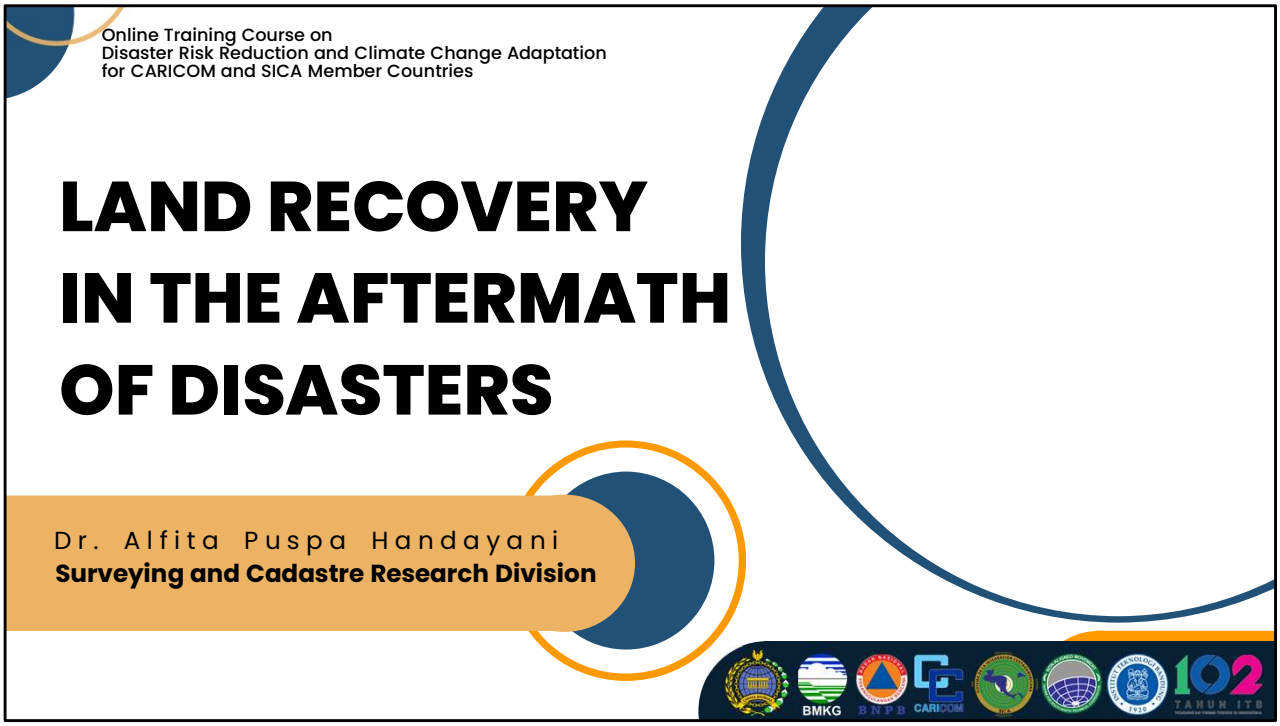

Dr. Alfita Puspa Handayani
Surveying and Cadastre Research Division

Dr. Alfita Puspa Handayani

Speciality

- Land Economics
- Land Development and Disaster Risk Management

Research and Project

- Land Price Prediction
- Land Consolidation, Land Institutional Models and Land Information Systems for Earthquake Risk Management Using a Community Participation in Lombok
- Multipurpose Cadastre Development Based on Sustainable Land and Disaster Risk Management in Sesar Lembang
- Early Warning System on Jakarta shore line

Disasters happen. There is nothing humanity can do to prevent earthquakes, tsunamis, or volcanic eruptions from occurring, and even disasters with a human cause may strike suddenly and without warning.

However, communities and populations can be made more resilient in the face of disaster through building resilient land and geospatial information systems.

@yoshginsu

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Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

https://www.opusa.org/blog-the-devastating-impact-of-man-made-disasters-2/

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A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. – UNISDR Terminology on Disaster Risk Reduction

Disasters are often described as a result of the combination of:
1. The **exposure to a hazard;**
2. The **conditions of vulnerability** that are present; and
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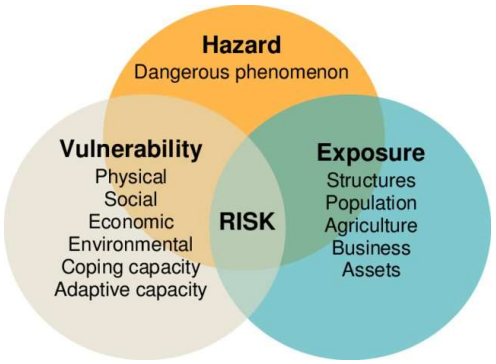
Index	Sub-index	Indicator	Metric
Vulnerability	Social vulnerability	Persons under 12 years	persons/km²
		Persons over 60 years	persons/km²
		Persons with disabilities	persons/km²
		Monthly per capita income	R$
	Physical/infrastructure vulnerability	Households with improper building material	percentage
		Households with accumulated garbage	percentage
		Households with open sewage	percentage
	Coping capacity	Disaster prevention institutions	inst. /km²
		Evacuation drills and training	drills./km²
		Distance to shelters	meters
		Existence of clearly marked escape routes	location
		Health care facilities	facilities/km²
Exposure	Human exposure	Population density	persons/km²
	Environmental exposure	Environmentally protected areas	location
	Socioeconomic exposure	Economic activities (agriculture, industry)	location
		Cost of flood damages in the last 20 years	R$
	Infrastructure exposure	Critical infrastructure (water and sewage treatment plants, power plants, hospitals, roads, bridges)	location
		Social hotspots (hospitals, schools, daycare centers, retirement homes)	location
		Density of buildings	build./km²



Prioritization of flood vulnerability, coping capacity and exposure indicators through the Delphi technique: A case study in Taquari-Antas basin, Brazil- Mariana Madruga de Brito-

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Disaster risk;
The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period - UNISDR Terminology on Disaster Risk Reduction.

The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least.

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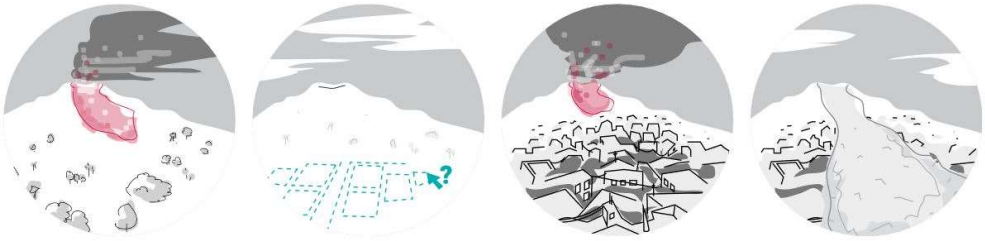
Risk and the context of hazard, exposure and vulnerability



