National Spatial Data Infrastructure (NSDI) for Resilient Territorial Development: Building a National Disaster Risk Register (DRR) for Serbia

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Abstract. In recent decades the number and intensity of the natural and man-made hazards have been persistently increasing, continuing to undermine the efforts invested in achievement of the sustainable development. In order to prevent the new risk disasters, reduce the existing ones, and enhance territorial resilience by decreasing the exposure and vulnerability of the people, communities, economies and countries, UN has adopted in 2015 an action-oriented Sendai Framework for Disaster Risk Reduction for the effective disaster risk management, from global to local level. Due to then triggered needs for the various risk maps and, generally, for geospatial information for the Sendai Framework implementation, UN-GGIM has introduced in 2018 the Strategic Framework on Geospatial Information and Services for Disasters to lead the countries worldwide in production and distribution of the quality geospatial data and services, which are required for the timely decision-making and efficient coordination of operations in all phases of disaster risk management cycle. Among the other leads, one of the main guiding principles for implementing this strategic framework in any country directs to the National Spatial Data Infrastructure (NSDI), as a reliable platform for building a common database and infrastructure for quality and interoperable risk-related geospatial data and services. Since NSDI is usually administered by the national mapping agencies, the Republic Geodetic Authority has got a critical role in establishment of the national Disaster Risk Register and related infrastructure in Serbia for all national stakeholders' data gathering and analysis towards the common understanding of the disaster events. Despite there are more functionalities and elements yet to be developed in future, the current Disaster Risk Register and its infrastructure already confirm advantages of the multi-hazard and multisectoral approach to the disaster risk reduction and territorial resilience development.

Keywords: Disaster risk management (DRM) · national spatial data infrastructure (NSDI) · disaster risks register (DRR) · resilient territorial development · Serbia

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1 Introduction

After the extraordinary rains and caused severe flooding in May 2014 in Serbia, which affected over 20% of the population and produced significant economic hardship, particularly for the poor and vulnerable, the Government of Serbia adopted the National Disaster Risk Management Program, aimed at establishing the comprehensive framework for the efficient and effective disaster risk management process. One of the key result of this program, which consists of the six components and is fully align with the UN Sendai Framework for Disaster Risk Reduction and UN-GGIM Strategic Framework on Geospatial Information and Services for Disasters, is a national Disaster Risk Register. This register is established as a subsystem of the existing National Spatial Data Infrastructure, and it uses the technical infrastructure and socio-technical framework developed and maintained today by the Republic Geodetic Authority, as national mapping agency for Serbia. Gathering geospatial data and information from the other national disaster risk stakeholders through the various standardized geospatial services, the main objectives of this register are to provide platform for the common risk understanding, to support risk-informed decision-making across all phases of DRM, as well as to introduce a disaster risk reduction and risk resilient territorial development within the land management and urban planning and development in general in Serbia. The last objective is of particular importance in the situation when urbanization is intensifying and climate changes aggravate the living and working conditions in every country, causing the effects spreading beyond the national borders and away from the location of disaster risk source.

Therefore, the aim of this paper is to present a state-of-the-art in building the national Disaster Risk Register for Serbia. Towards that end, after the Introduction the paper continues with the chapter that describes the current strategic frameworks and approach to the disaster risk reduction and resilience development, particularly focusing on the importance and role of the geospatial data and services for disaster risk management in the urban areas. After that, chapter Background provides information about the current situation in Serbia related to the geospatial data and services, i.e. NSDI, and the chapter with detailed description of the national Disaster Risk Register (context, concept, data and services). Paper provides then short Discussion explaining the advantages and disadvantages of developed solution, proposing the possible next steps in development of this register, before paper ends with the Conclusion chapter.

2 Geospatial Information and Services for Disaster Risk Reduction and Resilient Territorial Development

In recent decades the number and intensity of the natural and man-made hazards as well as the disaster losses due to these hazards have been persistently increasing, continuing to undermine the efforts for achieving the sustainable development, from global to local level. As a result, the previous disaster-preparedness approach has been replaced by the enhancing disaster-resilient approach to the territorial development process. This new approach assumes for new or future disaster risks to be prevented and for existing

ones to be reduced by tackling the disaster risk drivers[1] directly, decreasing thus the exposure and vulnerability to disaster of people, communities, economies and countries (Fig. 1). Exactly this proactive approach to the hazards and disaster risks has been supported worldwide since 2015 by the action-oriented Sendai Framework for Disaster Risk Reduction (Sendai Framework), which replaced the previous prevailingly the advocacy-oriented Hyogo Framework for Action (Hyogo Framework) for the disaster risk management [15, 20].

