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Disaster Risk Reduction Education Through Digital Technologies in the Context of Education for Sustainable Development: A Curricula Analysis of Security and Defense Studies in Serbia

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Abstract: This study examines the integration of disaster risk reduction (DRR) into security and defense studies curricula at Serbian universities, focusing on public and private institutions. As climate change accelerates and natural disasters become more frequent, addressing these risks is critical for national security and sustainable development. This research evaluates the extent of DRR incorporation in curricula and the use of emerging technologies in DRR education. A qualitative analysis of programs at institutions such as the Faculty of Security Studies at the University of Belgrade, the Military Academy, the University of Criminal Investigation and Police Studies, and private universities like Singidunum and Educons University reveals that public institutions have made significant progress. However, private universities still need comprehensive DRR-focused courses and technological integration. This study recommends fostering collaboration between public and private universities, expanding access to the National Simulation Center, and incorporating modern technologies and active learning strategies across curricula to bridge existing gaps. These steps equip future security professionals with the practical skills and interdisciplinary knowledge necessary for effective disaster management in an increasingly complex risk environment.

Keywords: disaster risk reduction education (DDRE); education for sustainable development (ESD); security studies; defense studies; Serbia; new technologies



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1. Introduction

The increasing frequency and severity of natural disasters, exacerbated by the global impacts of climate change, have thrust disaster risk reduction (DRR) to the forefront of both sustainable development and security studies. As the United Nations Secretary-General has emphasized, the integration of disaster risk considerations into development planning is essential for protecting the global progress made toward achieving the 2030 Agenda for Sustainable Development [1]. Natural disasters destabilize economies, disrupt social systems, and heighten security vulnerabilities, underscoring the growing importance of examining the interconnection between security, sustainability, and disaster risk reduction [2].

Serbia, located in the Western Balkans, is particularly vulnerable to various natural hazards, including floods, wildfires, earthquakes, and extreme weather events (Table 1) [3,4]. These risks are compounded by the accelerating impacts of climate change, posing significant threats to national security and environmental stability. This growing vulnerability highlights the urgent need for a comprehensive approach to disaster risk management that addresses these challenges within the broader context of national and human security.

Higher education institutions (HEIs) in Serbia play a critical role in educating future security professionals to confront these multifaceted challenges. Public institutions such as the Faculty of Security Studies at the University of Belgrade, the Military Academy of the University of Defense, and the University of Criminal Investigation and Police Studies have

taken significant steps toward integrating DRR into their curricula, particularly through courses in environmental security, emergency management, and disaster preparedness. However, private universities have yet to incorporate disaster risk reduction comprehensively into their curricula, often focusing more broadly on general security and sustainable development topics. One notable advancement in this field is the establishment of the National Simulation Center for Security Risks at the Faculty of Security Studies. This center serves as a vital resource, offering students hands-on experience through simulation-based training and preparing them for real-world disaster scenarios. The center’s ability to bridge theoretical knowledge with practical disaster management skills makes it a crucial component of DRR education in Serbia [5].

Table 1. Main natural hazards in Serbia.

Hazard	Risk Level
River floods	High
Urban floods	High
Wildfire	High
Earthquake	Medium
Landslide	Medium

Despite these advances, there remain significant challenges in fully integrating new technologies, such as Geographic Information Systems (GIS), drones, and artificial intelligence (AI), into DRR education across both public and private institutions. Traditional teaching methods still dominate, leaving students inadequately equipped with the skills necessary for modern disaster management. Addressing this gap is essential for advancing DRR education and ensuring that future security professionals are prepared to meet the increasingly complex challenges posed by climate change and natural disasters.

This paper examines the current state of disaster risk reduction education within security studies programs at public and private universities in Serbia. It evaluates how institutions such as the Faculty of Security Studies, the Military Academy, the University of Criminal Investigation and Police Studies, and several private universities incorporate DRR into their curricula, and it assesses the role emerging technologies play in preparing students for the complex security challenges of natural disasters. Special attention is given to the potential of the National Simulation Center for Security Risks as a model for expanding simulation-based learning across all institutions. By fostering collaboration between public and private universities and leveraging the resources of the National Simulation Center, Serbia can significantly enhance its capacity to prepare future security professionals for the increasingly interconnected challenges of disaster risk, sustainability, and national security.