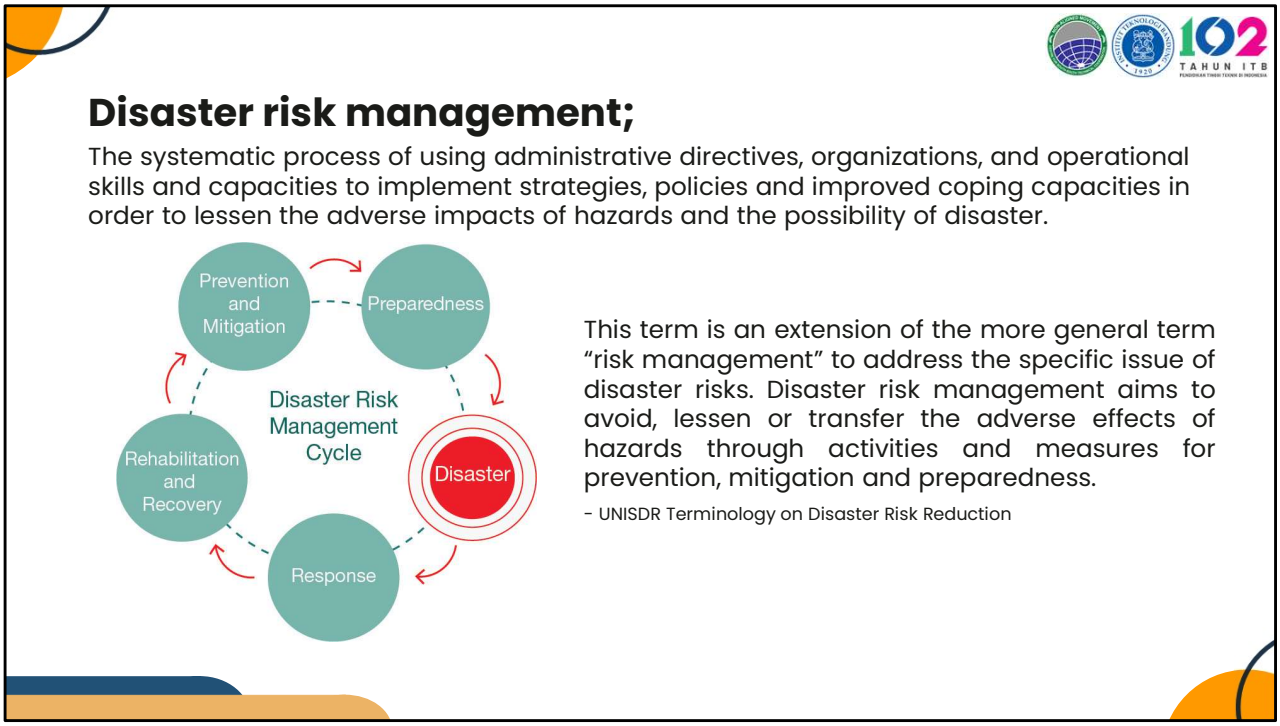
There is no such thing as a **natural disaster**, only **natural hazards**

We make **choices** as to where we inhabit, how we build and what research we do

Risk is the combination of **hazard**, **exposure** and **vulnerability**

Death, **loss** and **damage** is the function of the context of hazard, exposure and vulnerability

(Source: UNDRR 2019)



Disaster risk management;

The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

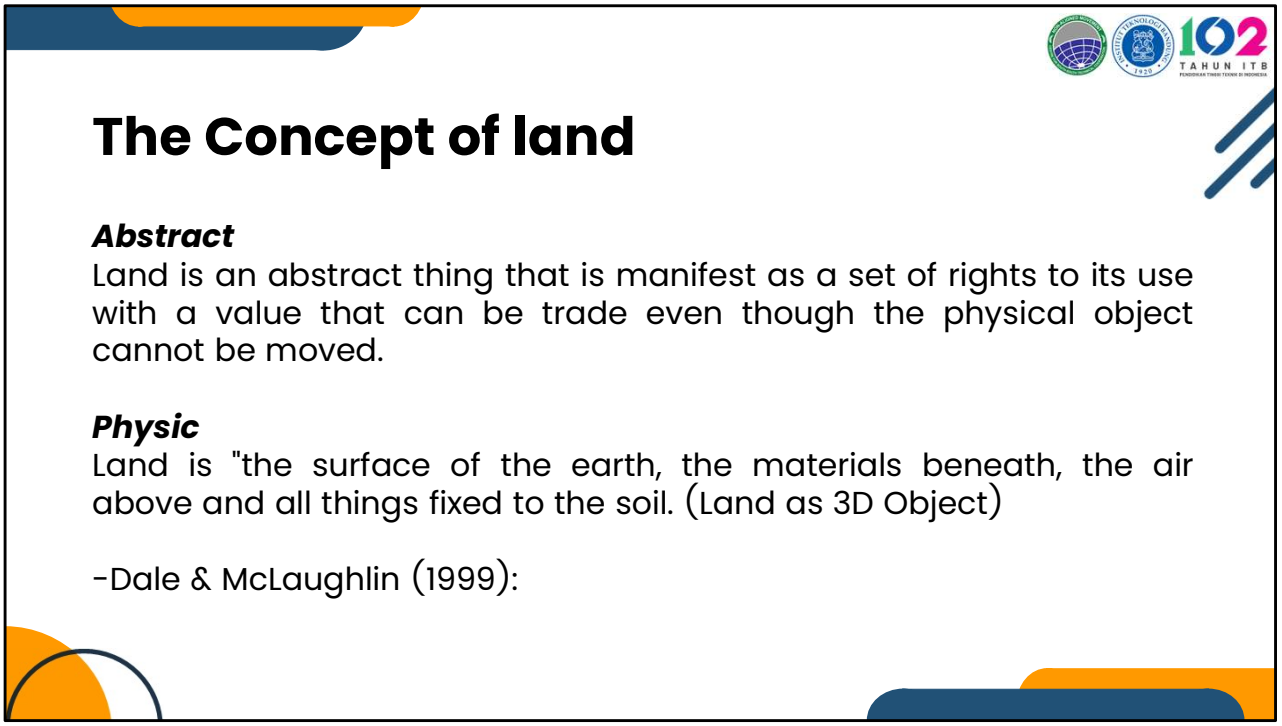
This term is an extension of the more general term "risk management" to address the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness. - UNISDR Terminology on Disaster Risk Reduction

When disasters displace people, land records and geospatial data are key to protect property rights and build resilience.

(Anna wellensteinmika-petteri torhonen, 2018)

Natural disasters, must occur on land. then everything above, on and below land will be affected. The essence of disaster risk management is to minimize the risks that occur. If we have a good land records and geospatial data, at least when disaster accured, we have the legality data that shows where we lived so we wont loose our land.

Land Records



The Concept of land

Abstract
Land is an abstract thing that is manifest as a set of rights to its use with a value that can be trade even though the physical object cannot be moved.

Physic
Land is "the surface of the earth, the materials beneath, the air above and all things fixed to the soil. (Land as 3D Object)

-Dale & McLaughlin (1999):

Dynamics of Human & Land Relationship

	Feudalism - 1800	Industrial revolution 1800-1950	Post-war reconstruction 1950-1980	Information revolution 1980 -
Human kind to land evolution	Land as wealth	Land as a commodity	Land as a scarce resource	Land as a community scarce resource
Evolution of cadastral applications	Fiscal Cadastre. Land valuation and taxation paradigm	Legal Cadastre. Land market paradigm	Managerial Cadastre. Land management paradigm	Multi-purpose Cadastre. Sustainable development paradigm

Williamson and Ting, 1999

Cadastral System

*A **parcel based land information system** that containing **a record of interests** in land (rights, restrictions and responsibilities), **a geometric description**, and **link to other records** on (a) nature of the interests, (b) ownership or control of the interests, (c) value of the parcel and (d) its improvement*

*Cadastral system established for **fiscal purposes, legal purposes, regulatory purposes, and sustainable development and environmental protection** → **Multipurpose Cadastre***

