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Land administration and management

Ecosystems and security for future land administration arrangements

Note by the Bureau of the Working Party on Land Admiration

Summary

The present draft document has been prepared by the Bureau of the Working Party on Land Administration in response to a request made by the Committee on Urban Development, Housing and Land Management during its eighty-fourth session (Geneva, 4–6 October 2023). The Committee requested the Working Party to develop a thematic report on "Ecosystems and security for future land administration arrangements".

At its last session, the Committee considered an earlier draft of the present document and approved its subsequent publication, once completed. After the Committee session, the draft document will be finalized and may also be supplemented by further case studies prior to its publication.

This document further aligns with decisions of the Working Party, at its thirteenth session, calling for studies on land administration ecosystems and security, with a progress report expected by 2025. The Working Party highlighted ecosystems and security as crucial elements in shaping land administration, particularly amid global trends like urbanization, climate change, and digital transformation. This document therefore outlines key concepts connecting ecosystems and security within land administration systems, exploring how cadastral systems, technology, and geospatial data contribute to secure land management. It also addresses critical challenges, including tenure security, disasters, informal settlements, and data security, offering strategies for enhancing effective land management in the ECE region and beyond.

The Committee is invited to take note of the information provided.

Introduction

1.   Ecosystems and security in land administration are the key areas influencing the domain of land administration and management in the ECE region and beyond, particularly in view of the current global megatrends. "Ecosystems" are the organizational and institutional arrangements underpinning the interactions among the different actors involved as well as their functions.

2.   Global megatrends, including urbanization, climate change and the continuous advancements in information and communications technology (ICT) are creating new opportunities for land administration authorities in the ECE region and beyond. However, these megatrends have also resulted in significant challenges, particularly with regards to ensuring good land governance and optimal land use to maximize the social, economic and environmental benefits for all.

3.   Ecosystems and security are key pillars of land administration, becoming more complex due to global megatrends and sector-specific factors. Ecosystems have become more diverse with the emergence of expanded and new formations. Changes in ecosystems also have a direct bearing on the different security aspects in land administration.

4.   The current megatrends are amplified by, among other things, the emerging needs and expectations of citizens and societies; the increasingly multi-faceted interplay between land administration and other social, economic and environmental policies; and, the reduced government spending on public services. The complex interactions between the global megatrends and national factors have significant consequences for the achievement of the United Nations Sustainable Development Goals (SDGs).

I.   Literature review and measurement

5.   The growing and multifaceted interplay between land administration and the social, economic and environmental well-being of citizens and societies is driven by global megatrends, with urbanization, climate change, digital transformation, the data revolution, distributed networks and front-end technologies being some of the major catalysts. This interplay is amplified by national factors, including the emerging needs and expectations of citizens and societies and reduced government spending on public services.

6.   These dynamics, combined with the cross-sectoral nature of land administration, have given rise to new formations of ecosystems of collaborations and distributed land administration functions, which offer new opportunities for bolstering the contribution of land administration to the achievement of the SDGs. New public-private partnership arrangements, online public services (i.e., government-as-a-platform approaches) and interoperability solutions (technical, semantic, legal and organizational) are examples of initiatives paving the way for that to happen.

7.   Digital transformation, other megatrends and sector-specific drivers detailed in the Scenario study on future land administration in the ECE region, have a major impact on networking arrangements, collaboration settings and the range of actors involved. In particular, digital transformation enables the alignment of the different functions of land administration, such as cadastre and land registration, Spatial Data Infrastructure (SDI), land-use planning and urban development. The resulting the changes in the processes and practices are crucial for creating new synergies for strengthening the role and efficiency of land administration and, ultimately, its contribution to the achievement of the SDGs.

8.   The Scenario study on future land administration in the ECE region and Digital transformation and land administration – Sustainable practices from the ECE region and beyond can be used as a reference framework for ensuring a forward-looking, inclusive and holistic perspective of ecosystems in land administration. This perspective is especially important given the digital transformation, where land administrations have adopted digital-as-default principles. While these principles and the solutions they involve provide new opportunities and enable innovations, they require sound strategic decision-making; one that is based on evidence, accumulated knowledge and experience as well as best practices for fostering security in land administration and ensuring that nobody is left behind.

9.   There is a complex interplay between ecosystems and security in land administration. These dynamics have significant implications for land administration arrangements, necessitating discussion and identification of common aspects that can inform national policies and raise global awareness.

1.1.   National cadastral and land registration organizations

10.   National cadastral and land registration organizations are increasingly adapting to and contributing to the evolving ecosystems within land administration. This section provides practical examples of how these ecosystems function and evolve in different national contexts, complementing the earlier discussion on the interplay between land administration and societal well-being driven by global megatrends such as urbanization, climate change, and digital transformation.

11.   Land administration systems are inherently inter-organizational, involving multiple actors whose interactions are shaped by political, personal, and societal factors. Theoretical frameworks such as transaction cost theory, resource dependency theory, cultural value theory, and technology adoption theory can be used to analyze the impact of legislative and technological changes on these systems. This analysis is crucial, as it highlights the delicate balance required between reducing transaction costs and managing enforcement costs, all while considering the dependencies and cultural values embedded within land administration systems.

12.   A practical example from the Netherlands illustrates a significant organizational and digital transformation. The implementation of the new Environment and Planning Act, which merges 26 regulations into a single law, represents an integration of spatial planning, housing, and environmental management into a unified digital platform known as the "Omgevingsloket" (Environment and Planning Portal). The portal simplifies access to regulations and integrates multiple data sources, significantly reducing societal transaction costs while shifting enforcement responsibilities to local municipalities. This case study demonstrates the importance of strategic decision-making in land administration ecosystems.

Role of National Geoportals in Land Administration of Armenia

In the Republic of Armenia, the Cadastre Committee manages land registration and ensures the accuracy of land ownership information. The country has faced challenges such as discrepancies between cadastral maps and actual land conditions, leading to litigation and the need for more reliable land information. In response, the development of the National Geoportal has been a pivotal step in standardizing spatial data collection, facilitating access to both basic and thematic spatial data, and supporting land transactions. This initiative aligns with the report's emphasis on digital transformation, demonstrating how national frameworks can evolve to meet emerging needs while maintaining legal and cadastral security.

