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DISASTER RISK REDUCTION - MODELS AND PRACTICES AT INTERNATIONAL AND NATIONAL LEVEL



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DISASTER RISK REDUCTION - MODELS AND PRACTICES AT INTERNATIONAL AND NATIONAL LEVEL

Thematic Collection of Articles

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CHANGE IN APPROACH TOWARDS FLOODS AND LEGAL CHALLENGES IN THE IMPLEMENTATION OF NATURE- BASED SOLUTIONS FOR FLOOD RISK MANAGEMENT IN SERBIA

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CHANGE IN APPROACH TOWARDS FLOODS AND LEGAL CHALLENGES OF THE IMPLEMENTATION OF NATURE-BASED SOLUTIONS FOR FLOOD RISK MANAGEMENT IN SERBIA^{2*}

Summary: Predictions about the effects of climate change in Serbia in the coming period indicate an increase in the number of days with extreme amounts of precipitation that can cause flooding. The increased risk of flooding, as well as the extreme flood events that occurred in Serbia, indicate the need for change in this field. The research is dedicated to the change from the concept of flood protection to flood risk management, with a special focus on nature-based solutions. The results of the research have showed that nature-based solutions as one of the approaches to flood risk management in Serbia are neither recognised as a concept nor as a term in strategies, policies and legislation. Therefore, there may be problems with the implementation of measures in practise, especially on privately owned land. The research has identified the gaps in the system and in legislation, and provided indications of possible solutions.

Keywords: *floods, flood risk management, nature-based solutions, climate change, property rights*

CLIMATE CHANGE AND FLOODS

Climate change is one of the biggest global challenges of the 21st century. The world is already facing its consequences, and it is predicted that significant challenges are yet to come in the following decades. The impacts and effects of climate change can be very different, from pronounced periods of drought to very large amounts of precipitation that influence the occurrence of floods. Over a period of more than fifty years, the number of extreme precipitation events (exceeding the maximum daily precipitation amounts) has increased globally (Westra et al., 2013: 3904, 3910, 3914). Lehmann et al. found that the “number of record-breaking rainfall events” increased by 12% on a global scale between 1981 and 2010 (Lehmann et al., 2015: 501, 509, 512; Jia et al., 2019: 147). Intense precipitation events are also becoming more frequent in the Republic of Serbia. According to the research from 2018, there were “changes in the precipitation pattern, annual distribution and their intensity distribution, as well as an increased frequency of extreme weather events and periods with extreme climatic conditions” (Đurđević et al., 2018: 6). Compared to the climatological reference period (1961-1990), annual and seasonal precipitation has increased, especially in the southern part of Serbia, where the increase was over 10% (Đurđević et al., 2018: 10). The redistribution of precipitation was particularly noticeable in the summer

2 * This paper was written as part of the 2023 Research Programme of the Institute of Social Sciences with the support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

months, when significant less precipitation fell than on average.³ In the last decade, the intensity of heavy precipitation has increased compared to the reference period (Đurđević et al, 2018: 12). The number of days with very heavy precipitation⁴ has increased by 1-2-fold, and the number of days with extremely heavy precipitation⁵ has “increased by more than 5-fold” (Đurđević et al., 2018: 12, 13). On the one hand, it is estimated that by the end of the 21st century, if the increase in greenhouse gas emissions continues, precipitation on the territory of Serbia will decrease by 20.5%, while in the southern regions the decrease will be up to 40% (Đurđević et al., 2018: 15, 17). On the other hand, predictions are that by the end of this century, around 60% of annual precipitation will fall during days with extremely high precipitation, if greenhouse gas emissions continue (Đurđević et al., 2018: 20). Periods of very heavy and extremely heavy precipitation pose a high risk that can lead to flooding. One example is the major flood event that hit Serbia in 2014 (see: Nikolić Popadić, 2021: 213-214). The long rainy period with considerable amounts of precipitation, began in the mid-April 2014 and lasted for twenty days. The extreme rainfall then fell between 12 and 19 May and caused major flooding (Prohaska et al., 2014: 15). Over 200 mm of rain fell in just one week, which is equivalent to the rainfall of three normal months (UN, EU, World Bank, 2014: 9). This excessive rainfall caused the increase in water levels in river basins with return periods of the flood wave from 100 years on the Zapadna Morava, the Sava, the Jadar and up to 1000 years in some parts of the Kolubara River (Babić Mladenović i Kolarov, 2015: 235-236; Nikolić Popadić, 2021: 214). The enormous rainfall also caused flash floods, followed by landslides, that caused severe damage behind (UN, EU, World Bank, 2014). This serious situation required the introduction of a state of emergency, which was declared by the Government on 15 May 2014, for the entire territory of Serbia (see: Gačić et al., 2015: 280). The floods led to evacuation of more than 30,000 people and 51 persons lost their lives. The floods affected different sectors. The total value of the damage and negative effects of the floods was estimated at EUR 1.7 billion (UN, EU, World Bank, 2014: 4, 11, 51).