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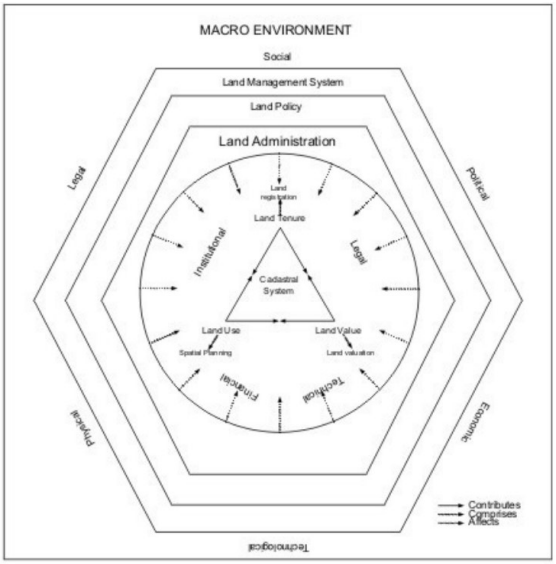
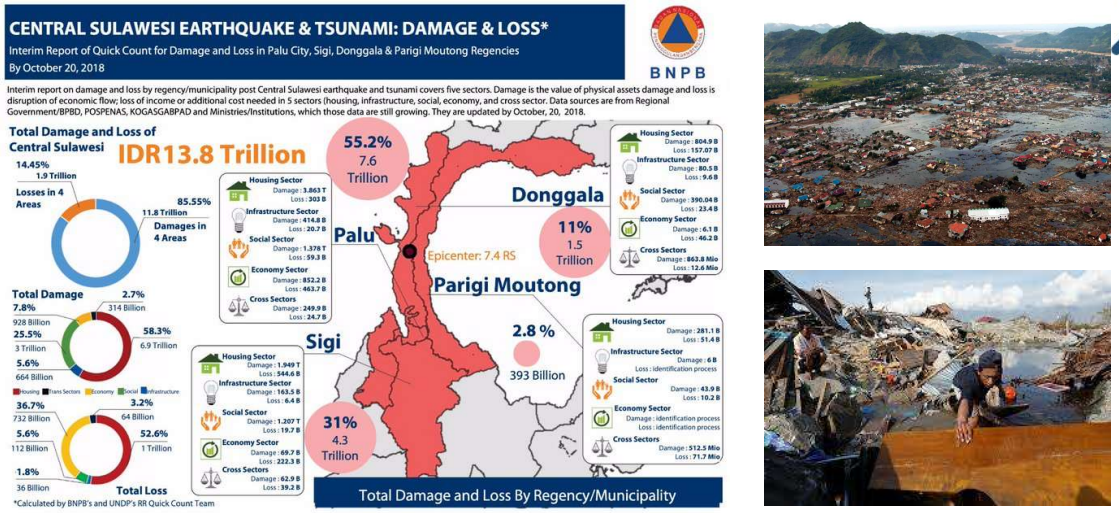
Cadastral System and Land Management



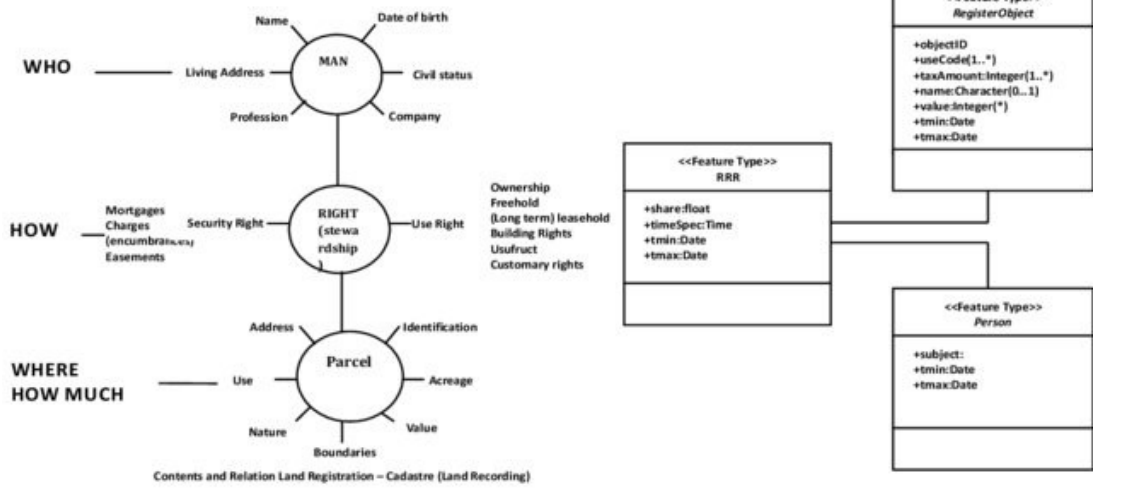
By Abdulharis, adapted from Dale and McLaughlin (1999), Barry (1999), and Enemark (2005)

Land Management and Disaster (1)



Every disasters must affect people that lived in the area. Most disaster will require residents to evacuate. When people leave their homes behind, land records offer critical protection of their property rights. This is crucial, as land and homes are usually the main assets that people have. Land and geospatial information is key to ensure that land records are comprehensive and secure.

Land Management and Disaster (2)

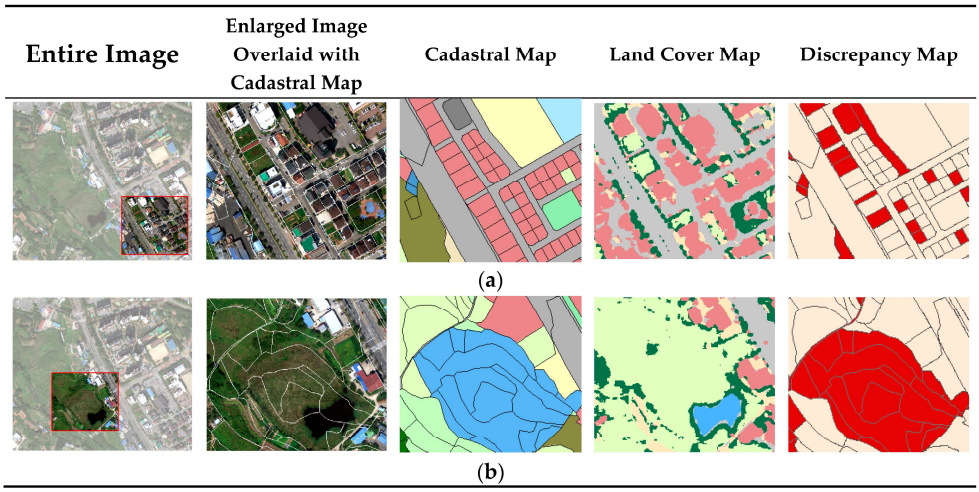


Contents and Relation Land Registration – Cadastre (Land Recording)

Elias Danyi Kuusaana. Adopted from Henssen (2008) and Lemmen et al. (2005).