Armenia's experience also highlights the importance of updating legislative frameworks to support these digital transformations. By aligning with international standards like the Infrastructure for Spatial Information in Europe (INSPIRE) directive, Armenia has enhanced its legal framework to support integrated cadastral systems, ensuring the efficient management of spatial data.

Source: e-cadastre.am; maparmenia.am

1.2.   Linking ecosystem integration with legal security

13.   The complex interplay between ecosystems and security in land administration remains a key theme. For example, transitioning to digital property transactions without traditional notarial oversight has raised concerns about the provision of legal advice and security. The integration of environmental and spatial planning data into unified systems, as seen in the Netherlands, illustrates the need for balancing efficiency with legal security. Similarly, Armenia's ongoing development of its National Geoportal highlights the challenges and extended timelines involved in integrating diverse datasets into a cohesive, legally secure framework.

1.3. Digital transformation

14. Digital transformation is one of the key challenges that land administration has encountered in the past and continues to face today. Technological advances and some situations, such as the COVID-19 pandemic and the need for a more sustainable use of resources in the different administrative institutions have led to the rapid development of digital solutions. The digital transformation of Land Administration Systems (LAS) is about the responsible transition of the entire sector from a paper based, manual service, to a service that is fully delivered by digital technologies. This increases accountability, transparency, and equality for all land sector stakeholders.

15. The Food and Agriculture Organization (FAO), UNECE and International Federation of Surveyors' (FIG) publication "Digital transformation and land administration: sustainable practices from the ECE region and beyond", analyses this issue by examining the impact of the COVID-19 pandemic on digital transformation in land administration within the ECE region and beyond. It highlights how many land administration organizations quickly adapted, leveraging technology to handle increased service demands and provide novel data analytics services. However, the pandemic also exposed challenges such as digital exclusion, data quality issues, and the need for staff capacity building.

16. The report emphasizes the importance of aligning digital transformation agendas with broader governmental initiatives and investing in partnership building, capacity development, and communication to bridge the digital divide. It underscores the vital role of spatial and other information on tenure rights in supporting various government policy goals and outlines the need for future land administration systems to be agile, inclusive, and technologically advanced. Key recommendations include adopting an ecosystem mindset, embracing emerging technologies, and implementing holistic approaches to digital transformation.

17. It considers that lessons learned from the ECE region can be applied globally, but contextual factors must be carefully considered. The report concludes by urging land administration organizations to capitalize on the momentum gained during the pandemic and accelerate their digital transformation efforts.

18. Finally, based on this publication, the FAO and FIG developed an investment brief on "Funding digital transformation of land administration" which provides practical guidance and steps to develop action plans to support the digital transformation of LAS. The guide is intended for senior-level decision-makers, leaders, and practitioners.

II. Tenure security

19. Security in land administration should be approached from different levels. Each level involves a specific aspect, and combined, these aspects capture the different factors and issues that need to form the focus of land administration authorities and policy makers. This study considers land security in three levels: security regarding individual citizens, security regarding LAS, and security related to the society, region, or nation. The three levels involve different, albeit partly overlapping, aspects, including tenure security, system security and data security.

2.1. Concept and aspects of tenure security

2.1.1. Concept

20. Tenure security is commonly understood as protection of the right to ownership and other rights over land and housing property, and its role as part of economic and social development and reconstruction efforts is well recognised. Thus, it is important to learn about the various institutional arrangements and policies developed throughout the world to ensure tenure security in response to natural or man-made disasters.

21. The workshop celebrated in Madrid between the 1-3 November 2023, discussed the main aspects of this type of security and the main challenges that it is facing. This chapter reflects the conclusions and lessons learned from it.

22.   Some essential topics related to tenure security that need to be taken into account nowadays are how geospatial information can be linked more effectively to legal information associated with land and housing property and how the different countries promote the use of digital solutions to support sustainable and resilient urban development.

23.   Another challenge is losing property rights or information about the legitimate right holders for the property affected by the disasters and the establishment of informal settlements or slowdown of the reconstruction process.

2.1.2.   Legal aspects of tenure security: legal certainty

24.   Property right is considered to be a fundamental right. The Universal Declaration of Human Rights[1] (Article 17) states that "everyone has the right to own property alone as well as in association with others. Moreover, property rights and equal access to land is recognized by the United Nations, since they were also incorporated into the 2030 Agenda for SDGs, as targets.

25.   Countries must establish a property right framework and to protect it. Nations need to establish a system of rights that puts property at the reach of all the people. There is a responsibility to install efficient property rights systems to promote its fair access. These systems are fundamental for achieving individual well-being, peace, poverty reduction, economic development and political justice.[2]

26.   Moreover, the social function of property must be considered, emphasizing its rational use for the benefit of the community. For rural properties, this includes restrictions aimed at ensuring the sustainable use of agricultural or forest land, as well as environmental protection through relevant limitations, such as those related to soil sealing and contamination.

27.   The Prindex Study[3], which focuses on measuring global perceptions of tenure security for land and housing property identifies that about one billion people around the world worry about losing their homes, land or other property (Prindex, 2020. The reasons for this are often connected to issues of fragility, conflict, and violence: fear of expropriation or displacement, difficulty in planning for the future or making reliable investments, and the need to spend resources on protecting property or remaining in homes, even when it is unsafe.

28.   The main problems that generate tenure insecurity nowadays are war, climate disasters, gender inequalities, and informal/lack of documentation. War often means territorial invasion and destruction, and therefore the migration of entire communities which requires the legal reconstruction of the ownership structure. Climate disasters, like floods, volcanic eruptions, earthquakes, fires or others that vanish buildings or pieces of land are increasing in frequency and demand more information on land use restrictions and imply that proprietors need to demonstrate their rights, at least for compensation purposes. As for gender inequalities, certain populations, including women, are still restricted from owning immovable property in some regions, which implies instability in single families with no male presence, undermining the fundamental right to housing (Article 25, UN 1948)[4].

29.   In the case of refugees and internally displaced persons, property restitution is recognized as a fundamental human rights issue. Sustainable peace cannot be achieved without the protection of legitimate housing, land, and property rights, as well as the restitution of arbitrarily expropriated property or, at the very least, equivalent compensation. Societies must establish fair conditions and provide legal guarantees for property acquisition, along with effective mechanisms for compensation when these rights are violated or disregarded.