In view of the climate change predictions outlined above and the increasing number of extreme weather events and days with very heavy and extremely heavy rainfall in the future, situations similar to 2014 are to be expected. Therefore, some changes need to be made with regard to flood protection and prevention, as the current approach has proven to be inadequate.

³ Deficit of precipitation in the central and southern parts of the country was up to -20%, -30% negative change (Đurđević et al., 2018: 10).

⁴ Days during which accumulation is higher than 20 mm (Đurđević et al., 2018: 12, 13).

⁵ Days during which accumulation is higher than 40 mm (Đurđević et al., 2018: 13).

FROM FLOOD PROTECTION TO FLOOD RISK MANAGEMENT

The change in flood management in the European Union was influenced by Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (Floods Directive). With this Directive, the European Union made a step “towards institutionalising an ongoing paradigm shift in dealing with floods, away from flood protection and towards flood risk management” (Hartmann and Spit, 2016: 361). The Floods Directive prescribes three stages for Member States, each of which forms the basis for the next: preliminary flood risk assessment⁶, flood hazard maps and flood risk maps,⁷ and flood risk management plans⁸ as the final stage of the process. It is prescribed that flood risk management plans should cover different aspects of flood risk management such as prevention, protection and preparedness (Floods Directive, Art. 7(3)). The plans must be coordinated “at the level of the river basin district or management units” and be based on their characteristics (Floods Directive, Art. 7 (1) (3)). The objectives of the flood risk management plans should focus on reduction the likelihood of floods occurring and reduction the harmful effects of floods in different sectors (Floods Directive, Art. 7 (2)). They should include environmental objectives “soil and water management, spatial planning, land use, nature conservation” (Floods Directive, Art. 7 (3)). The change brought about by the Floods Directive also meant a change in approach to the role of nature-based solutions for flood risk management. According to Article 7, flood risk management plans should include potential water retention areas, and promote “sustainable land use practises, the improvement of water retention and the controlled flooding of certain areas in the case of a flood event” (Floods Directive, Art. 7 (3)). It is interesting that the view of “giving rivers more space” was incorporated in the Directive (Floods Directive, (14)), reflecting the change in approach to flood problem that began in the Netherlands when the government introduced “the concept of giving rivers space” - the new approach that emerged in response to the floods of the late 20th century (Hartmann, Slavíková, McCarthy, 2019: 4; van Ruiten and Hartmann, 2016: 698). This was the beginning of the shift from flood defence and “keeping the water out” to a different water management that would absorb water and “give water space” (Hartmann, Slavíková, McCarthy, 2019: 4; Hartmann and Spit, 2016: 361; Johnson & Priest, 2008: 513). The EU Member States transposed the Floods Directive into their legislation and complied with the three stages of implementation. However, there have been some

6 Preliminary flood risk assessment had to be finished by 22 December 2011. It should have been “reviewed, and if necessary updated, by 22 December 2018 and every six years thereafter.” (Floods Directive, Art. 4, 14).

7 Flood hazard maps and flood risk maps had to be finished by 22 December 2013, and reviewed/updated by 22 December 2019, and then every six years (Floods Directive, Art. 6, 14).