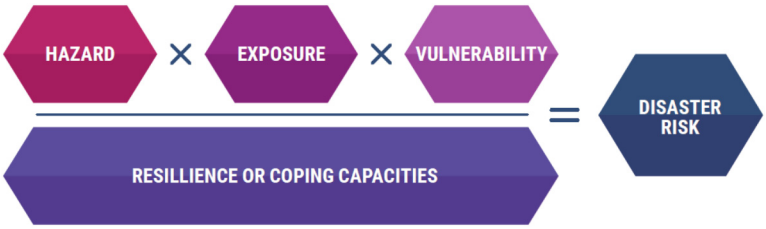


Fig. 1. Relationship between vulnerability, resilience and disaster risk, where higher is the exposure to hazard the higher is vulnerability and disaster risk, especially in absence or low resilience level: "…resilience can be seen as the opposite of vulnerability, as the ability of a system to withstand shocks and stresses, to bounce back better or recover from these…" [20]

In other words, comparing to the Hyogo Framework, Sendai Framework has identified for its four priorities areas the lists of concrete risk reduction actions on global, regional, national and local levels. Also, aimed at implementation of the integrated and inclusive measures[2] for establishing the multi-hazard and multisectoral disaster risk reduction practices in the countries, which would substantially reduce the disaster related losses while strengthening the overall territorial resilience, the Sendai Framework has identified the seven targets and thirteen guiding principles for this Framework appropriate implementation [14, 15].

Also, besides the fact that Sendai Framework covers more types of hazard comparing to the Hyogo Framework, including both those that are land-specific (like floods) and not spatially ubiquitous ones (like pandemics) [14, 18], the Sendai Framework' thirteen implementation guiding principles and listed four priorities' actions highlight –among the others- two factors or approaches significant for this framework successful implementation by each country. These approaches, which are in the focus of this paper, assume that [15]:

1. Effective disaster risk reduction process requires a multi-hazard and inclusive risk-informed decision-making approach based on the open exchange and dissemination of interoperable location-based or geospatial disaster risk information, like risk maps,

[1] Some of the key drivers of risk are: poverty and inequality, climate change, environmental degradation, climate change, unplanned urban expansion, poor land management/governance, weak institutional arrangements, limited implementation and enforcement capacity, lack of participation in decision-making [20].

[2] Including economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional ones [15].

to decision makers, the general public and communities exposed to disaster risk(s), in an appropriate format by using the geospatial information technologies (like GIS) and related services [5, 9, 13, 15, 17, 18, 22]; and

2. Disaster risk reduction and management depends on the coordinating mechanisms and shared responsibilities between the different sectors and institutions on the national level, where the central Governments have critical enabling, guiding and coordinating role, but it is necessary to empower the local authorities and communities to reduce disaster risk. This is because the disaster risks have local and specific characteristics that must be understood for the right measures determination for disaster risk reduction (through decreasing the exposure and vulnerability to each hazard) [15, 18–20].

2.1 Geospatial Information and Services for Disaster Risk Reduction

In relation to the two described approaches above for the effective Sendai Framework implementation into the national disaster risk management (DRM) practice, UN-GGIM has introduced in 2018 the Strategic Framework on Geospatial Information and Services for Disasters (SF-GISD). The main aim of this framework is to lead efforts in making available and accessible the quality geospatial information and services necessary for the timely decision-making and efficient coordination of operations through the national DRM cycle, from prevention and preparedness to response and recovery from the disasters (Fig. 2). However, besides supporting countries in the implementation of Sendai Framework priorities, this strategic framework also supports the achievement of 2030 Agenda for Sustainable Development, i.e. Sustainable Development Goals (SDGs), as well as the Paris Agreement on Climate Change, as shown on Fig. 3 [17, 20, 23].

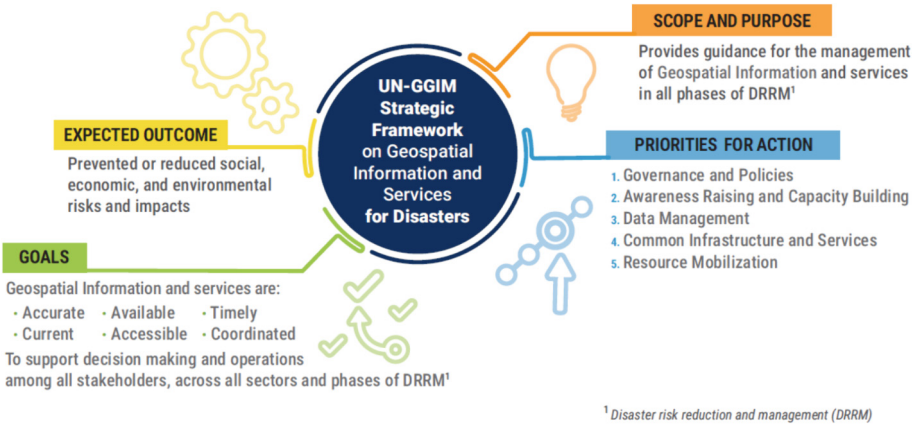


Fig. 2. Overview of the UN Strategic Framework on Geospatial Information and Services for Disasters [23]

In light of the Sendai Framework, the outcome of SF-GISD implementation assumes that "human, socioeconomic and environmental risks and impacts of disasters are prevented or reduced through the use of geospatial information and services". Similar to

the Sendai Framework, the SF-GISD outcome and goals implementation are supported by the concrete list of actions for global, regional, national and local levels for all five priorities, including the five major principles for guiding the SF-GISD implementation. Among those five, one guiding principle that is particularly important for the aim and topic of this article stresses that "implementation of the [SF-GISD] framework shall comply with the standards and requirements of the NSDI" [17].