30.   The way to protect real property rights is through a sound registration system, capable of ensuring that no interference with real rights can take place without the intervention of the legitimate entitled person. The Registry is the State's institution in charge of protecting real rights, ensuring a safe, cost-

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[1] United Nations General Assembly, *Universal Declaration of Human Rights, 1948.*

[2] Louisa Clode, ELRA President

[3] Feyertag, J., Childress, M., Flynn, R., Langdown, I., Locke, A. & Nizalov, D. (2020). Prindex
 comparative report: A global assessment of perceived tenure security from 140 countries,
 https://www.prindex.net/reports/prindex-comparative-report-july-2020/

[4] (UN) United Nations General Assembly (1948). Universal declaration of human rights, Paris, 10
 December 1948 (General Assembly resolution 217 A), accessed online:
 https://www.un.org/en/universal-declaration-human-rights/

effective and efficient functioning of the real estate market. It is also critically important to make the Registry robust to physical and cyber threats.

31.   In the aftermath of war and climate disasters, it is the registered property rights that can be recognized and upheld, whether for restitution, repair, reconstruction, or compensation. Beyond registration, an independent judicial system and effective procedural mechanisms are essential to enforce and protect legitimate rights, particularly when they are disputed or unrecorded. These safeguards are critical for the proper defense of property rights in times of crisis.

32.   Moreover, as highlighted by the Prindex Study, it is important to recognize that the perception of tenure security is influenced not only by the possession of formal documents but also by the public's confidence in national and local government institutions responsible for protecting and administering property rights. Additionally, awareness of how to safeguard these rights plays a crucial role in shaping individuals' sense of security.

33.   Experience teaches us that adequate protection of property rights facilitates the individuals to take roots, personal and family development and entrepreneurship. In addition, greater economic and social progress is generated for the benefit of all including the re-development and re-vitalisation of disaster-affected territories.

2.1.3.   Geospatial information and tenure security

34.   Land administration is a key element to ensure the adequate development of countries and, within it, Geospatial Information (GI) is an essential tool that must be continuously improved through cooperation between actors and the exchange of good practices. Land and geospatial information provides essential details such as the what, who, where, and value of a property, playing a crucial role in ensuring that land records are both comprehensive and secure. Additionally, these systems enhance the protection of recorded rights by allowing backup copies of records to be stored in multiple secure locations.

35.   Geospatial information also plays an important role in all phases of natural disasters and property management, such as disaster prediction, prevention, preparedness, response and mitigation,[5] but it must follow a realistic approach, and it must take into account people's needs, concerns and capacity to access the system. The lack of open, harmonized and interoperable information models and datasets across land, built environment and natural environments, hampers realizing the full GI potential. UN GGIM's IGIF (Integrated Geospatial Information Framework) provides a methodology for developing and implementing country-level action plans, which has been specifically developed for land administration by the FELA (Framework on Effective Land Administration). The future geospatial information ecosystem is expected to take Geospatial Information Management to the next level.

36.   We have learned from the experiences of several countries regarding the coordination between legal and geographic information. This coordination strengthens preventive legal certainty, safeguards properties, reduces costs, and ensures that the description of registered properties aligns with the law. For property owners, it provides clarity on whether their property may be impacted by the rights of adjoining parties and helps them fully understand any limitations on their property rights.

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[5] Noted by Mr. Hartmut Müller, Professor of Geoinformation at the Mainz University of Applied Sciences
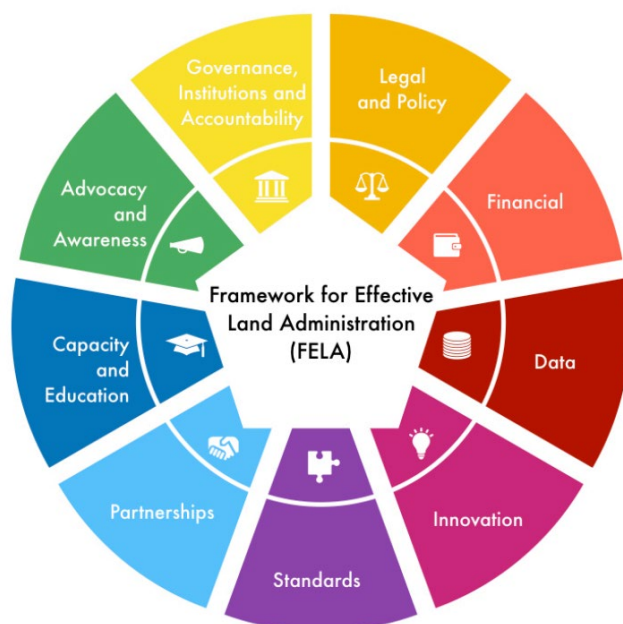
Source: FELA. E/C.20/2020/29/Add.2. Expert Group on Land Administration and Management, United Nations Committee of Experts on Global Geospatial Information Management Section, Statistics Division Department of Economic and Social Affairs United Nations.

Natural disasters and land registry: the geoportal and solutions in Spain

The role of a legal property register in the event of natural or human-caused disasters should focus on incorporating geographic and geolocation data for the properties on which registered rights are established and published. This integration allows legal information regarding ownership or tenure, along with any charges or rights affecting the property, to be combined with geographic data. This data enables the precise geolocation of the property, as well as the accurate definition of its description, surface area, and boundaries. As a result, both the property rights and the physical land on which they apply are legally protected, recognized as a unified entity within the legal system.

This comprehensive information positions the real estate registry as a cornerstone of legal certainty, benefiting both property transactions and the real estate market. In this context, the relevance and impact of a real estate legal register in the face of a disaster can be articulated in two phases: in the realm of prevention, prior to the disaster, and in reconstruction, following the event. Specifically, the registry plays a critical role in both these phases.

Prevention: A georeferenced registered property, precisely defined on the territory or at least geolocated, can be linked to geographic layers that indicate potential natural risks, such as forest fires, heavy snowfalls, floods, seismic activity, and more. While these layers may have a degree of uncertainty, as they are often based on historical models, they provide an assessment of the potential risks that a property (defined by its specific geometry or geolocation) may face in the future. This information offers an approximate understanding of possible future hazards.