8 Flood risk management plans had to be finished by 22 December 2015, reviewed/updated by 22 December 2021, and after that every six years (Floods Directive, Art. 7, 14).

difficulties along the way as outlined in the Special report of the European Court of Auditors from 2018,⁹ and 5th (2019) and 6th (2021) Water Framework Directive and Floods Directive Implementation Report.¹⁰

The Law on Waters of the Republic of Serbia is largely harmonised with the Floods Directive (Nikolić Popadić, 2021: 215; Nikolić Popadić, 2020: 210-212). As in the Floods Directive, it is also necessary to carry out a preliminary flood risk assessment, prepare flood hazard maps and flood risk maps, and prepare and implement flood risk management plans (Law on Waters, Art. 47-51). The process of preparing and implementing these three phases was not easy and there were some delays. Namely, it was prescribed that the flood risk management plans had to be prepared by 2017 (Law on Waters, Art. 222), which means that all three phases should have been completed by this year, as the preliminary flood risk assessment, flood hazard maps and flood risk maps, form the basis for the preparation of the flood risk management plans. In practise, however, the situation was different. The preliminary flood risk assessment was completed in 2012. According to the Law on Waters, it should be reviewed/amended every six years, which was done in 2019. The preparation of flood hazard maps and flood risk maps was much slower. According to the data of the Public Water Management Company “Srbijavode”, which is responsible for preparing the maps, the majority of flood hazard maps and flood risk maps were finalised for 101 areas with potentially significant flood risk identified in the Preliminary Flood Risk Assessment for the Territory of the Republic of Serbia (2019).¹⁰ The Water Directorate of the Republic of Serbia, together with the Public Water Management Companies “Srbijavode” and “Vode Vojvodina“, prepared a Proposal for a Flood Risk Management Plan for the Territory of the Republic of Serbia for the period from 2021 to 2027, in September 2022,¹¹ which represents a significant delay compared to the deadline initially prescribed by the Law on Waters. The implementation of the flood risk management plan is a process that will take place in Serbia in the coming years.

The harmonisation of Serbian legislation with the Floods Directive also represented a turning point in the approach to floods, but primarily in a formal term, while more significant changes in practise are yet to come in the following years. Traditional flood defence measures are primarily way of dealing with the flood problem issues in Serbia. Although there are over 3.550 kilometres of embankments and other types of traditional “line” protection, they have proved to be insufficient for flood protection in various places, especially in 2014 (Water Management Strategy of the Republic of Serbia, 2017; Babić Mladenović i Kolarov, 2015; Nikolić Popadić, 2021:

9 See: European Court of Auditors, Special Report no. 25/2018, Floods Directive: progress in assessing risks, while planning and implementation need to improve. <https://op.europa.eu/webpub/eca/special-reports/floods-directive-25-2018/en/>

10 As indicated on the website of the Srbijavode, preparation of maps for the six remaining areas with potentially significant flood risk is in progress. See: <https://www.srbijavode.rs/karte-ugroznosti-i-karte-rizika-od-poplava.html> (11.01.2023)

11 The draft is available at: <https://rdvode.gov.rs/lat/arhiva-2022-istorija-aktivnosti-u-2022.php>

214). The Water Management Strategy of the Territory of the Republic of Serbia until 2034, which is supported by water management experts (Nikolić Popadić, 2021: 214), concludes that the current state of flood protection is unsatisfactory (Water Management Strategy of the Republic of Serbia, 2017). In view of the possible aggravation of the problem of the high-water regime due to climate change, it is necessary to promote and implement active flood protection measures (Water Management Strategy of the Republic of Serbia, 2017; Babić Mladenović i Kolarov, 2015; Stefanović et al., 2014; Babić Mladenović, 2018). In this regard, nature-based solutions can be one of the ways to help alleviate this problem.