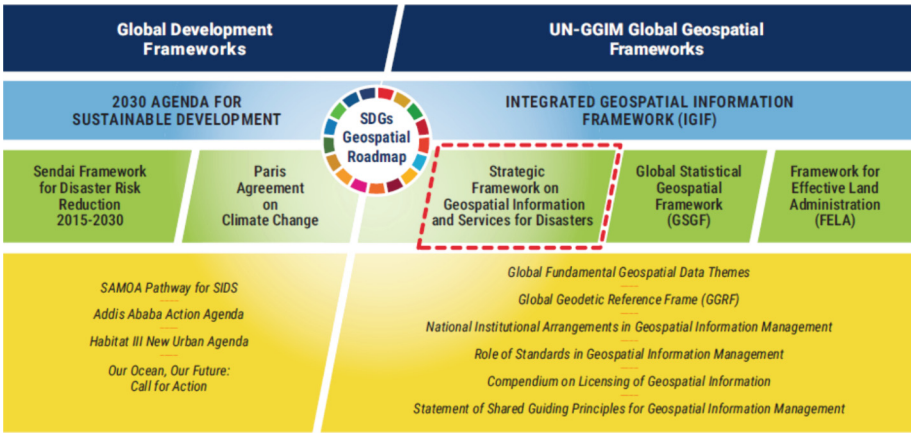


Fig. 3. UN-SFGISD within Global Development and UNGGIM Frameworks [23]

Since NSDI is confirmed as a one of the pillars for production and distribution of the quality and interoperable geospatial information and services provision for the national DRM framework, the national mapping agencies that are usually responsible for the NSDI initiatives have been recognised as one of the leading stakeholders for SF-GISD implementation, along the national statistical institutions, national disaster management agencies, etc. [17]. This is due to the fact that national mapping agencies by applying the relevant international and/or national standards for the geospatial data and services, like INSPIRE Directive in Europe, have already developed or are developing infrastructure and capacities needed for the DRM process, and could thus support efficiently "a common and accessible database system of minimum/baseline geospatial information and services requirements, including an initial list of essential elements of information addressing all phases of DRM" [17]. Besides the other elements, this database system includes both common and fundamental operational datasets, like administrative boundaries, critical infrastructures and earth observation data. These data are already administrated by the national mapping agencies and posses required accuracy, resolution, authoritativeness, integrity, openness and interoperability imposed by the relevant national regulation [6, 12, 17].

Finally, the implementation of shared, quality and interoperable geospatial data and information using the geospatial technologies for the disaster risk management is not a new idea or endeavour [13], but the systematised approach proposed by the Sendai Framework and SF-GISD for the natural and man-made disasters prevention, preparedness, response and recovery make it possible to compare the national DRM frameworks

(Fig. 4) and create best practices in usage of the geospatial information and technologies for enhancing the territorial disaster risk resilience. [5, 9, 12].

S. No.	Translated Products and Services	Activity	Criteria
1	• Base maps (topographic maps, geological data, land-use map, Elevation data) satellite images, LIDAR or Photogrammetric • Disaster risk maps (simulation, prediction) and assessment templates (regulation, procedure for reaction), (maps, documents)	Collection and processing, quality and accuracy ▪ Geospatial Data ▪ Statistical Data	1. Existing data
2	• Situational awareness (maps, systems) • Real-time services (alert messages, prediction maps) • Post-Disaster Need Assessment- procedural regulations; (documents) • Disaster assessment regulations. Data (documents) Application software; Assessment (software) • Disaster losses-Disaster loss registers; (map, documents)	Collection of real-time data, forecasting, early warning, disaster assessment	2. Real-time data
3	• Database management systems (software) SDI and Platforms (software/services) • Standards (documents)	Data management, sharing and dissemination	3. Data management
4	Traditional, local or scientific knowledge (document) • Public Education, Awareness and Knowledge Strategies (document)	Capacity building and public participation	4. Capacity building
5	• Policy to maintain data, services and systems (documents)	Resource mobilisation	5. Resources mobilisation

Fig. 4. Criteria for comparing the national DRM systems implementation in line with Sendai Framework and SF-GISD [12]

2.2 Towards Resilient Territorial Development

In order to build awareness, promote a culture of disaster prevention and resilience, support mutual learning and sharing experiences, etc., the Sendai Framework implementation at the local level is relying –among the other actions- on the "Making Cities Resilient: My City is Getting Ready" (MCR2030) campaign, launched first back in 2010 [15, 20, 21].