For citizens and businesses, this data allows for informed decision-making by helping them evaluate potential risks and choose actions that align with their needs. It also provides valuable support to public administrations, enabling them to shape or adjust public policies based on the risk information associated with specific properties.

Reconstruction: After a catastrophe, whether caused by natural events or human actions that impact a significant portion of the territory, any reconstruction efforts, aid distribution, or property reorganization initiated by national or international authorities should incorporate the information from the real estate registry. Both the legal and geographic definitions of properties in the registry serve as essential foundations for these processes.

It is important to remember that while the physical terrain may be altered by events like fires, volcanoes, or other disasters, the geographic coordinates defining a registered property remain constant. This immutability allows properties to be accurately redrawn and re-established even after a catastrophe, providing a reliable basis for post-disaster recovery and reconstruction efforts.

The pre-existing information in legal registers serves as a vital foundation, ensuring that any public policy aimed at mitigating the effects of a disaster respects existing property rights and is directed toward those who are legitimately entitled to benefit from such policies. This information provides the assurance that recovery efforts are fair and legally sound.

The Emergency Registry Portal of Spain was developed in response to an extraordinary event, namely the eruption of the La Palma volcano, which will be detailed in the case study found in Section 2. Natural Disasters.

Source: College of Registrars (registradores.org) and Law 13/2015, of 24 June, on the Reform of the Mortgage Law

2.2. Challenges

2.2.1. Natural disasters

37. The impact of natural disasters on tenure security has provided valuable insights from countries that have faced such challenges, including the eruption of the volcano on La Palma, the earthquakes in Turkey and Armenia, and the fires in Portugal. These shared experiences demonstrate that the key points for effectively addressing these situations are:

(a) Coordination among the various authorities involved.

(b) The crucial role of human capital.

(c) The necessity of a suitable legal framework, including measures such as declaring a disaster area, implementing a state of alarm, or suspending procedural deadlines.

(d) The importance of secure proof of ownership for accessing public aid. An effective example from some countries is the use of Land Registry certificates, which provide a fast and secure method of proving ownership.

(e) The use of tools that enable the geolocation of affected properties, such as the emergency registry portal of the Public Law Corporation of Spanish Registrars. This tool allows the identification of registered properties through a geographic viewer, enabling citizens to locate their property, confirm ownership, and apply for corresponding subsidies and relief packages. Any property reorganization process must respect the registered ownership rights.

38. In summary, integrating geographical or geospatial information with legal data enhances sustainability and supports more informed decision-making, while strengthening citizens' property rights. With today's technological advancements, it is possible to incorporate more information. This data should be effectively shared with both authorities and property owners to ensure it is used efficiently for sound land administration.

Case study: Turkiye

Turkiye is a nation situated in a seismically active area. As a result, both large- and small-scale earthquakes frequently happen in Türkiye. On February 6, 2023, Turkiye was struck by two significant earthquakes with magnitudes of Mw7,7 and Mw7,6. Nearly a 100,000 square kilometers are impacted by the Kahramanmaraş Earthquake. The 11 provinces that were impacted by the earthquake have a combined population of 14,013,196. More than 50 thousand buildings and 883.000 individual units were severely damaged or demolished. Almost 5 million parcels are effected.

Apart from causing harm to communities and infrastructure, the earthquakes also had an adverse impact on cadastral boundaries, which require clarification and modeling in order to support efforts to mitigate disasters. Procedures for redetermining boundaries following earthquakes are becoming more complex due to surface deformation. It is challenging to identify borders and cadastral positions in different zones.

The priority purpose of Turkish cadastral system was defined as «ensuring tenure security» by keeping land registry under state guarentee. Fixed boundary concept under state guarantee is in force in juristic system of Türkiye. The boundary of a parcel is expected to be static by law and the documented, physical, and legal boundaries are expected to point out the same reality even without the consideration of spatial uncertainty caused by surface deforming geohazard.

The Turkish Civil Code was adopted from Switzerland in 1926. According to the Turkish Civil Code, the cadastral plans are regarded as legitimate even if there is a discrepancy with the ground. While the "permanent danger of ground displacement" situation is defined as an exemption in the Swiss Civil Code, only "landslides" is mentioned in the Turkish Civil Code. However, the Civil Code should also list other kinds of surface deforming as exceptions. Awareness on this issue should be increased and Turkish courts have to consider this situation until the Civil Code is revised. Support efforts to review and improve regulatory requirements, create distinct legal and technical regulations for each area (fault, landslide, ground displacement, etc.)[1].

Turkiye continues to maintain a dual registration system, where traditional land books are still in use alongside digital records, and not all cadastral documents have been fully digitized. The recent earthquake-related events have highlighted the critical need to protect title deed records and other important documents buried under debris, emphasizing the urgency to complete the digitization process. Maintaining land registry and cadastral information in digital format is crucial, as well as creating multiple backup files and secure storage for key records, such as maps, titles, and land use plans.

Turkiye has also implemented a mandatory earthquake insurance program for homes within municipal boundaries. However, in some cases, this insurance has proven insufficient to cover all damages. Therefore, it is essential to develop additional financial instruments and diversify portfolios to better address the full scope of earthquake-related losses.

Source: https://www.tkgm.gov.tr/

Case study: Spain

The Cumbre Vieja Volcano and the Land Registry

The eruption of the **Cumbre Vieja** volcano caused immense devastation, disrupting social, neighborhood, family, and professional relationships that were deeply tied to essential elements of life: homes and farms (both residential and business properties). In an instant, without warning, more than two thousand people were affected, including registered owners, co-owners, tenants, usufructuaries, partners, cadastral owners, mortgage creditors, tax authorities, social security beneficiaries, holders of insufficient titles, small business owners, merchants, and even mere occupants. This dramatic event could neither have been avoided nor foreseen.

The lava flow from the eruption covered an area of more than 10 square kilometers, a significant portion when considering that the island of La Palma measures approximately 723 square kilometers, with 250 square kilometers dedicated to parks and nature reserves. La Palma hosts a total of 20 environments within the Canary Islands network of protected natural areas. Despite the island's unique orography and geology, the residents of La Palma, with determination and ingenuity, chose to settle and cultivate the land many years ago, adapting to its challenging landscape.