NATURE-BASED SOLUTIONS

The analysis in the previous sections has shown that there are various ways of tackling the problem of flooding. In recent decades, the focus has been on flood risk management, which can be based on different aspects. One of them is nature-based solutions (European Commission, 2021: 4). In general, the concept of nature-based solutions was first mentioned in a 2008 World Bank publication (Sowińska-Świerkosz and García, 2022: 1; World Bank, 2008). Since then, there have been different definitions of nature-based solutions, all of which attempt to clarify this very broad concept (Sowińska-Świerkosz and García, 2022: 1). The official definition comes from the European Commission, and states that nature-based solutions are “actions inspired by, supported by or copied from nature. Nature-based solutions use the features and complex system processes of nature, such as its ability to store carbon and regulate water flows, in order to achieve desired outcomes, such as reduced disaster risk and an environment that improves human well-being and socially inclusive green growth” (European Commission, 2015: 24). The broad definitions of nature-based solutions have led to different interpretations of what can fall within their scope. It was therefore necessary to provide an additional specification. In 2020, the International Union for Conservation of Nature and Natural Resources (IUCN) published the Global Standard for Nature-based Solutions which consist of 8 criteria and 28 indicators (IUCN, 2020: 3). The criteria are that nature-based solutions: 1) effectively address societal challenges; 2) are at scale in their design; 3) result in a net gain in biodiversity and ecosystem integrity; 4) are economically viable; 5) are based on inclusive, transparent and empowering governance processes; 6) provide and equitable balance between achieving their primary goal(s) and the continued provision of multiple benefits; 7) are managed adaptively, and evidence-based; 8) are sustainable and embedded in an appropriate legal context (IUCN, 2020).¹² These

¹² For more information about the content and application of each criterion see: Guidance for using the IUCN Global Standard for Nature-based Solutions, A user-friendly framework for the verification, design and scaling up of Nature-based Solutions, 2020 <https://portals.iucn.org/library/sites/library/files/documents/2020-021-En.pdf>

Global Standard for Nature-based Solutions aim “to provide users¹³ with a robust framework for the design and verification of NbS that achieve the desired results in solving one or more societal challenge(s)” (IUCN, 2020: 2).

The importance of using nature-based solutions was emphasised in the EU Strategy on Adaptation to Climate Change from 2021. It states that nature-based solutions play an important role in climate change adaptation and can increase resilience to climate change (European Commission, 2021: 11). There is a need to promote nature-based solutions and their implementation in practise. Therefore, the Strategy suggests that benefits of nature-based solutions should be better quantified and communicated, especially to decision-makers and practitioners (European Commission, 2021: 11). According to the Strategy, one of the benefits of implementing nature-based solutions is the reduction of flood risk (European Commission, 2021: 11). Nature-based solutions could therefore be part of flood risk management.¹⁴ Recently, there have been numerous studies looking at the possibility of applying nature-based solutions for flood risk management (Hartmann, Slavíková, McCarthy, 2019: 3, 9). The results have shown that different measures that fall under nature-based solutions can contribute to reducing the risk and/or consequences of flooding. Some of these include peatland restoration, nature-based solutions related forests (e.g., water retention in forests, afforestation of former pasturelands), changing agricultural practises (Bourke, Wilkinson and Srdjevic, 2022: 15-16, 18, 21-22; Albrecht and Nikolić Popadić, 2022: 33), reconnecting rivers with their floodplain, “planting native species to slow down the flow and stabilise river banks”, etc. (European Commission, 2021: 125). In its 2019 report on implementation of the Water Framework Directive and the Floods Directive, the European Commission found that all Member States included nature-based solutions in all or some of their flood risk management plans and usually in the form of preparatory studies or projects (European Commission, 2019: 8). Although interest in the application of nature-based solutions for flood risk management has increasing in recent years, there are also certain limitations, i.e., problems when it comes to applying these measures in practise. This is because those measures may have to be implemented on privately owned land, and usually require more land than grey infrastructure (such as dikes) (Hartmann, Slavíková, McCarthy, 2019: 5). Encroachment on private property rights could pose a challenge. As significant areas of land are required, the instruments used to acquire land for the construction of traditional flood defence systems, such as expropriation, are not an appropriate solution in this case (Nikolić Popadić, 2021: 217). Countries are therefore faced with the challenge of how to regulate the implementation of

13 User can be „anyone working on the verification, design and scaling up of NbS. Users may include project managers in the public and private sector, landscape planners, development practitioners and conservationists, governments or representatives of the finance sector (donors and investors), policy makers and planners.“ Guidance for using the IUCN Global Standard for Nature-based Solutions, p. 11.

14 European Commission defines nature-based solutions in the context of flood risk management as “measures that work with natural processes to address flood risk management, while providing multiple benefits for both human well-being and biodiversity” (European Commission, 2021: 125).

nature-based solutions on privately owned land, in particular whether and how it is possible to oblige owners to allow/enable implementation. In most countries, the application of nature-based solutions is voluntary, while some countries have a system of incentives, compensation, etc. (see: Hartmann, Slavíková, McCarthy, 2019; Hartmann, Slavíková, Wilkinson, 2022).