This focus on the disaster risk reduction in the cities is result of the significance of urbanisation process today globally, including the need for climate change adaptation, which calls for the Sendai Framework's actions to particularly target the disaster risk drivers in the urban areas through strengthening existing land use and urban planning practices, especially in developing countries [19, 20].

Urban land use planning is seen both as a key actor for preventive measures, but also an important instrument for the disaster recovery phase, as proposed by the Sendai Framework's Priority 4 [15, 18, 19, 24]. In other words, urban planning has an important role in the reducing current and preventing future disaster risks since 60 per cent of all areas that will be urban in 2030 are yet to be built [20]. There is hence an enormous opportunity or challenge for the planning to both support future urban growth and retrofit the existing urban areas to be more resilient to shocks and stresses in future.

However, current integration of DRM process in the urban planning practices is often limited [19, 20]. According to the results of MCR2030 report for 2019 about the

progress of local governments in reducing disaster risk, significant efforts still need to be made for reducing disaster risks in the cities and achieve urban resilience and SDGs, in all categories including the Technology one[3] [21] that is important for the SF-GISD actions implementation for the right land use and investment decision-making, which is also in the focus of this paper.

3 Background

After the extraordinary rains and following severe flooding in May 2014, which affected more than 22% of the Serbian population and caused significant economic hardship, particularly for the poor and vulnerable, Serbia adopted the National Disaster Risk Management Program (National Program) [7]. The objective of the National Program is to support the Government of Serbia in establishing a comprehensive framework for the DRM process, able to support it (Government of Serbia) in coordination, distribution and implementation of the funds and activities relevant for reducing the existing disaster risks and preventing future ones, as well as enhancing overall territorial resilience to disaster risks in Serbia [7]. In order to stimulate the effective risk reduction and efficient response to the natural and man-made disaster risks, the National Program guiding framework is divided into the six components[4] with a list of eligible activities for investment for each of them (components) in the coming years.

Relying on the non-structural risk measures of the National Program's Component 3, as well as on established legal framework for the DRM on national level [1–3], which are fully aligned with the Sendai Framework, Serbia has began establishment of the national Disaster Risk Register (DRR) [4] and related information infrastructure, aimed to implement actions proposed under the SF-GISD's Priority 3: Data management and Priority 4: Common Infrastructure and Services.

This register development is the legal responsibility of the Ministry of Interior Affairs' Sector for Emergency Management, while all the other relevant institutions and authorities are obliged to provide updated authoritative data from their responsibilities relevant for the DRM process. Due to the developed technical capacities, the Republic Geodetic Authority (RGA) that is responsible for the INSPIRE Directive implementation in Serbia and NSDI management, is responsible also for provision and maintenance of the technical infrastructure for the DRR in according with the exiting geospatial regulations [2, 3].

This means that national DRR in Serbia is established and maintained as a subsystem of the Serbian NSDI, as prescribed by the RGA Strategic Action Plan for the NSDI, relied on the UN-IGIF guidelines [8]. In the same strategic document, the establishment of DRR is also linked with the other NSDI improvements that would in future secure

[3] Like Develop and update hazard maps (category: Policy and Plans), Establish information system on hazards and set up a mechanism to update; Enhance intuitional capacity, training program for concerned personnel, technology and equipment support (Spatial mapping and GIS); etc. (category: Technology).

[4] Component 1–6: Institutional building; Disaster risk identification and monitoring; Structural and nonstructural risk reduction; Early warning systems and preparedness; Risk financing strategies; Resilient recovery.

the quality geospatial data and services needed for the DRM process in Serbia in line with the SF-GISD, including the collection and recording of the disaster loss data for the Sendai Framework's DesInventar database.

Finally, as a result of performed activities on the Sendai Framework implementation on the local level, nine Serbian local self-governments participated in the MCR2030 campaign and analysis of the disaster resilience scorecards [11]. Measurements of the "Ten Essential for Making City Resilient" showed relatively good and similar results or lacks in all nine local self-governments, with conclusion that disaster risks information –namely, the risk maps- available on the NSDI platform GeoSerbia via DRR are not yet incorporated in the urban planning documents preparation, like the obligatory General Urban Plan, in order for a sustainable urban and territorial development to be accomplished.

4 Disaster Risk Register

According to the guiding principles and priorities for the SF-GISD implementation, geospatial information and services for the DRM should comply with the standards and requirements of the existing NSDIs, while national mapping agencies that play a key role in their implementation and development should be fully supported (financially and in other ways) towards the better availability and accessibility of quality geospatial information and services for all phases of DRM [17].

Towards this end, establishment of a modern central register for the disaster reduction in Serbia is supported at the moment by the two EU-funded projects, namely "EU for Civil Protection and Disaster Risk Resilience Strengthening in the Republic of Serbia" [10] and "EU for enabling a more responsive healthcare system" [25], where the RGA has an important role to build a national DRR and provide the modern common infrastructure and services necessary for the DRM process flow [17].