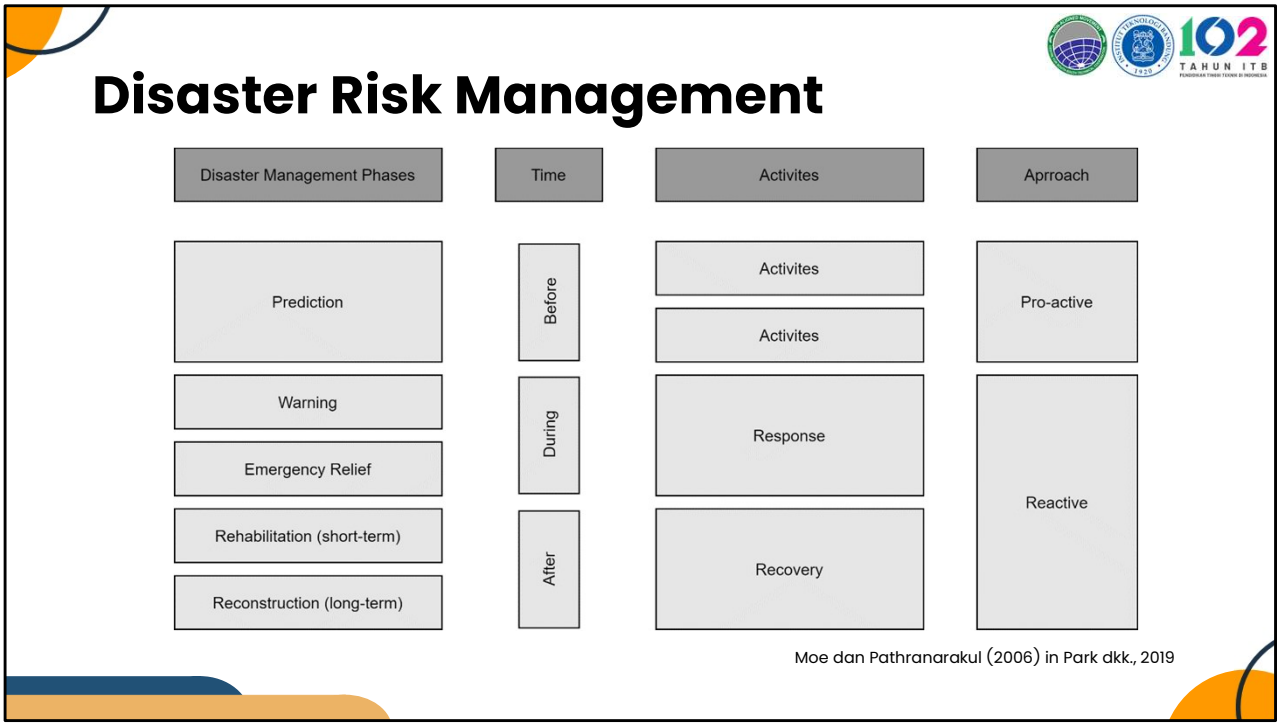
Land and geospatial information tells the what, who, where, how much, and other key attributes of a property. Without this information, it is almost impossible for cities and communities to develop proper disaster response or preparedness plans.

Land Management and Disaster (3)



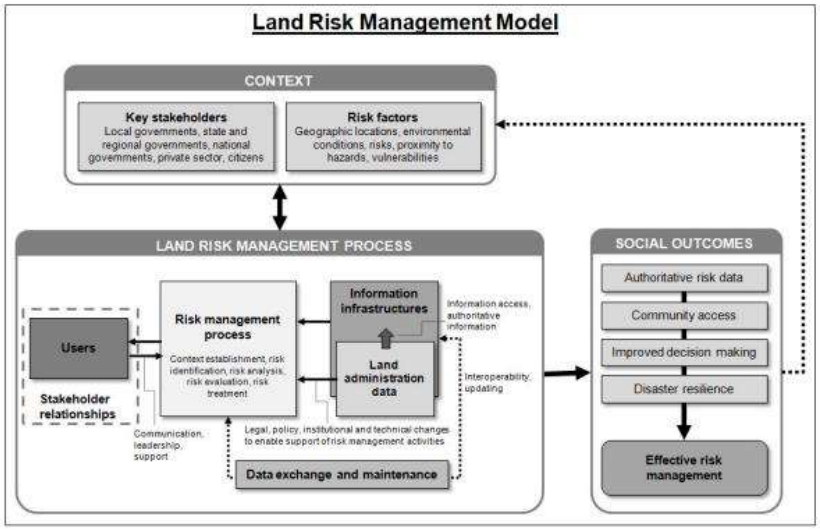
Seula Park and Ahram Song

Comprehensive land and geospatial systems can secure the resilient recovery of economic activities – by providing accessible and instant data on disaster impact, the value of losses, the beneficiaries, as well as the levels of appropriate compensation and required investment to restore activities.



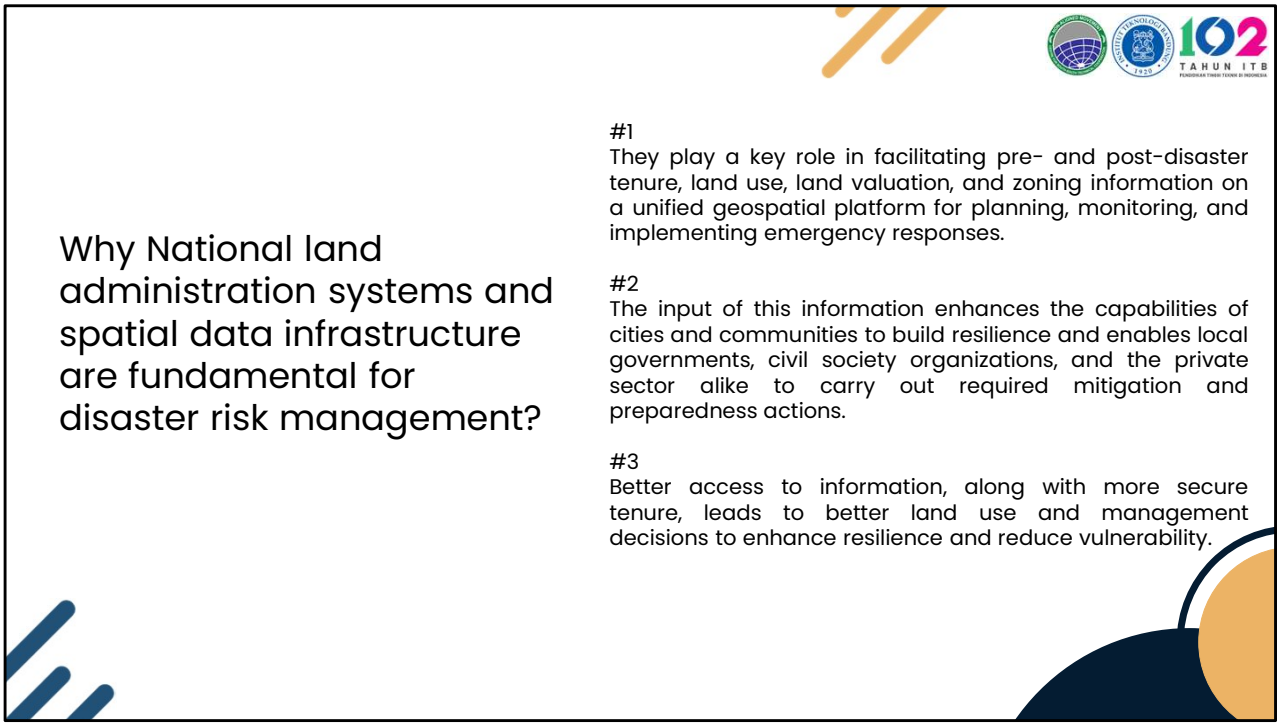
Currently, disaster management activities are more focused on disaster reduction activities in disaster response activities. Although post-disaster activities are as important as pre-disaster activities, it is better to reduce the impact of a disaster than to act after a disaster occurs (Gill et al., 2014). Disaster management itself is defined as a disaster concept which includes prevention, management, reduction, and recovery measures. Disaster management activities include four processes, namely mitigation activities, disaster preparedness activities, disaster response activities, and post-disaster recovery activities.