Approximately 3,000 buildings met a "premature death" due to natural causes. Fortunately, the scientific and preventive work of geographers, seismologists, and volcanologists enabled the State security forces to evacuate residents with order and efficiency. In this context, the Land and Commercial Registry took on a role beyond its traditional function, becoming a crucial institution in helping to investigate and resolve the complex legal issues that emerged from the new situation.

Coordination between authorities

The Land Registry office sought legal precedents, doctrines, and registry backgrounds to provide guidance on this unprecedented situation. The registry records were thoroughly examined, including searches for any entries related to previous volcanic eruptions. Interesting findings were uncovered in the Spanish legislation concerning **Destroyed Registries**, which was initially designed for military or human conflicts, as well as in legal studies conducted by registrars. These sources provided valuable insights for addressing the challenges posed by the volcanic disaster.

National representatives reached out to the Land Registry to offer support and shared insights on how a Registrar from Lorca handled a similar situation during an earthquake disaster. It was deemed essential to convey the full support of the National College of Registrars and the Santa Cruz Registry Office, emphasizing their readiness to provide registry certifications and any necessary advice to those affected by the catastrophe.

The Land Registry extended its collaboration to various public officials, including the Minister of Justice, Government delegate, Island Director, president of Pevolca, and the president of the Cabildo, among others. In the following days, a dedicated Geo-Portal was launched on the official website of the National College of Registrars to provide updates on the situation in La Palma. This initiative was also publicized in the media to ensure it was accessible and visible to the public.

There are no words to fully convey the experience of those who have suddenly lost everything. Fortunately, the swift and organized evacuation carried out by the State Security Forces from the very beginning was both commendable and widely acknowledged.

One of the immediate needs of those affected was obtaining proof of their property ownership, leading many to request certifications from the La Palma Land Registry. These certifications confirmed various types of property rights, including full ownership, co-ownership, usufruct, bare ownership, and mortgage rights. Regarding the number of registration certificates issued, a distinction must be made between those provided in person or by email (200) and those requested by the Insurance Compensation Consortium after the properties were identified (320).

After receiving their registry certification, which provided full proof of ownership, and being informed about the Royal Decree-Law of October 5, 2021, regarding aid and moratorium requests, the affected citizens' primary concern was their ongoing uncertainty. Many were particularly worried about the validity of their property rights. They were advised to supplement this reliable document

with additional proof of their property's location and usage (whether for habitual residence, commercial, tourist, or other purposes) for submission to the Affected Office in Llanos de Aridane.

Representatives of affected platforms, landowners, and especially farmers, expressed interest in the future use of land covered by the lava flow, as well as the status of those whose property was not officially registered. Additionally, concerns were raised regarding the distribution of public aid, the availability of sufficient housing on the island for those needing to be rehoused, and the amount of compensation in the event of expropriation.

In any case, these issues demand multidisciplinary collaboration, involving representatives of those affected, engineers, geologists, architects, urban planners, as well as municipal, regional, and state authorities, along with legal experts. Within Urban Planning Law, there are procedures, systems, and regulations that are currently helping to establish the appropriate legal framework for the area devastated by the lava.

Conclusion

Even in the face of a disaster like the Cumbre Vieja volcano eruption, valuable lessons were learned, and new tools were developed. The measures imposed by Royal Decree Law 20/2021 of October 5, on urgent actions for the economic and social reconstruction of La Palma, were not just a legal obligation but also an opportunity to tackle the challenge of geolocating registered properties affected by the volcanic lava flows. This was made possible thanks to the efforts of the Graphic Databases Service of the College of Registrars.

In a country like Spain, where emergencies frequently impact significant portions of the territory—particularly forest fires—the conclusion was clear: the creation of a web portal for graphic information. This portal would enable the quick uploading of data related to such unfortunate events and allow the publication of geolocated registry properties within the affected area, known as the **Emergency Portal**. The Portal's primary goal is to assist affected citizens by providing easy access to legal information regarding their registered ownership and properties, helping to expedite the recovery process from the damage to their lives and, most importantly, their properties.

Source: Support for those affected by the eruption of the Cumbre Vieja volcano (registradores.org)

2.2.2. Man-made disasters

39.   From an architectural perspective, the reconstruction of cities should be driven by the aspirations of the citizens and a thoughtful consideration of the identity they envision for their communities. The design of new buildings requires local involvement from architects and planners to ensure it reflects the unique character and needs of the area. At the same time, it is crucial to define the cultural, social, and historical identity that the reconstructed cities will embody.

40.   Moreover, modern reconstruction efforts must prioritize the creation of greener, more technologically advanced, and resilient cities, aligning with the Sustainable Development Goals of the 2030 Agenda. For instance, the guiding principle for all reconstruction projects in Ukraine, provided by Buildings Performance Institute Europe (BPIE), is to "Build back better", emphasizing sustainability and resilience in the face of future challenges.

41.   Regarding land ownership in areas devastated or occupied during war, restitution is not always what citizens desire. Compensation, however, is often unavailable due to a lack of funding or a country's economic constraints.

42.   The World Bank's experience in countries like Bosnia and Herzegovina demonstrates that restitution is not a one-size-fits-all solution. Many people may not wish to return to their homes after a disaster or war, perhaps because their place of employment no longer exists, living conditions have drastically

changed, or they simply want to move on and forget the past. Compensation, as an alternative, presents its own challenges, as it requires significant financial commitment from government authorities. Experience has shown that large-scale compensation has rarely been successfully implemented in such situations. Furthermore, compensation programs can introduce the risk of corruption, as seen in countries like Colombia, adding another layer of complexity to the issue.

43.   The recent and distant experiences of other post-conflict countries offer valuable lessons in developing the appropriate legal framework for reconstruction. For example, Spain's history during the Civil War demonstrates that the land registry played a crucial role in protecting citizens' assets during the conflict. After the war, the registry became instrumental in supporting the development of the working class, particularly through the construction of housing, which contributed to the country's recovery and growth. This historical context provides important insights into how legal mechanisms can aid both asset protection and long-term reconstruction efforts in post-conflict settings.

44.   Any reconstruction process requires financing, which can come from public or private sources and may take various forms, such as donations or loans. In the case of loans, they are typically secured by mortgages on real estate. In such situations, a public, secure, and independent institution—like the land registry—is essential to establish the priority of loans. The legal certainty provided by registration is crucial for attracting investors, as it removes the uncertainty they would face in the absence of a reliable and transparent system for recording property rights and claims.