Establishment of the DRR within the Serbian NSDI, aligned with the EU INSPIRE Directive and the EU Initiative to Enhance Data Interoperability [10, 22], has begun in 2020. Once established, DRR has been connected also with the existing national Disaster Risk Information System, where this system uses the data from DRR for its own purposes and vice versa.

After the public launching of DRR in 2022, this interactive, electronic, geographic information database for the territory of Serbia, which contains geospatial data and services important for the risk management domain [4], is now under further development and upgrading with the public health related risks data that would with the other risks information (floods, landslides, earthquakes, etc.) lead to better risk-informed decision-making and overall risk reduction and emergency preparedness in Serbia in future [25].

4.1 DRR Concept

In sense of its context, DRR is planned and implemented as the subsystem of Serbian NSDI and its digital platform GeoSerbia, meaning that it is loosely integrated with its other subsystems from which it gathers thematically relevant data, provides analytical capacities for generations of risk-relevant data products, and distributes them to the

identified data users systematically. This means that DRR is intended primarily to tackle the identified challenges related to the data sharing among the various stakeholders on national and local level in Serbia. In relation to this, it is planned for the DRR to eventually include several functionalities, which are in line with the Sendai Framework and SF-GISD, as presented below on the Fig. 5.

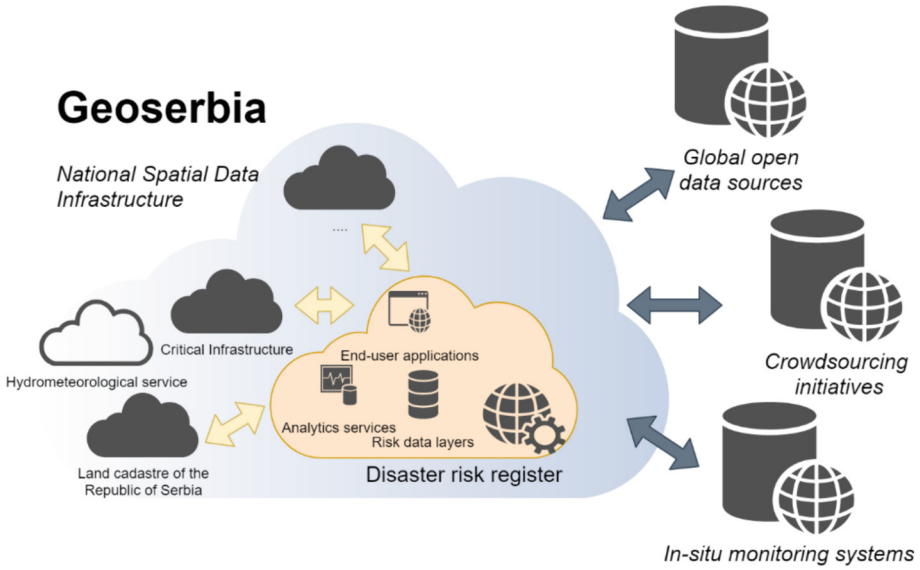


Fig. 5. The context of DRR requires support for different functionalities, like data harvesting from third party data sources, integration of sensory platforms in support of disaster risk management, support to crowdsourcing platforms for rapid data collections, support to development of dedicated applications for DRM, etc. [16]

In accordance with its purpose, DRR is defined as one-stop-shop for all risk-relevant data and services that includes four conceptual layers, as outlined on the Fig. 6.

4.2 DRR Data

Serbian NSDI and its digital platform GeoSerbia [26, 27] contains today more than 280 various datasets from the different national stakeholders, including both main (infrastructure, cadastre, topography, statistics) and specific data categories (natural resources, seismology, condominium register, agriculture, forestry, land cover, government and public institutions, geology, economy, real-estate market price register, etc.). This broad basis of available geospatial datasets and registers (Fig. 7) has provided the necessary information for performing the territorial vulnerability analysis and assessment and establishment of the DRR content, making it now one of the strategic subsystems within the Serbian NSDI.

Besides the existing NSDI geospatial datasets and registers, DRR includes relevant risk-related data and information. Some of these have been already created with the