Land Risk Management Model



Katty Potts (2013) in Rodríguez dkk., 2018

A comprehensive approach between cadastre, spatial data infrastructure, land administration, and disaster risk management will result in an efficient disaster risk management system that enables the identification and minimization of possible exposures and vulnerabilities that occur in the community (Rodríguez et al., 2018). Katty Potts (2013) in Rodríguez et al. (2018), developed a land risk management model that is integrated with land (Figure 2.8). The model considers three general aspects, namely context, land risk management processes, and social outcomes. The context aspect allows analyzing the situation of the different countries, institutions and stakeholders involved as well as the level of risk in land risk management. The land risk management process consists of five main elements, namely users, the land risk management process itself, information infrastructure, land administration data, and data maintenance and integration. In this aspect, land and cadastral management is fundamental in making decisions to produce alternative risk mitigation and disaster-resilient communities. The end result is creating up-to-date information related to land-based disasters that can be easily accessed by the community. This information is also useful for the authorities in making mitigation decisions to minimize losses and damage in the face of disaster events.

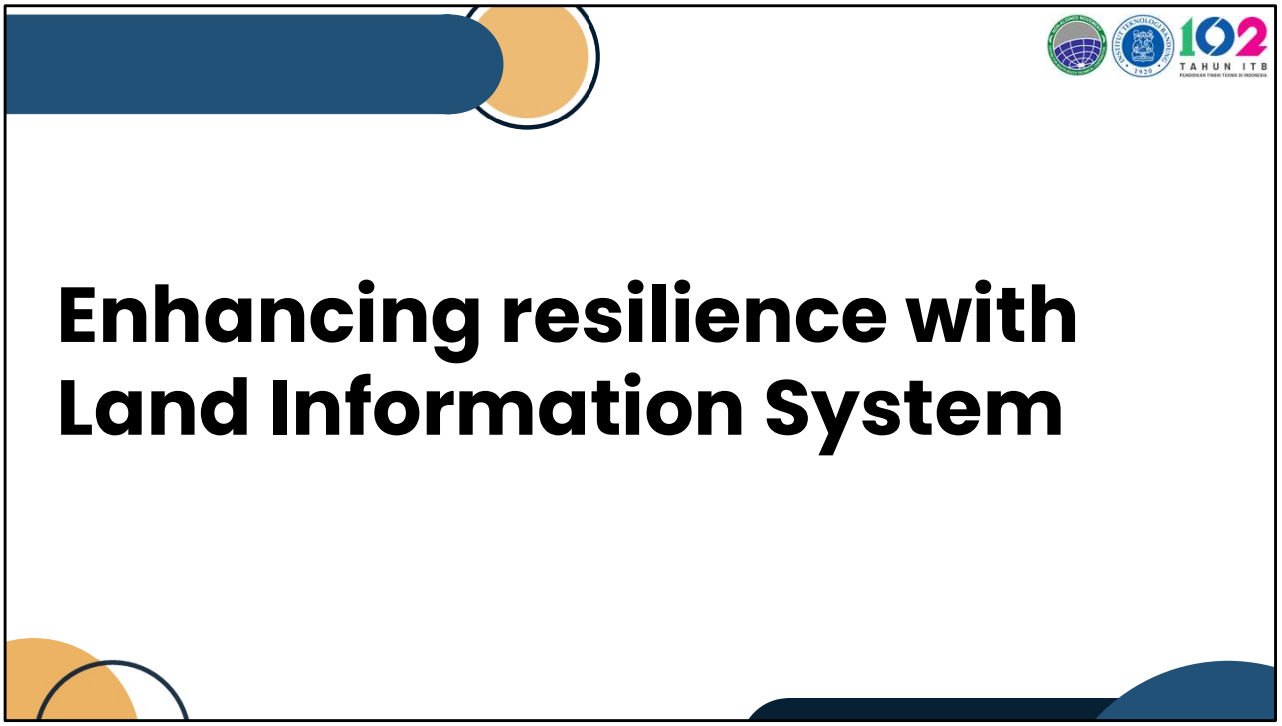


Why National land administration systems and spatial data infrastructure are fundamental for disaster risk management?

#1
They play a key role in facilitating pre- and post-disaster tenure, land use, land valuation, and zoning information on a unified geospatial platform for planning, monitoring, and implementing emergency responses.

#2
The input of this information enhances the capabilities of cities and communities to build resilience and enables local governments, civil society organizations, and the private sector alike to carry out required mitigation and preparedness actions.

#3
Better access to information, along with more secure tenure, leads to better land use and management decisions to enhance resilience and reduce vulnerability.


Enhancing resilience with
Land Information System

Land Administration and Damage Assessment After a Disaster

Figure 9, Dump of damaged land records after the Tsunami Disaster in Aceh, Indonesia
(Photo Source: GIMLA ITC, 2007)

As the cadastral information was in analogue format in the Aceh Province of Indonesia, these records were also damaged by the disaster (Figure 9). Consequently who owned what could not be assessed as the overall landscape appearance was
changed by the aftermath of the Tsunami, and at the same time, many of the landowners themselves were taken up by the sea apart from the severe damage on the building holding the land records. If the data were in a database, then the authority would be able to identify the high casualty area with dense population, and it would help to rapid the rescue process not only to assess the aftermath of the disaster.

Land Administration and Damage Assessment After a Disaster

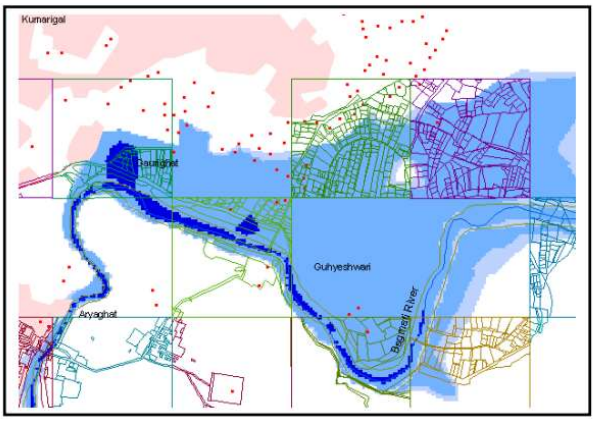
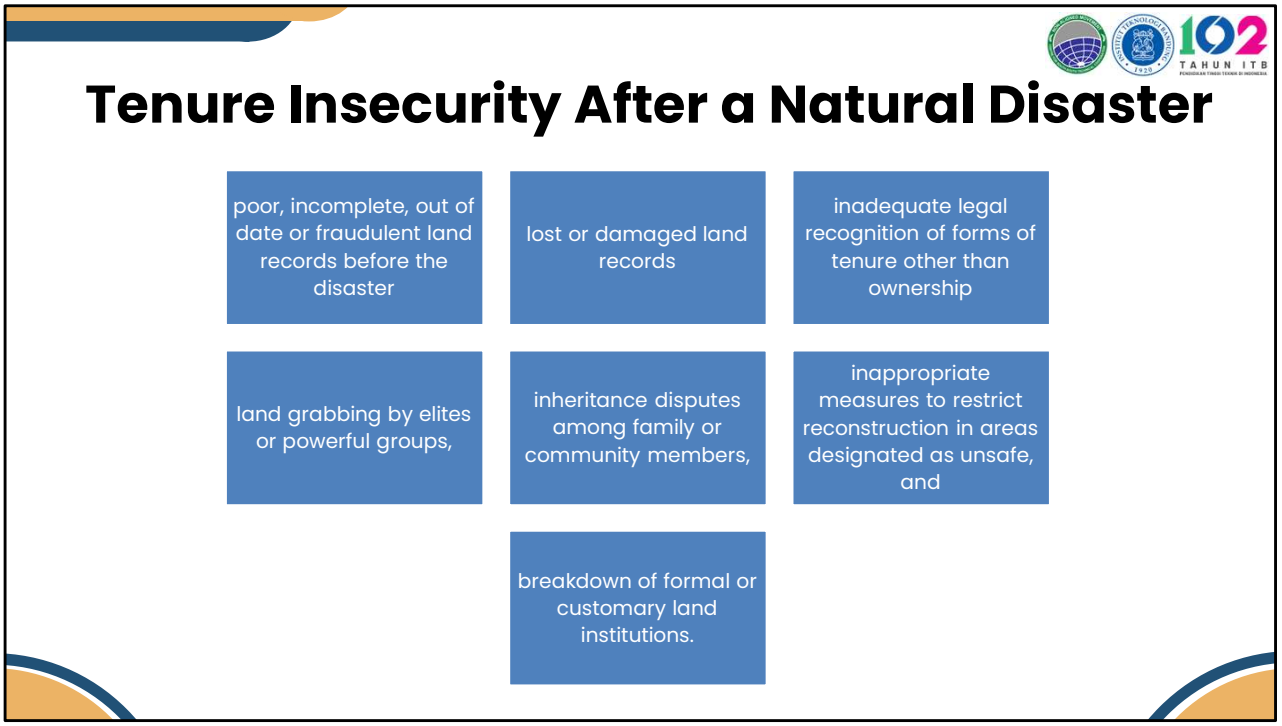