45.   The experiences of countries such as Honduras and Romania highlight that, while common insights can be drawn in the realm of reconstruction, there are significant differences that must be considered when comparing post-conflict reconstruction to reconstruction following a natural disaster. These distinctions involve not only the nature of the damage but also the social, political, and legal complexities that accompany each type of recovery process. Understanding these differences is essential for developing tailored approaches to each situation.

46.   To begin with, conflicts typically last much longer than natural disasters, resulting in people being displaced from their places of origin for extended periods. Additionally, conflicts are dynamic, with both people and territories experiencing significant changes over time. In some cases, population displacement may not only be a consequence of war but also a deliberate objective. Unlike natural disasters, issues of national security play a major role during conflicts.

47.   During periods of occupation, property ownership can change through both legitimate means (such as inheritance or genuine sales) and illegitimate ways (such as forced expropriation). These changes are often recorded according to the rules imposed by the occupying authorities, which may or may not be recognized by the national government. Furthermore, land speculation frequently arises in post-conflict situations, adding another layer of complexity to the process of reconstruction.

48.   What is beyond doubt, based on the experience of all these countries, is that the presence of a well-established Register of Rights and accurate geospatial identification of the territory are crucial elements. These components are essential for ensuring the success of any reconstruction efforts and play a key role in safeguarding both individual and national security.

2.2.3. Informal settlements

49.   The work of the United Nations on the formalization of informal settlements highlights several key causes of their development, including:

(a) Rapid urbanization and the influx of people into select urban areas;

(b) War and natural disasters, which result in mass movements of people seeking safety and opportunities;

(c) Poverty and the lack of affordable housing and serviced land; and

(d) Inefficient public administration, inappropriate urban planning, and inadequate land administration tools.[6]

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[6] Noted by Ms. Doris Andoni, Urban planning expert

50.   It also identifies the main forms or types of informal settlements, emphasizing the need to exclude certain areas, such as natural parks, from any formalization process. Additionally, it highlights the financial aspects of formalizing informal settlements, including the costs of upgrading infrastructure and providing essential services, as well as the need for sustainable funding mechanisms to support these efforts.

51.   It is important to take into account that the problem of informal housing is not typical only of poor and developing countries, but it affects many UNECE member States. As for solutions to informal development, they are a function of consistent land policies, good governance, and well-established institutions and systems. However, there is no simple solution that fits all the diversity of informal development as well as social and economic capital of each country. Therefore, it is essential to identify policy responses to address these challenges, which, in any case, must take property rights into consideration.

52.   Considering the different legislative policy options for dealing with this phenomenon, it can be done through a formal process of planning-urbanizing-acquiring land-getting permissions-building or through an informal process of occupying land-building-legalizing-urbanizing.

53.   Examples from different countries show that solutions to informal settlements are different from country to country. Moreover, in a country they can change over time and at the same time they can change due to the social, economic, environmental and risk level of the area.

54.   For instance, in Albania, in the early 1990s, there was an attempt to demolish informal housing that began to appear after the country's political and economic changes. Due to the recommendations of international organizations, the demolition attempt was stopped and a short phase of ignorance followed. Later, the government, supported by international organizations started a Land Development Project to build self-help houses and while the informal housing expanded faster than the planned developed land, the Project turned into upgrading the informal settlements. In 2004, the Parliament passed the first law on the legalization of informal settlements. However, the law did not stop the further expansion of informal settlements, on the contrary, the number of informal dwellings tripled since 2006 and legalization policy is highly politicized.

55.   In terms of conclusions related to these policies, it is important to emphasize that repressive measures are essential in addressing environmental infringement, invasion of the public domain, or violations concerning the protection of cultural heritage. Additionally, it is crucial to regulate these situations from a social perspective, employing procedures grounded in the registration and redistribution of property to promote fairness and effective land management.

56.   Furthermore, studies show that the process of formalization often encounters the issue of "weak private property rights," which can lead to delays. To prevent this, a strong Land Registry System is essential, as it provides tenure security and reduces land disputes. This is achieved by offering accurate data on property ownership, plot boundaries or construction details, as well as any encumbrances or priority claims.

57.   Additionally, a robust Land Registry allows public administrations to efficiently manage land administration and enforce relevant legislation. It also strengthens the real estate market by creating marketable assets, ensuring secure and swift transactions, and attracting financial institutions by facilitating access to credit. Ultimately, the benefits extend to citizens, as it safeguards their property and inheritance rights.

58.   One more lesson to be drawn from the above cases is that it may be easier to prevent the formation of informal settlements than to address their consequences. Governments should have contingency plans in place to manage the flow of displaced people, providing designated areas for temporary and longer-term settlements in the event of natural or man-made disasters. These plans should cover different regions within the country and potentially neighboring countries as well, ensuring a more organized response to displacement.

2.2.4. Building resilient cities

59.	When talking about building resilient cities, it is interesting to highlight the outcomes of the "Making Resilient Cities" Campaign. The MCR Campaign[7], launched by United Nations Office for Disaster Risk Reduction (UNDRR) in 2010, aims to raise awareness among local authorities and cities on disaster risk governance and resilience. It provides tools, technical assistance, and the support networks for local governments. A survey conducted in 2018 compared the progress of cities participating in the MCR Campaign with those that are not. Key findings include:

(a)	Most participating cities conduct disaster risk assessments, with MCR cities producing more risk assessment outputs.

(b)	MCR cities tend to communicate risk information more effectively, primarily through online social media.

(c)	A majority of MCR cities have developed local Disaster Risk Reduction (DRR) strategies aligned with the Sendai Framework, compared to non-MCR cities.

(d)	Implementation of DRR strategies is ongoing, with financial constraints cited as a significant barrier.

(e)	MCR cities show higher engagement with stakeholders and partnerships for local disaster resilience building.

60.	The conclusions drawn from the survey analysis indicate that MCR cities outperform non-MCR cities in various aspects of disaster risk reduction, from understanding risks to implementing DRR actions. It suggests policy implications such as prioritizing DRR, integrating risk assessments into city planning, and strengthening disaster preparedness. Overall, the MCR Campaign plays a crucial role in supporting local governments towards achieving greater resilience to disasters.

