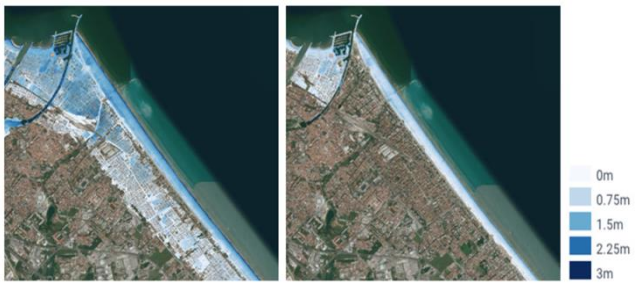

Figure 1. Scenario of foreseen floodings by 2050 without and with the Parco del Mare project in Rimini, Source: Legambiente, Italy

4. Insurance as a Means of Protection

4.1. The Role of Insurance for Natural Disasters

Nowadays, trends seem to emphasise funds and insurance for natural disasters, focusing less on concrete prevention plans. Funds and insurance play a crucial role when it comes to efficiently starting a recovery process in the aftermath of a natural disaster. Although some studies do portray funds and insurance as the most suitable solutions, it is nonetheless crucial to recognise the complexity of the issue.

It is, however, true that citizens residing in high-risk zones frequently express a willingness to rely on insurance to mitigate the uncertainties associated with losses generated by natural disasters. India is an example of this trend: according to a record published in 2009 by the World Wide Fund for Nature (WWF) and Allianz, due to climate change, insurance claims have surged, reaching a peak during the 2005 unprecedented rainfall in Mumbai (Lenton et al., 2009).

While beneficial for recovery, funds and insurance, are not a solution by themselves. They neither substitute the lack of legislative measures supporting prevention, nor do they reduce the vulnerability of the population. In other words, they do not offer practical solutions to fixing the consequences of natural disasters or prevent them; preventive measures remain the most effective solution.

4.2. The Limits of Insurance

Indeed, insurance presents a series of criticalities. For example, given the unprecedented frequency and scale of disasters, in the coming years, insurance companies might have to raise their rates. This increase may make insurance premiums so expensive as to become increasingly unaffordable for many. Secondly, the possibility of an increase in dishonest (fraudulent) insurance claims, possibly stemming from a rise in poverty as one of the consequences of climate change, should also be considered. What is more, insurance provides a temporary solution only at an individual level, and cannot compensate collective damages. This means that while an individual or a family may receive financial assistance to rebuild their personal property after a natural disaster, their broader community and environment will nonetheless remain adversely affected, making it difficult for the individual household to recover and for local economy to restart in any significant way.

5. Conclusion

Natural disasters pose a significant challenge to humanity. During the past decades, people and authorities have underrated problems related to them: for example, irresponsible urbanization policies have, if anything, exacerbated them. Natural land cover was replaced by surfaces made by concrete and asphalt which reduced soil drainage capacity, thus increasing the risk of floods in many areas, and a bad construction policy can lead to seismic potentially vulnerable buildings and infrastructures.

Insurance is a crucial means to start an efficient recovery stage after the disaster occurs, but the sustainability of this system, in the long run, is unfeasible and it does not eradicate the underlying risk.

However, there is still an opportunity to take preventive measures: testing NBS in urban environments and conducting further research is crucial to highlight their benefits as local governments may be persuaded to implement them. Governments, and various organisations, as well as local institutions, also need to spread disaster prevention and reaction awareness and knowledge to citizens. Ensuring that populations are well-informed about the risks they face is essential enable them to make informed decisions when aware and facing natural disasters.

References

European Commission, "The Future of Cities." urban.jrc.ec.europa.eu/thefutureofcities/the-resilien-city#:~:text=One%20billion%20

GAR2022: (2022). Our World at Risk (GAR) | UNDRR."Www.undrr.org, 26 Apr. 2022, www.undrr.org/gar/gar2022-our-world-risk-gar#container-downloads.

Lenton, T., Footitt, A. & Dlugolecki, A. (2009). Major Tipping Points in the Earth's Climate System and Consequences for the Insurance Sector. people%20live%20in.

Shahbaz, B., T. Ali, and A. Q. Suleri. (2007). A Critical Analysis of Forest Policies of Pakistan: Implications for Sustainable Livelihoods. Mitigation and Adaptation Strategies for Global Change 12: 441–453. doi: 10.1007/s11027-006-9050-9

UNDRR. "Poorly Planned Urban Development". Www.preventionweb.net, 2013,

UNDRR. Vulnerability. www.undrr.org. Available at: https://www.undrr.org/terminology/vulnerability.

United Nations. "68% of the World Population Projected to Live in Urban Areas by 2050, Says UN. "United Nations Department of Economic and Social Affairs, United Nations, 16 May 2018, www.un.org/ development/ desa/en/news/population/2018-revision-of-world-urbanization-prospects.html.

United Nations. "World Urbanization Prospects- Population Division- United Nations. "Un.org, 2018, population.un.org/wup/.

Vojinovic, Z., Alves, A., Gómez, J.P., Weesakul, S., Keerakamolchai, W., Meesuk, V. and Sanchez, A. (2021). Effectiveness of small- and large-scale Nature-Based Solutions for flood mitigation: The case of Ayutthaya, Thailand. Science of The Total Environment, 789, p.147725. 10.1016/ j.scitotenv.2021.147725

Wahba Tadros, S. N., et al. "Demographic Trends and Urbanization", World Bank, 2021, documents. worldbank.org/en/publication/documents-reports/documentdetail/260581617988607640/demographic-trends-and-urbanization.

World Bank. (2013). Forest Carbon Relationships. Washington, DC: World Bank.

World Health Organization. (2021). "Guidance on Research Methods for Health Emergency and Disaster Risk Management". 3.2 Disaster Risk Factors -Hazards, Exposure and Vulnerability.

World Urbanization Prospects – (2018). Population Division- United Nations. Un.org, 2018, population.un.org/wup/.