Figure 10, Parcels in the flood zone (blue shaded) near the Guheswori temple in Kathmandu

Flood Analysis conducted by Nab Raj Subedi

The disaster-prone (flood, earthquake or landslide) parcel can be identified through the overlaying of cadastral information. The following figure shows parcels in Gauri Ghat, near Guheswori temple of Kathmandu, which is within the 50-year flood-prone zone (Subedi, 2009)



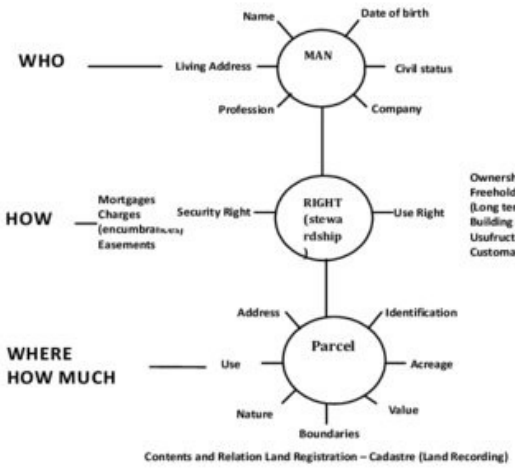
System will be multilayered, each layer comprising data which relates to a particular theme

Land Issues on Disaster

Pre-Disaster Condition	Pre-disaster attitudes to land
	The main features of the property rights and land tenure systems
	Existing land policies
	Key land laws and regulations
Post-Disaster Condition	The impact of the disaster on individual properties
	The impact of the disaster on communal and customary lands
	The impact of the disaster on land records
	The impact of the disaster on vulnerable groups
	The impact of the disaster on land agencies
	The demand for resettlement and related needs.

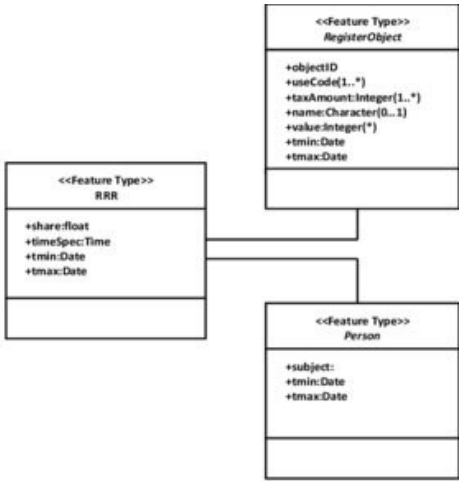
Source: Mitchell 2009: 128

Geospatial Land Data



Contents and Relation Land Registration – Cadastre (Land Recording)

Ownership
Freehold
(Long term) leasehold
Building Rights
Usufruct
Customary rights



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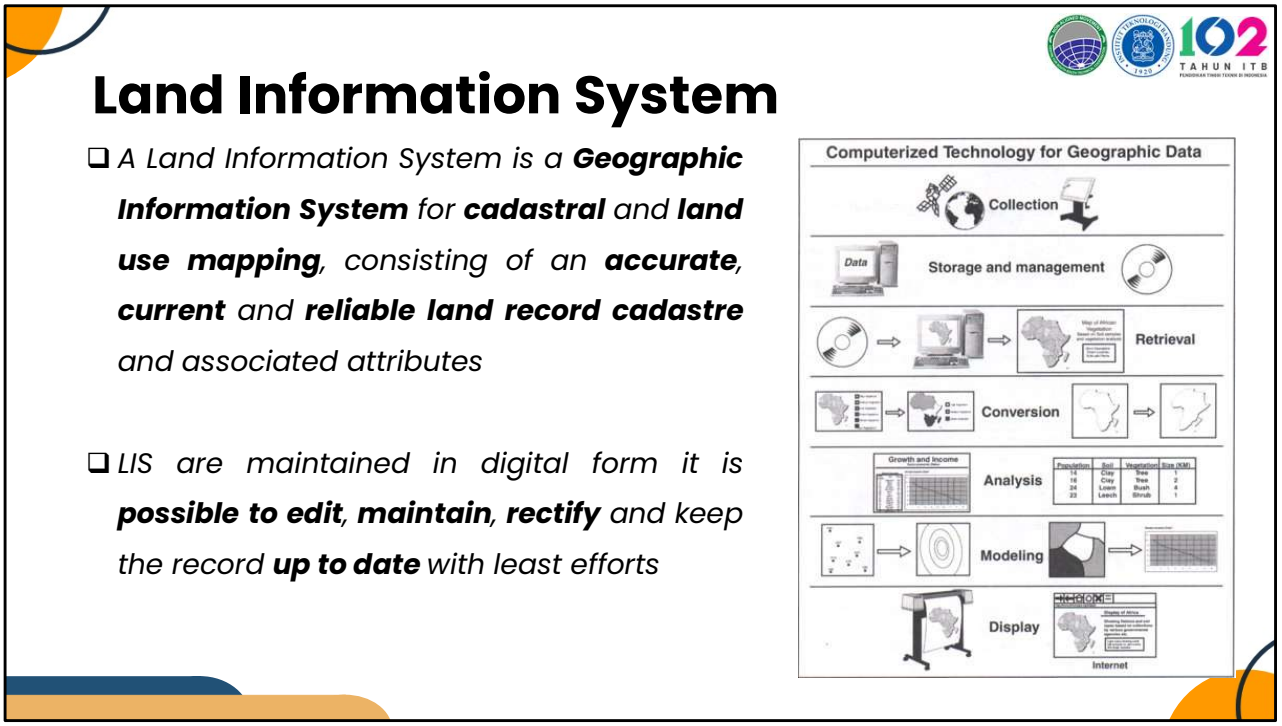
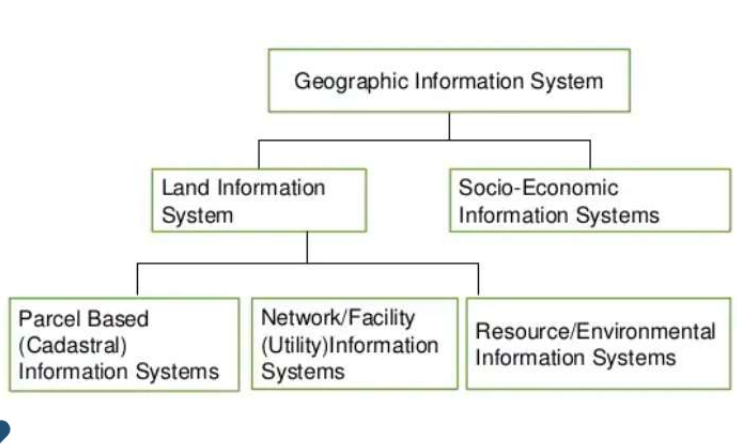