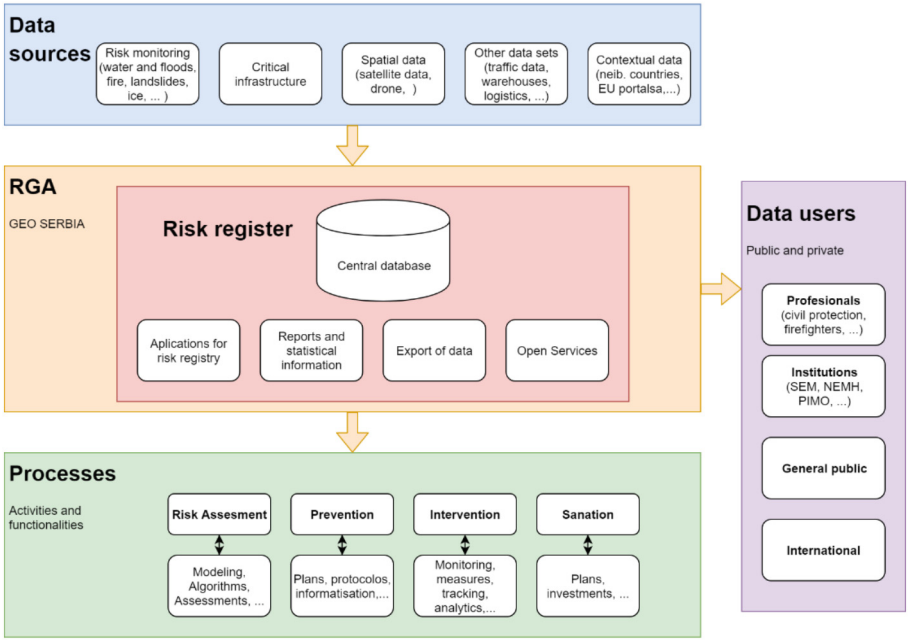


Fig. 6. The DRR concept includes four conceptual layers: 1) NSDI digital platform GeoSerbia with DRR and other subsystems; 2) data sources layer; 3) processes layer; and 4) risk data users layer [16]

location information by the relevant national stakeholders and, then, integrated in DRR and its Web GIS platform via appropriate Web services; on the other hand, some of the risk-related data and information were created for the first time during the establishment of DRR, by linking the non-geospatial datasets with the existing geospatial datasets (consisting of appropriate entities with a location information), or produced as results of the risk analysis or assessment before their integration with the other DRR geospatial datasets (Fig. 8).

4.3 DRR Services

In Serbia, established DRR is the primary source of all relevant information at national level related to the disaster risk assessment, prevention or reduction, intervention, and recovery and reconstruction. This means that implemented DRR solution provides the crucial geospatial services required by the decision-makers, which could be used to support various aspects and all phases of DRM cycle in any part of Serbia, including decisions on actions before disasters, during disasters and after disasters.

Therefore, in line with the SF-GISD recommendations for geospatial services for disaster, DRR system in Serbia encompasses the widely recognized standard geospatial services for managing data and information needed to all key stakeholders, to have a common picture of the disaster events and make decisions in all phases of the DRM. However, due to the sensitivity of DRM geospatial data and information as well as

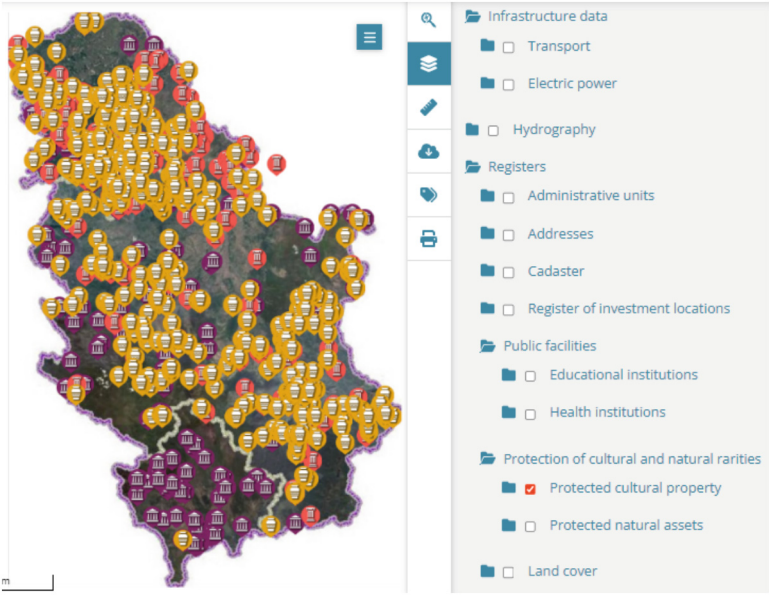


Fig. 7. NSDI datasets and registers integrated and provided through the DRR Web GIS: Administrative unit register, Address register, Cadastral parcels, Digital ortophoto and satellite images, Land cover, Geographical names, Protected cultural assets (presented here), etc.

prescribed data management policies related to the security and control for accessing and using the same, provided OGC Web services for DRR geospatial data and information are accessible at the moment only to registered users, i.e. the key DRM stakeholders. For these users, DRR platform functionalities are offered via the standard geospatial data exchange services (WFS, WMS, WPS) and REST APIs built in a service layer of the DRR system (Fig. 9), through a single access point on the DRR portal, including web applications offered therein.

Besides these geospatial services, through the DRR platform users could access the Web services available at the NSDI digital platform GeoSerbia, as well as those available through the RGA Metadata catalogue. In both cases, it's about the geospatial services that are developed in accordance with the OGC standards (WFS, WMS, etc.) for the available INSPIRE-compliant RGA's geospatial datasets and registers. Finally, all DRR Web GIS users could add the WMS service from the cloud in order to integrate in the common environment geospatial data or information needed for the risk-related decision-making.