2. Sustainable Development and Disaster Risk Reduction

The publication of Silent Spring in 1962 was a pivotal moment in the history of the environmental movement. In her book, Rachel Carson called for a balanced and sustainable approach to resource management, foreseeing many of the world’s challenges regarding environmental protection today [6]. However, it was not until 25 years later, with the adoption of the Brundtland Report, also known as Our Common Future by the United Nations World Commission on Environment and Development, that the foundations of the modern concept of sustainable development were laid. The report emphasized that economic, social, and environmental goals are interdependent [7]. It highlighted the concept of interdependence, which means that major global issues such as poverty, population growth, environmental degradation, uneven economic development, and global interdependence are deeply interconnected [7].

Five years later, at the United Nations Conference on Environment and Development, the Rio Declaration on Environment and Development and Agenda 21 were adopted. These documents defined the relationship between development and environmental protection

and provided a comprehensive action plan for achieving sustainable global, national, and local development [8,9]. The international community's efforts to promote sustainable development were also reflected in the Millennium Development Goals, which included eight global targets addressing fundamental issues such as poverty, hunger, inequality, education, health, and environmental protection [9].

However, what was missing from the previously mentioned documents was a focus on the connection between disaster risk reduction (DRR) and sustainable development, often described as “two sides of the same coin” [10,11]. Shaw and Uitto believe that minimizing the impact of natural disasters will be crucial for achieving sustainable development [11]. This understanding has also been confirmed by the UN Secretary-General, who stated that “development cannot be sustainable if the disaster risk reduction approach is not fully integrated into development planning and investments. . . Development investment that does not consider disaster risk will lead to the accumulation of more risk” [12].

Efforts to reduce disaster risk have developed in parallel with the concept of sustainability, starting from the International Decade for Natural Disaster Reduction (1990–1999) as a key global initiative, followed by the International Strategy for Disaster Reduction (1999). Subsequent documents, such as the Yokohama Strategy (1994), the Hyogo Framework for Action (2005), and, more recently, the Sendai Framework (2015), the Paris Agreement, and the Sustainable Development Goals (2015), highlighted the interrelationship between sustainable development and DRR. The Hyogo Framework for Action (2005–2015) stated that “disaster risk reduction is a cross-cutting issue in the context of sustainable development and, therefore, an important element for the achievement of internationally agreed development goals” [13]. This understanding was also confirmed in the United Nations Conference on Sustainable Development outcome document titled *The Future We Want* [14]. In other words, as Canlas points out, DRR is “one of the key pillars of sustainable development” [15].

The link between disaster risk reduction and sustainable development has been confirmed by adopting the 2030 Agenda and the 17 Sustainable Development Goals (SDGs). In a study by Cabello et al., DRRE is linked to SDGs, such as SDG 1 (Poverty Eradication), SDG 3 (Health and Well-being), SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) [16]. Achieving these goals requires incorporating disaster risk reduction strategies to preserve sustainable development progress. As the Disaster Risk Reduction and Resilience in the 2030 Agenda for Sustainable Development report states, “a key part of the success of the 2030 Agenda for Sustainable Development will, in part, be measured by progress in the implementation of disaster risk reduction” [17].

Sustainable development and disaster risk reduction are interdependent and complementary. Sustainable development requires policies that reduce disaster risks, while disaster risk reduction enables long-term economic, social, and environmental stability, which is essential for achieving sustainable development. Establishing resilient communities and reducing the environmental, social, and economic consequences of disasters are necessary to meet global sustainability goals.

Considering that the concept of sustainable development is based on the idea that these three pillars (economic, environmental, and social) are interconnected, threats to sustainable development represent a combination of environmental, social, and economic risks, which can also be referred to as a “triple threat”. While it is important to address these threats equally, climate change has emerged in political and academic discourse as one of the most significant threats to sustainable development, as it impacts all dimensions of sustainability [18].

From this paper's perspective, we highlight SDG 13, “Climate Action”, which specifically focuses on global efforts to mitigate the effects of climate change. This goal sets key targets, including enhancing understanding of disasters, improving education and awareness, strengthening stakeholder and institutional capacities, and promoting adaptation, resilience, and mitigation efforts [19].

Countries have adopted action plans and initiatives to reduce disaster risks and achieve sustainable development goals in line with the above-mentioned agreements. However, education has emerged as one of the most important tools for achieving sustainability and disaster risk reduction [15]. There is a belief that sustainable development post-2015 begins with education [20]. Chapter 36 of Agenda 21 highlights education as a “crucial element” for advancing sustainable development and enhancing people’s ability to address environmental and development challenges [21]. The Sendai Framework for Disaster Risk Reduction 2015–2030 emphasizes education as a key component in building disaster resilience [22]. Education is essential for raising awareness, improving preparedness, and fostering a safety culture at both community and institutional levels. Through formal and informal education, individuals and communities can better understand risks and adopt practices that reduce their vulnerability to disasters [22]. According to Moggi, the 2030 Agenda has positioned higher education as pivotal in the transition toward sustainable development [23].