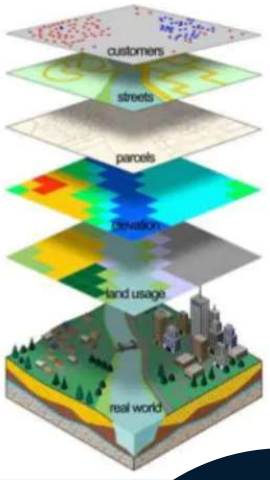
Land Information System

- *A Land Information System is a **Geographic Information System** for **cadastral** and **land use mapping**, consisting of an **accurate**, **current** and **reliable land record cadastre** and associated attributes*

- *LIS are maintained in digital form it is **possible to edit**, **maintain**, **rectify** and keep the record **up to date** with least efforts*

Land Information System Concept





System will be multilayered, each layer comprising data which relates to a particular theme

Land Information System Concept

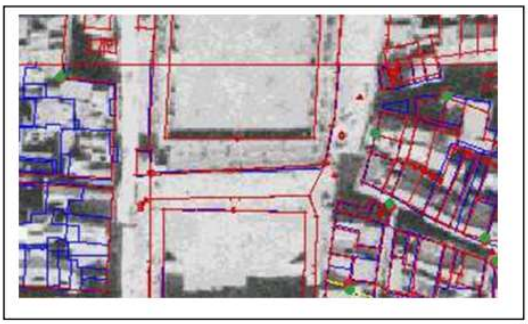


Figure 3a. Cadastral boundaries delineated on the ortho-image of Part of Thimi, Bhaktapur

Data source: Survey Department, Nepal

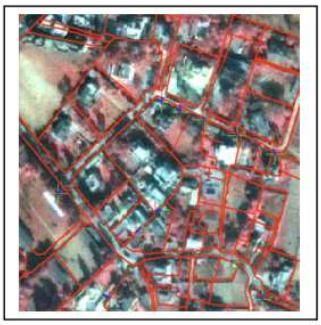


Figure 3b, Cadastral boundary on the overlaid on the IKONOS Image (False Color Composite), in Maharajganj, Kathamandu

A cadastral boundary can be directly delineated in the field over the ortho-rectified imageries which are more convincing and easy-working thus consuming less resource and indirectly gaining more public support during the data acquisition. Such boundaries can be acquired digitally using handheld data collectors in the field. These data can be easily overlaid with other spatial information of the same area. Similarly, GPS infrastructure can be used so that the land information can easily be updated at the real-time by sending the data away from the field at the offices through the communication network. The pre-determined corner coordinates can quickly identify boundary corners using Geo-ICT.

Key areas – **land administration, disaster risk management, and geospatial information production and sharing**

National Spatial Data Infrastructure (NSDI).

Haiti and New Zealand

On 12 January 2010, Haiti was struck by a force 7.0 Mw earthquake approximately 25 kilometers west of the capital of Port-au-Prince. It is estimated that over 225,000 people were killed by the earthquake, and over 1 million displaced. Ten months later, Christchurch, New Zealand, was also struck by a similar 7.1 Mw earthquake, but in this case, no fatalities were reported.

Countries struck by equally powerful disaster events are affected differently in terms of the devastation caused, the number of casualties, persons displaced, and impact on livelihoods. There are many underlying reasons, but one key factor that can certainly improve the country's odds to withstand a devastating earthquake is the quality of its land and geospatial systems which underpins strong preparedness, supports swift emergency responses and enhance the pace of reconstruction and recovery.

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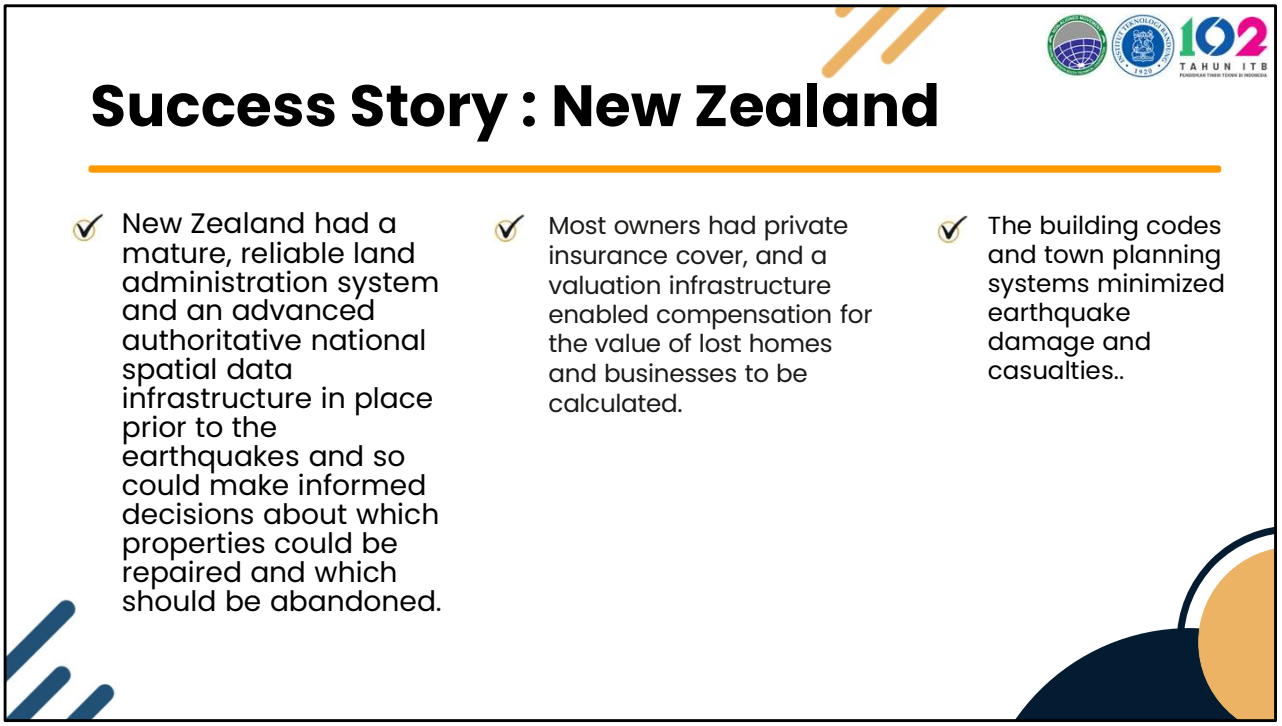


Success Story : New Zealand

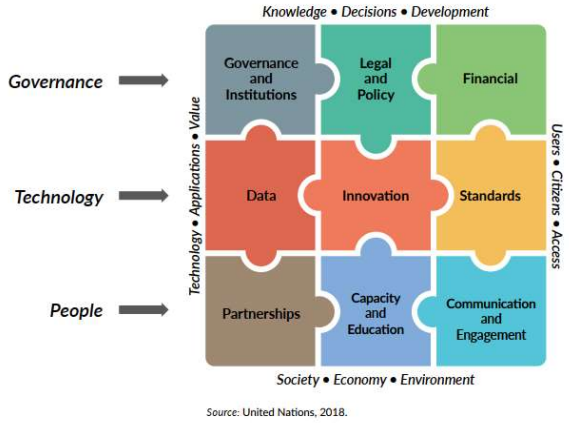
1. New Zealand had a mature, reliable land administration system and an advanced authoritative national spatial data infrastructure in place prior to the earthquakes and so could make informed decisions about which properties could be repaired and which should be abandoned.