Opportunities for the implementation of nature-based solutions for flood risk management in the Republic of Serbia

Nature-based solutions have not been in a particular focus of research in Serbia in the past decade, as has been the case in some other countries. Only recently, in 2019, the first comprehensive analysis on the importance and applicability of nature-based solutions in Serbia was conducted (see: UNDP, 2019). This study was focused on nature-based solutions to address the challenges of climate change. One part of this study was dedicated to the problem of flooding. But, the specific, comprehensive research on the possibilities of applying nature-based solutions for flood risk management in Serbia has not yet been conducted. The gap in the literature in this area and the lack of data on projects (especially small, local ones) that have been implemented or are in progress and relate to the application of nature-based solutions in general and flood risk management in particular pose a challenge in researching the possibility of implementing of nature-based solutions for flood risk management in Serbia.

Identifying appropriate nature-based solutions, assessing their impact and putting them into practise is a challenging process that requires cooperation and involvement of experts from different fields and stakeholders. The connection between different sectors for the appropriate application of nature-based solutions should be visible in policies and strategies, especially those dealing with broader issues such as climate change. It is also necessary to link strategies from different sectors such as, agriculture, forestry and water management, as the application of nature-based solutions for flood risk management requires the involvement of all these sectors and affects them simultaneously.

After the analysis conducted, we come to conclusion that nature-based solutions are generally not yet recognised as such in strategies and policies in Serbia. This does not mean that there are no nature-based solutions at all and that they are not applied in the practise, but that the term and concept as defined in the previous section have not yet found the place they should have in Serbia. Therefore, it is sometimes not easy to recognise the measures that may fall within the scope of nature-based solutions. The Water Management Strategy does not include the term nature-based solutions, but after analysing it, we have come to the conclusion that certain measures can be subsumed under this term. One of the goals prescribed in the Strategy is the use of “active flood protection measures (existing and future reservoirs, retention basins, relief and perimeter channels) on smaller watercourses in order to reduce maximum flows” (Water Management Strategy of the Republic of Serbia, 2017). It

is necessary to create retention basins in less valuable areas, such as forestry and agriculture, in order to reduce the peaks of flood waves on international transit watercourses. Natural retention areas, such as wetlands and floodplains should be restored and expanded (Water Management Strategy of the Republic of Serbia, 2017). The maintenance and expansion of retention areas must be planned together with other relevant sectors. In general, watercourses should be designed in accordance with environmental conditions, and for smaller watercourses that are not located in settlements, hydromorphological changes should be minimal applying the principles of “natural regulation” as much as possible (Water Management Strategy of the Republic of Serbia, 2017). Another measure that should be applied is afforestation. This should help to prevent erosion in hills and mountains and flash floods. Green areas and parks in the settlements should be designed and planned in such a way that rainwater can seep into the ground in the best possible way (Water Management Strategy of the Republic of Serbia, 2017). As we can see, there are some nature-based solutions foreseen in the Water Management Strategy, but there is still space for improvement and for additional measures that should be part of flood risk management. Furthermore, the term and concept of nature-based solutions for flood risk management should find a place in this Strategy.

The draft Flood Risk Management Plan for the Territory of the Republic of Serbia for the period from 2021 to 2027, also does not contain a term for nature-based solutions as such, but certain nature-based solutions are envisaged. The measures envisaged in the Flood Risk Management Plan include the planning and implementation of measures for protection against erosion and natural water retention. These measures aim “to reduce inflows into natural or man-made drainage systems, e.g., by intercepting and/or accumulating surface inflows, improving infiltration, etc., including channel and inundation works and afforestation of riparian areas, thereby restoring natural systems that contribute to slowing down flow and water accumulation” (Flood risk management plan, 2022). This measure belongs to the group of measures related to the natural management of large bodies of water, runoff and the watershed management. Another measure from the same group is the implementation of biological and biotechnical protection works, especially in reservoir basins. A more detailed description of this measure within the Flood Risk Management Plan is identical to the previous one. The last measure, which may include nature-based solutions is planning for the preservation and expansion of existing and the creation of new retention areas (including necessary retentions). From this analysis we can conclude that nature-based solutions are recognised in the draft Flood Risk Management Plan, but not under this term and certainly not detailed and comprehensive enough. There is room for the inclusion of additional nature-based solutions for flood risk management. We can also recommend the introduction of the term nature-based solutions.