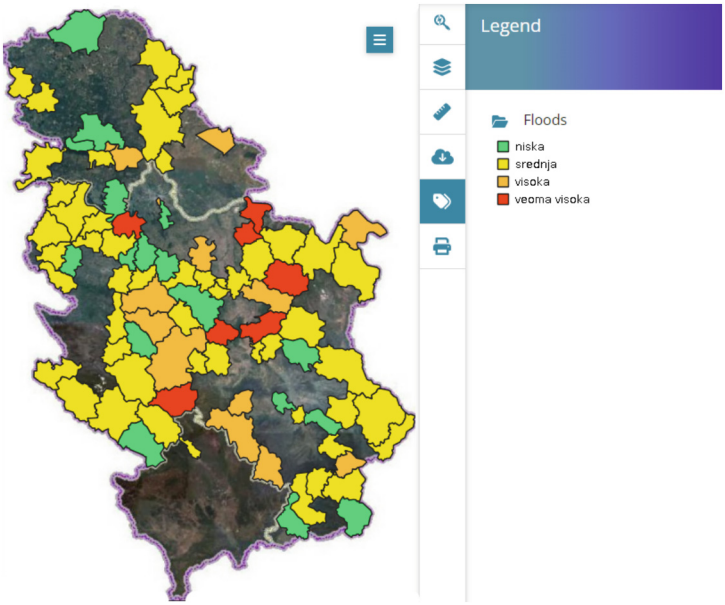


Fig. 8. Risk-related datasets in the DRR Web GIS environment include data and information on the main risk hazards identified as relevant for the territory of Serbia, like flood risks (presented here on the municipality level), forest fire risks, extreme weather phenomena, seismic risks, landslide risks, technological risks and risks of different epidemic diseases

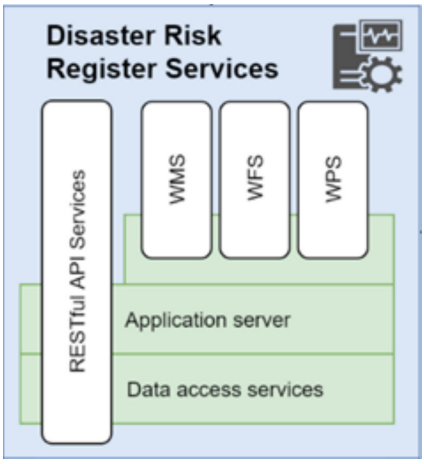


Fig. 9. Service-layer of DRR [16]

5 Discussion: DRR and Its Application for Territorial Resilience

As described in the previous chapter, DRR solution implemented in Serbia for the DRM process steering on national level is relying and uses advantages of the already developed NSDI infrastructure and its socio-technical framework developed by the RGA and other stakeholders. Thus, DRR establishment is a result of the close collaboration between the RGA and other relevant national key stakeholders, exclusively from the public sector for time being, who succeeded to set up this common and accessible database system for the DRM on national level in a relatively short time. Taking into account the identified main hazards relevant to the territory of Serbia, here presented DRR system has today only the baseline geospatial information and services needed for the DRM process flow. Also, the geospatial data and information integrated within existing DRR possess needed accuracy, resolution, authoritativeness, integrity and interoperability for national level risk-informed decision-making and risk management, but still more efforts have to be invested by the key stakeholders to improve these risk-relevant data and information quality as well as openness required for building the similar systems for the risk reduction and resilient territorial development on regional and, particularly, local or urban area level, following the MCR2030 initiative (Fig. 10). In other words, besides continual development and maintenance and technological improvement of the established DRR for national level, a more should be done on the promotion and education about benefits of this system for a sustainable regional development and urban land use planning and implementation monitoring, which needs better risk understanding and various risk maps with the higher precision producing for the right decision-making.

Overall, the established DRR provides the basic risk assessment maps and other reference information that are crucial inputs for both national and local DRM plans preparation, but also important inputs for the formulation and elaboration of different projects, programs and activities, including spatial and urban plans for resilient territorial development. Also, it's important that developed DRR system has put forward and prescribed the necessary common standards, protocols and processes for the DRM domain in Serbia, which makes it a model for building the similar systems/SDIs for the other domains in Serbia, from national to local level. These common geospatial standards are particularly important for creating the common picture of disaster events by all key stakeholders, national and international, since current intensive urbanization and rapid climate changes' negative impacts have no boundaries and make sustainable development goals even more challenging for achievement.

On the disadvantage side, established DRR still lacks population data, including the other statistics needed for the optimal DRM planning and plans implementation, monitoring and evaluation, which are of the key importance for the risk reduction and territorial resilience enhancement, particularly in urban areas. Also, connections to the risk-relevant regional and international databases are still to be established, while the integration of sensory networks for real-time data is left to be implemented in the coming years as well.