2. Most owners had private insurance cover, and a valuation infrastructure enabled compensation for the value of lost homes and businesses to be calculated.

3. The building codes and town planning systems minimized earthquake damage and casualties..

- If the recording of property rights is weak, and there were problems with proof of titles, it will make a recovery process after disaster harder.
- Reference and record systems were often unclear, incomplete, or out of date.
- The land titling system was not computerized. Banks could not use contested properties as guarantees. Land administration, land use planning, zoning, building codes, and property valuation were all in need of strengthening before the earthquake.
- Possession was often the only tool available to defend property rights.
- Relief work was partly hampered by the poor state of geospatial data, and uncertainty over land rights prevented the reconstruction of some infrastructure, which has had long-lasting impacts. The many lessons from this disaster have informed efforts to improve land administration going forward

Land and geospatial information is extremely valuable for resilience but to produce it and effectively use it, right systems need to be in place: a Land Administration System that provides current, reliable, and complete land tenure, land valuation, land use, and land development information, and a sustainable National Spatial Data Infrastructure (NSDI).



Source: United Nations, 2018.

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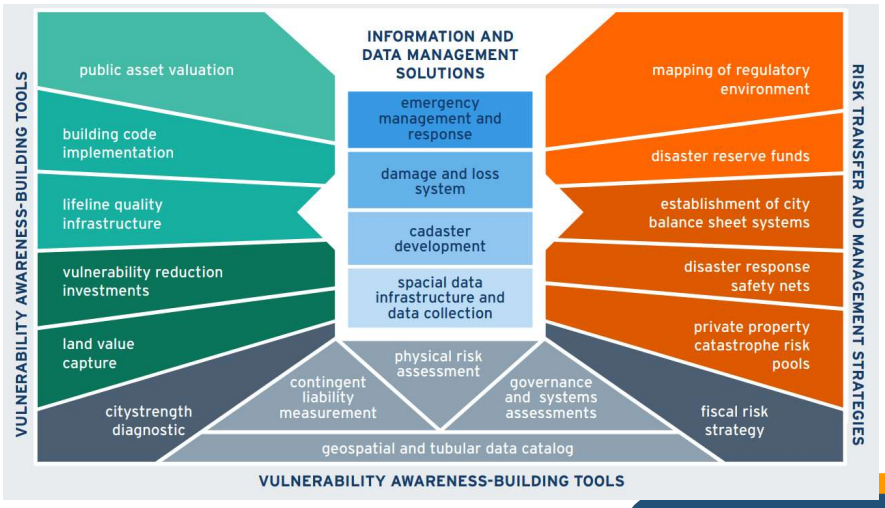
Menu of Options for Urban Resilience Investments from World Bank



Land Responses to Promote Disaster Resilience

Build on community-based initiatives.

Understanding and supporting community response strategies is critical to improving resilience in the long-term, particularly where they serve to strengthen land rights documentation and land use planning, and can be integrated into the broader land governance system.

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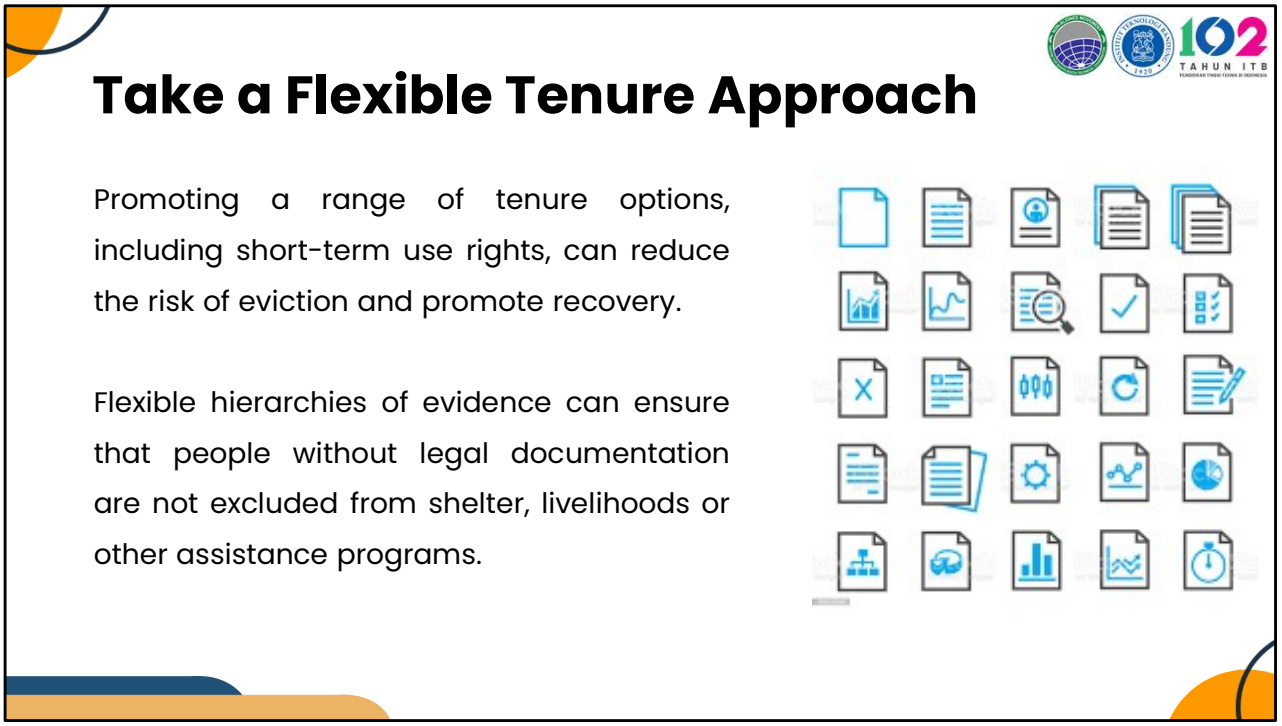

Promoting a range of tenure options, including short-term use rights, can reduce the risk of eviction and promote recovery.

Flexible hierarchies of evidence can ensure that people without legal documentation are not excluded from shelter, livelihoods or other assistance programs.

Adopt strategic and flexible planning, land-use and construction policies.

Flexible land use planning standards can facilitate reconstruction aimed at building back better and mitigating the risk of future disasters.

Housing standards should aim to reduce the risk of hazards by building on existing skills and practice, rather than promoting unaffordable or inappropriate techniques and materials.

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Take a pro-poor approach to land administration.

Land administration systems should be pro-poor; they should not require levels of education, wealth, influence and technical capacity beyond the reach of poor individuals or Government capacity.

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Secure rights and access to land are crucial for the vulnerable groups most affected by a disaster, including renters, informal landholders, widows and orphans.

Mutually beneficial arrangements that promote access to land without
arbitrarily destabilizing ownership relations should be promoted.

Key principles for land responses that promote disaster resilience

Principle underlying land response	Effects on disaster resilience
Build on community initiatives	Builds on local risk reduction strategies Leverages local knowledge Builds local capacity Encourages sustainable resource management
Take a flexible tenure approach	Strengthens security of land tenure Improves access to shelter and livelihoods
Adopt strategic and flexible planning, land use and construction policies	Improved access in informal settlements Hazard resistant and sustainable building reconstruction Improved disaster risk reduction
Take a pro-poor approach to land administration	Strengthens security of land tenure Strengthens local land institutions Allows inclusive land management and planning
Focus on vulnerable groups	Minimises landlessness Strengthens livelihoods


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