One of the examples of nature-based solutions for flood protection in Serbia is the Study on Bosut Forests’ ecosystem services: How to achieve better flood protection,

income from wood production, and traditional animal husbandry. The results of the study show that “if environmental flooding of the forest complex and the expansion of traditional animal husbandry are implemented together with joint management and the establishment of protected areas, the value of the four ecosystem services selected as most important for the area (wood production, flood protection, meat production and biodiversity) is expected to increase” (Kiš et al., 2018: 1). For the perspective of flood risk management, it is important that retention area in the forest “can store 100 - 200 million cubic metres of water” (Kiš et al., 2018: 1)

There are also other potential nature-based solutions that could be used for flood risk management in Serbia. As suggested in the study *Enhancing Nature-based Solutions in Serbia*, there is the potential to enhance and transform special nature reserves Zasavica, Obedska Bara, Gornje Podunavlje and Karadjordjevo, so that they can be used more efficiently for flood protection (Popovicki, 2022: 52). Wetlands, which are also located within above-mentioned nature reserves, can play an important role in flood risk management. Serbia has great potential in this regard as there are 11 areas designated as Wetlands of International Importance (Ramsar Sites), with a surface area of 130,411 hectares (Ramsar Serbia). In addition to implementing nature-based solutions on the land that is publicly owned (as in previous examples) some measures, such as, water retention, land use change, etc., may also need to be implemented on the land that is privately owned. In this case, various challenges may arise.

Legal challenges in the implementation of nature-based solutions

The results of our research show that the term nature-based solutions has no place in Serbian legislation. We have analysed the Law on Waters of the Republic of Serbia, as a fundamental law governing the field of flood protection and water management. As in the Water Management Strategy, there are no nature-based solutions as such, but some measures that the Law prescribes can be subsumed under this term. The measures to be implemented that are aimed at flood protection include, for example, protection and improvement of natural retention areas (Law on Waters, Art. 52). Measures that should be taken to prevent and remove the harmful effects of erosion and flash floods include the use of agricultural and other land in accordance with the erosion control requirements. Other measures that should be implemented include biotechnical and biological protection measures such as afforestation, cultivation and maintenance of protective vegetation, weeding, planting of orchards and artificial meadows, melioration of pastures, cleaning of river beds and streams, etc. (the Law on Waters, Art. 62). The Law on Water obliges owners and users of land in the erosion area to carry out works and take measures to protect against erosion and flash floods (the Law on Waters, Art. 64). The previous measures can be categorised under the concept of nature-based solutions, but are not sufficiently developed, the Law only mentions them in general terms, while their concretisation and application in practise must be regulated more precisely by other laws. With the exception of land located in an erosion area, where the implementation of measures (which can be considered

nature-based solutions) by the owner and user is mandatory,¹⁵ the application of nature-based solutions on privately owned in other areas is not regulated. It is therefore necessary to make appropriate amendments to the Law on Waters to allow the implementation of nature-based solutions on privately owned land that is not located in the above-mentioned areas.

Nature-based solutions for flood risk management can be applied to the agricultural land (Albrecht and Nikolić Popadić, 2022: 33, 44). Therefore, we analysed the Law on agricultural land to determine whether there is a legal basis for the introduction and implementation of nature-based solutions on agricultural privately owned land. Unfortunately, the term nature-based solutions does not exist in the Law. Based on the analysis of this Law, we have come to the conclusion that the introduction of nature-based solutions for flood risk management on agricultural land is possible to a certain extent, within the framework of this Law. The Law on Agricultural Land regulates the planning, protection, organisation and use of agricultural land as a good of general interest (Law on Agricultural Land, Art. 1). Since certain measures of nature-based solutions for flood risk management imply changes in the way land is managed, this means that it would be possible to regulate the way the agricultural land is used in this sense. Certain restrictions on the use of agricultural land are already prescribed in this Law, and additional changes that may contribute to reducing flood risk could be possible. As we can see, the Law prescribes some erosion control measures to protect agricultural land from the harmful effects of erosion and flash floods. Some of them are the “temporary or permanent prohibition of ploughing meadows and pastures and other land in order to turn them into arable land with annual crops; the introduction of crop rotation; the cultivation of perennial crops; the type of cultivation of agricultural land; the creation and maintenance of agricultural shelterbelts or the planting of perennial woody plants; the prohibition of clearing forests and forest plantations above vulnerable land; etc” (Law on Agricultural Land, Art. 18). Some of these measures can also be useful for water infiltration, which can help reduce flood risk. We propose decision-makers to include nature-based solutions for flood risk management, related to the way the agricultural land is used, in this Law, according to the same model. When it comes to nature-based solutions that cover larger areas of agricultural land and are intended to prevent the owner or user from cultivating agricultural land for a certain period of time or sometimes permanently, other solutions should be found. Some examples of such measures are temporary water retention on agricultural land, the conversion of agricultural land into natural areas for the purpose of water retention, the conversion of agricultural land into floodplain forests, the construction of small ponds on agricultural land, etc.