2.2.5. Restrictive measures regarding property to ensure tenure security

61.	It is crucial to address the fact that, in certain cases, access to property rights must be subordinated to considerations of public order, such as national security. National security may sometimes necessitate limiting or restricting access to property. In many countries, specific laws provide authorities with additional tools to monitor properties deemed critical to national security. These laws aim to prevent scenarios where the functioning of security authorities or national security operations could be compromised or influenced.

Case study: Finland

In 2020, Finland introduced new instruments related to restricting ownership and other land-related rights, on the basis of national security and ensuring security of supply. The instruments are written in the Act on the Right of Redemption of Immovable Property and Special Rights in order to protect national security (468/2019), Act on State's pre-emption right in certain areas (469/2019), and Act on Transfers of Real Estate Requiring Special Permission (470/2019).

Based on these Acts, a permission for acquiring real estate has to be applied from the Ministry of Defence, if the buyer is outside EU/EEA area. The requirement of applying a permit concern all the transactions where the buyer is coming outside from EU/EEA region, meaning both private persons and companies.

The pre-emption right can be used within 500-1000 meter buffer zone, depending on the object. If a land use plan allocates areas for Defence Forces or Border Security, the right can be used on a 500 m buffer zone, 1000 meters buffer zone from telecommunication building, radar station, aviation areas or harbors, or other objects that serve the marine or air traffic of the Defence Forces or Border Security in normal conditions, fault conditions, or state of emergency, and maximum 500 meters from other real estates that are used by Defence Forces or Border Security and securing their use requires a buffer

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[7] UNDRR 2019. Making Cities Resilient (MCR) Campaign: Comparing MCR and non-MCR cities. https://mcr2030.undrr.org/who-we-are/history

zone. Pre-emption right is practiced for all the transactions within the buffer zones if needed, despite the nationality of the buyer.

The law is applied to expropriation of real property and rights for securing the operations of national defence, territorial integrity, interior security, leading the State, border security and control, security of supply, critical infrastructure, or other such societal operation. The responsible ministry of the operations gives the permit for authority or entity for the expropriation if required by public need. The process of expropriation follows the legal procedure stipulated in general expropriation act (603/1977) unless otherwise stated. Like pre-emption right, expropriation tool is applied to all the real estates.

So far, the permission has been denied in few cases, pre-emption right has been used in few cases, and expropriation based on the act has not yet been used, being the ultimate interference on private property rights. The conclusion from the Finnish experiences in drafting and applying new laws can be drawn as follows. (1) To ensure the usability of the new Act, it should be based, if possible, on existing legal structures. (2) Instruments should be used in the order of their severity on the private property. (3) Instruments should not cause harm to existing property markets. (4) In order to build a system of public intervention to private rights, reliable cadastre and land registry are prerequisites.

Source: https://www.maanmittauslaitos.fi/

III.   System security

62.   In an increasingly interconnected world, where technology is an integral part of our daily lives, the importance of cybersecurity cannot be overstated. Technology and digitalization are shaping every aspect of today's world, serving as enablers of development and the modernization of the public sector, including land administration. While the conversion of analogue, paper-based land administration data into digital format has been completed in many countries, digital transformation of land administration in the ECE region is yet to be completed. This is because more needs to be done with regard to the modernization of land administration processes.

63.   As individual land administration authorities are in the process of modernizing their systems, or are considering doing so, digital transformation is raising numerous security concerns. In relation with this several questions are raised such as how can land administrations maintain trust and confidence in their security; what measures – technical and procedural – could land administrations implement to maintain the trust of their customers in the security of their personal data. And, on the other hand, how can land administrations meet evolving threats whilst still making the most of the technological advances available to the customers, or what security issues should land administrations consider when looking at new technological developments (such as Artificial Intelligence) to deliver better customer services?

64.   To address the questions raised, we have to begin by defining system or cybersecurity as it relates to land administration and by identifying the main issues that threaten this kind of security. System security refers to the overall vulnerabilities of the information systems of land administration authorities, both in terms of design and users. When talking about Cybersecurity, the word Cyber: "refers to both information and communications networks." And Security to: "The state in which the integrity, confidentiality, and accessibility of information, service or network entity is assured." Therefore, cybersecurity can be defined as: "the body of technology, process, and practice, designed to protect systems, networks, programs, and data from cyber risks like cyber-attacks, damage, or unauthorized access. It is also referred to as information technology security."[8]

65.   Threat must be understood as: "An event or condition that has the potential for causing asset loss and the undesirable consequences or impact from such loss" which is carried out by an adversary ('threat source') which is a: "Person, group, organization, or government that conducts or has the intent to conduct detrimental activities" after identifying a vulnerability: "a flaw or weakness that may allow harm to occur to an IT system or activity".

66.   These threats may derivate in just "events", which are any observable occurrence within a system. It can be a successful or unsuccessful attempt, intentional or accidental. It does not necessarily pose a

threat, but it warrants monitoring and investigation. However, they can also provoke an incident, which means a violation or imminent threat of violation of computer security policies, acceptable use policies, or standard security practices that can result in a breach, which is a specific type of incident where there is a confirmed disclosure of information to an unauthorized party. It is the culmination of an incident where attackers achieve their malicious intent. Breaches are significant security failures, as they involve the loss of control or unauthorized access to sensitive, protected, or confidential data, and they are the ones which need to be prevented.

67.   It is important to take into account some facts. More than 70% of security breaches occur within the organization. Over 99% of attacks are opportunistic and random, not targeted. Most cyber-attacks can take place because of operational lapses and deficiencies. Moreover, hackers know we have protection technologies today so they find weaknesses, errors and loopholes to try to come in by.

68.   Traditionally, LAS have had fragmented IT, old legacy core systems, procedures which are not integrated, fragmented infrastructure and policies and very difficult processes to upgrade. They have had a lack of infrastructures, people, skills and procedures to face cybersecurity issues. Moreover, cybersecurity has not been part of the culture everywhere and some land authorities have ended up responding to incidents more than proactively planning to prevent them.

69.   While governments, organisations, and cybersecurity professionals now work as thoroughly as possible to defend against cyber threats, another challenge is that individuals' actions in cyberspace can either bolster or weaken these efforts and these actions cannot always be controlled if digital services are to be provided. The general public do not have a high awareness of:

(a) Good cyber hygiene – Regularly updating software, using strong and unique passwords, and enabling multi-factor authentication to protect against cyber threats.