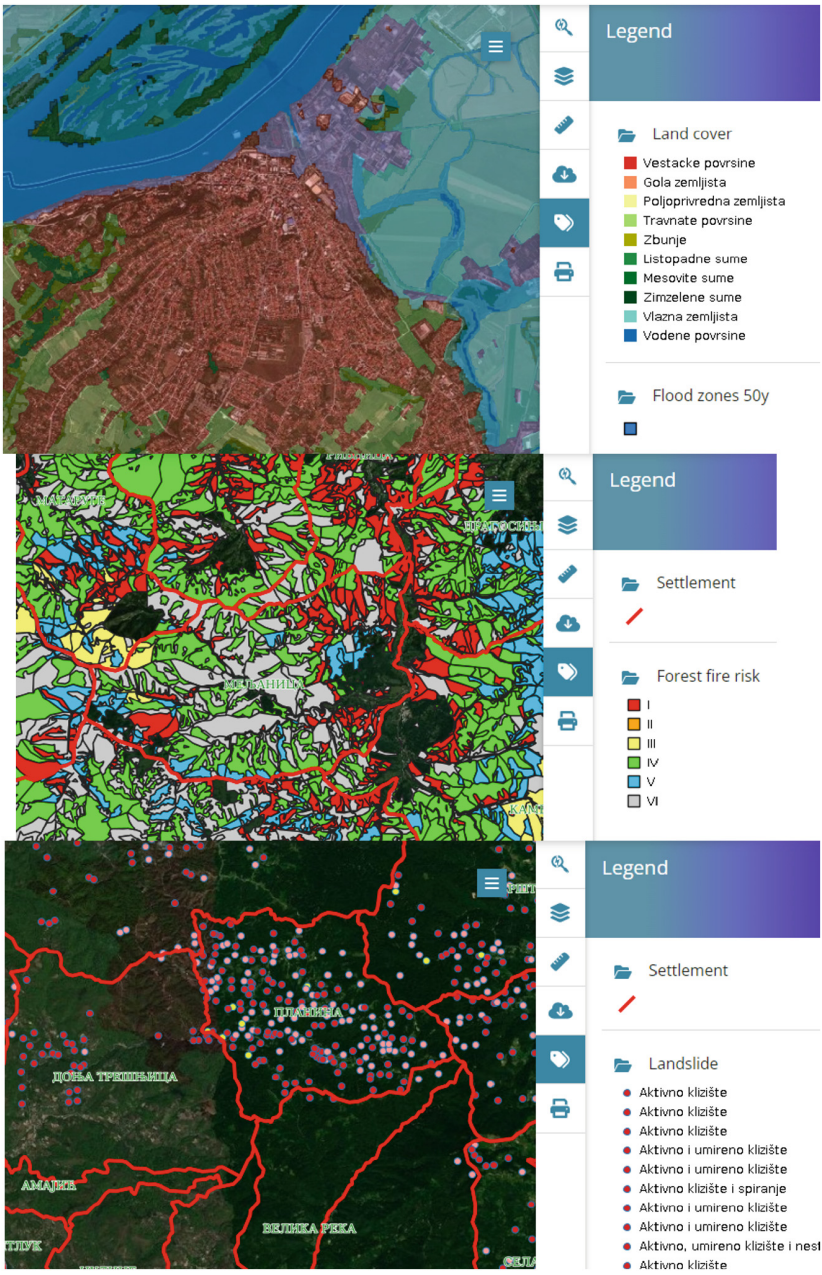


Fig. 10. Rapid urbanization and dynamic climate changes in Serbia need risk data and information with the higher precision on local and regional level for preventing the new risks, reducing existing ones and making the cities and regions resilient in future. National DRR data examples: land cover data combined with flood risk data for 50-year return with different resolution (up); forest fires risk map created on regional level (middle); landslides location on settlement level (down)

6 Conclusions

In order to foster the consistent response and effective solutions for reduction and management of the negative effects caused by the natural and man-made hazards worldwide, which persistently undermine the efforts invested in achievement of the sustainable development, UN has adopted in 2015 the Sendai Framework for the effective DRM process establishment on all levels. Aiming to support implementation of this strategic framework with recognized advantages of the location information, UN-GGIM has adopted 3 years later the SF-GISD that –among the other guidelines- directed to the NSDI as the proper national geospatial framework for producing and distributing the quality geospatial data and information for all phases of DRM process.

On one side, developed as the subsystem of the NSDI in Serbia, the national DRR is today the main source of quality and interoperable geospatial information for building the common understanding and decision-making about the disaster events among the multisectoral stakeholders community. On the other side, this national geospatial framework combined with the different risk information presents the reliable DRM platform for implementing the right measures for preventing the new/future risk disasters, reducing the existing ones, and enhancing territorial resilience both for urban and regional areas.

Thus, based on the INSPIRE-compliant NSDI datasets and Web services, DRR provides through the established Web GIS platform the basic risk assessment maps and other reference information that are crucial inputs for the DRM plans preparation, but also important inputs for the preparation of other strategic documents in Serbia, like spatial and urban plans.

However, besides the already developed advantages and functionalities that make DRR the one-stop-shop for all risk-relevant data and services in Serbia today on national level, there are needs and plans for future development that will enhance this national register applicability for the effective DRM process especially on the local level.

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