15 It should be emphasised that the Law prescribes the prohibition of the application of certain measures riparian land is involved, as well as the obligation to apply prescribed measures by the owner or user of riparian land, but all these measures do not fall under nature-based solutions (perhaps with the exception of the implementation of measures of conservation, improvement and presentation of natural values), see: the Law on Waters, Art. 133-135, but, this only applies to the implementation of measures in a well-defined area.

A model must be found that is suitable for both owners/users and the community. An appropriate system of subsidies and compensations for the loss of the possibility of using agricultural land must be created. In this context, a model that does not provide for expropriation must be considered, since, for example in the case of temporary water retention, the state would have no interest in becoming the owner and paying for large agricultural areas that may rarely be used for water retention.

When amending regulations or adopting new regulations that would enable the implementation of nature-based solutions for flood risk management, it should be noted that the Constitution of the Republic of Serbia and the Law on Foundations of Property Law Relations allow for the restriction of property rights. The Constitution of the Republic of Serbia prescribes that the property right may be restricted or revoked only in the public interest as defined by the Law, and the manner of use may be prescribed by the Law (Constitution of the Republic of Serbia, Art. 58). According to the Law on Foundations of Property Law Relations, the owner is entitled to possess, use and dispose of his/her property, but only within the limits set by the Law (Law on Foundations of Property Law Relations, Art. 3; Albrecht, Nikolić Popadić, 2022: 39). The way in which the land is used to enable nature-based solutions for flood risk management can therefore be determined by the Law on Waters and Law on Agricultural Land.

CONCLUSION

The change in dealing with floods in Serbia is a slow but necessary process. In addition to traditional flood protection measures, it is essential to implement more active flood protection measures. This change from flood protection towards flood risk management is particularly important considering the expected effects of climate change and the increasing number of days with extremely high rainfall that can cause flooding. Based on the research we conducted, we have concluded that nature-based solutions are not recognised as one of the approaches to flood risk management in Serbia, neither as a concept nor as a term in strategies, policies and laws. Certain measures that are prescribed can be brought under this concept, but further development and more detailed regulation of this field is necessary. We can propose a systemic approach in which nature-based solutions are first introduced into strategies and policies that define the goals and areas in which this concept must be applied, and one of these is certainly flood risk management. Detailed regulation is then necessary, either by amending existing regulations or by adopting new ones. For Law on Waters and the Law on Agricultural Land, we have made suggestions and recommendations as to which directions could be taken.

The definition and implementation of nature-based solutions requires cross-sectoral cooperation and the involvement of different stakeholders, professionals from different fields, decision-makers, but also people at local level who should be involved in the application of these measures, and who may be responsible for them (e.g., users of agricultural land). The role of lawyers in this process should also be recognised,

as they should propose appropriate solutions and regulatory changes based on the opinions of experts from different fields to enable the implementation of the measures in practise. The promotion of the concept of nature-based solutions to the general public is also necessary in this process, as the population is generally unfamiliar with it, and the implementation of measures requires community acceptance.

In this research, we have identified gaps in the system and in certain laws, and provide guidance on further changes that may be of benefit to decision-makers. We hope that this paper will help to fill the gap in the literature in this field, as the topic of nature-based solutions for flood risk management in Serbia has not yet been studied from a legal perspective by analysing the legislation in Serbia.

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