(b) Phishing awareness – Understanding how to recognize and avoid phishing scams, which involve misleading emails or messages from cybercriminals attempting to trick individuals into revealing sensitive information or clicking on malicious links.

(c) Internet of Things (IoT) security – As IoT devices become more prevalent, securing these gadgets is crucial. Poorly protected IoT devices can serve as vulnerable entry points for cybercriminals.

(d) Data privacy – Protecting personal data is essential. Many people do not fully understand its value, how to use encryption, or the importance of being cautious about oversharing information on social media.

70.   Workplace cybersecurity presents a significant challenge, as employees play a crucial role in protecting systems and data. It is essential for land authorities to educate staff on how to recognize threats and report suspicious activities. The rapid advancement of technology further complicates matters, with cyber threats evolving at an unprecedented rate, often outpacing the ability of land administrations to adapt. In many countries, Digital Security Authorities are relatively new, and there is sometimes a lack of horizontal continuity among governments. Additionally, the implementation of emerging cybersecurity laws can be both complex and costly. To illustrate the integration of technology and cybersecurity in land administration systems, the case of Spain will be examined.

71.   In Spain, in the context of the land registry sector, cyber resilience has a critical role in cybersecurity practices that are used when managing the vast amount of data involved in property transactions. Spain's adherence to EU directives on cybersecurity includes the development of national strategies and the establishment of incident response teams to address emerging threats effectively. Spain has implemented robust cybersecurity measures, such as secure network infrastructure and comprehensive staff awareness training programs. These measures are crucial for safeguarding sensitive data and ensuring the integrity of digital systems.[9]

72.   Within the regulatory framework applied in this country, there are reporting obligations and incident management procedures designed to foster consistency and harmonization of cybersecurity practices across EU member states. This regulatory approach aims to enhance cybersecurity preparedness and response capabilities at both national and supranational levels.

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[9] https://registradores.org/

73. Spain's experience highlights the critical need for ongoing updates and proactive strategies to counter evolving cyber threats. This involves consistent network maintenance, prompt application of security patches, and investment in advanced threat detection and prevention technologies. Additionally, collaboration among stakeholders and compliance with regulatory standards are vital for strong cybersecurity governance. Effective information sharing and cooperation are also key to addressing shared challenges and ensuring the resilience of digital infrastructure and information systems.

74. In conclusion, cybersecurity is as a dynamic and evolving field, which needs for constant vigilance and adaptation to emerging threats. And it is essential to bear in mind the role of regulatory frameworks and collaborative initiatives in promoting a proactive and holistic approach to cybersecurity across the European Union.

IV. Data Security

75. Data can be described as any information that is recorded in the land administration system. Such information is considered as sensitive, if it includes private personal information (e.g., bank account and credit card numbers) or information pertaining to national issues (e.g., location of critical infrastructures or military grounds). Sensitive data is treated as confidential information, in that it must be kept safe and out of reach of third parties unless they have permission to access it. Thus, data privacy and ownership are at the core of the concept of data security. Questions on who is allowed to access the data; how the data is collected, used and protected and transferred between authorities and private entities; and who is responsible for the ownership and maintenance of the data should be clearly addressed.

76. Land authorities have a duty to respect the confidentiality and integrity of information and data that they keep and which their staff have access to, and are accountable for safeguarding assets. System security events or incidents may result in the security of data being lost or compromised. However, we also need to consider the extent to which open data policies are a threat to the security of data. Where land registry information is made open, there is a need to balance complexity, data privacy, and fraud risk. Jurisdictions have differing perspectives on open data versus data privacy and take the following into account when making decisions about what data to make open:

  (a) Balancing Benefits and Risks: The potential benefits of open data in land administration must be balanced against privacy risks and the need for fraud prevention.

  (b) Transparency vs. Privacy: Effective measures are required to protect sensitive information while promoting transparency and public trust in land data systems.

  (c) Ensuring Data Integrity: Institutions must ensure that open data initiatives are supported by mechanisms to maintain data accuracy, prevent misuse, and provide secure access to information.

77. Open data policies can contribute to economic growth and ensure data transparency. There are several types of value which Land Administrations add to society, specifically by the use of data and building additional services on top of cadastral data. There are resources available which help land authorities to make decisions about what data to make open and how to manage the risks.

78. European Union approaches to land registry publicity involve diverse models for land registry access, including unconditioned access, access based on legitimate interest, and open access to basic information with restricted access to deeds, all influenced by social culture and judicial traditions. These models aim to balance transparency with the protection of sensitive information, often requiring legitimate interest for accessing detailed records. Additionally, the European Parliament's briefing emphasizes the importance of robust regulatory measures to prevent money laundering and fraud through real estate transactions, further shaping access policies. This case study highlights how EU states navigate the complexities of land registry publicity.[10]

79. Spain's land registry approach prioritizes legal certainty and public service in real estate, with the economic value of data being a secondary effect. This raises important questions about data ownership and control. Collaborative efforts among Spanish institutions, including the use of technology and property registries, are crucial in preventing fraud and money laundering. Additionally, Spanish institutions rely on centralized databases to manage information, prevent misuse, and ensure that property registries contribute

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[10] https://www.europarl.europa.eu/thinktank/en/home

to transparency and the legal security of real estate transactions. This case study illustrates how Spain navigates the complexities of its land registry system.[11]

V. Conclusion

80.   This document highlights the intricate relationship between ecosystems and security in land administration, particularly within the context of global trends like urbanization, climate change, and digital transformation. As these trends continue to reshape the way land administration systems operate, they introduce both challenges and opportunities for ensuring effective land governance. The report underscores the importance of adapting to these changes through strategic, evidence-based decision-making, robust legal frameworks, and the integration of digital technologies.

81.   Real-world examples from various countries illustrate how these principles can be applied to strengthen land administration systems, enhance tenure security, and support disaster recovery efforts. As land administration becomes increasingly digital, the need for secure, interoperable systems that protect property rights and ensure data privacy is paramount. By addressing these challenges, land administration systems can better contribute to the achievement of the United Nations Sustainable Development Goals (SDGs), ensuring that land resources are managed effectively and equitably for the benefit of all.

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[11] https://www.registradores.org/