Considering the “new reality” of an increasing number of disasters and losses that threaten the planet’s future, “higher education institutions must take on a stronger role to tackle the world’s most pressing issues” [24]. However, it is important to note that the new reality is not only about threats to sustainability but also the emergence of new digital technologies, which can significantly contribute to reducing disaster risks and achieving sustainability. Therefore, trends in education must align with rapid technological developments, focusing not only on theoretical knowledge but also on their application.

3. Education for Disaster Risk Reduction in the Context of ESD—Importance and Challenges

As mentioned in the previous section, education has been identified as one of the critical factors in achieving sustainable development. In line with sustainable development, the UN advocated that “education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues” [25]. In 2002, the United Nations adopted a resolution to initiate the UN Decade of Education for Sustainable Development covering 2005–2014. This global initiative aimed to develop and promote Education for Sustainable Development (ESD) as a critical element in supporting sustainable development efforts across societies worldwide [26].

ESD, an evolving concept, aims to equip learners with the knowledge, skills, values, and attitudes needed to tackle environmental, social, and economic challenges. While ESD is implemented at primary and secondary education levels [27], higher education institutions (HEIs) play the most crucial role in ESD. As per the 2030 Agenda, higher education has been positioned as a key player in the transition towards sustainable development [24,28–30].

The role of universities and HEIs in promoting sustainability through curriculum reform, research, and community engagement has been widely studied. HEIs are critical to advancing sustainable development through innovation and leadership in sustainable practices [31]. According to a UNESCO document, if HEIs “do not embrace the 2030 Agenda, it will be difficult, if not impossible, to achieve it” [24].

Given the interrelationship between sustainable development and disaster risk reduction and in line with the Hyogo Framework for Action, which emphasizes the inclusion of disaster risk reduction as a fundamental aspect of the UN Decade of Education for Sustainable Development, ESD provides a framework for analyzing Disaster Risk Reduction Education (DRRE). Research indicates that DRRE and ESD “have synergy” [31–33] and that “ESD is a crucial concept and method for effectively promoting DRR education in schools and communities” [34]. Education is crucial in developing a safety culture and creating resilient communities that respond to disasters [35].

ESD and DRRE are closely related because both focus on education that empowers individuals to confront the challenges of our time, including natural disasters, climate change, and unsustainable practices. While DRR education specializes in disaster preven-

tion and response, ESD provides a broader framework that encompasses all aspects of sustainability, making DRR a vital element within the broader concept of education for sustainable development. As emphasized several times, sustainable development can only be achieved if disasters undermine economic growth and social progress [36].

One of the challenges in education is how to link knowledge and action, especially today in the context of the Fourth Industrial Revolution and the rapid development of new technologies. Existing research points to a certain gap between knowledge and behavior. While ESD positively influences students' understanding and engagement with sustainability, its implementation must be improved and expanded to have a more significant impact. Similarly, there is a gap between knowledge and behavior in the context of DRRE. According to Nakano and Yamori, acquiring knowledge about disaster risks only sometimes leads to proactive behavior [37]. The authors cite traditional teaching methods as the reason why teachers (the experts) pass knowledge to students (the learners) in a one-way hierarchical manner, which has been termed the "transmission paradigm" [37]. Therefore, a shift towards a new approach is necessary. This approach should involve students' active engagement to cultivate knowledge and a proactive attitude that leads to real-life preparedness. The authors term this approach the 'proactive attitude paradigm' [37].

One question that can be raised is whether the existing concepts of DRRE and ESD are keeping pace with the development and application of new technologies. According to the Innovation in Disaster Management Report, various technological advances are used in disaster risk management, such as 3D printing, artificial intelligence, virtual reality, drones, GIS, social media, satellites, and sensors [38]. Furthermore, based on this report, in 2022, the Frontier Technology Radar for Disaster Risk Reduction tool was launched to track technology development and classify them based on the type of technology, type of disaster, and phase of emergency management [39]. Initiatives like Destination Earth (DestinE) for climate modeling have also significantly contributed to achieving SDG 13 and DRR [40]. According to research by Vinuesa et al., AI can be a critical enabler for the SDGs and has the potential to enable progress on 134 of the 169 targets (around 79%) across all the SDGs [41].

Abid et al. point out that new technologies, especially those based on artificial intelligence, "have significantly increased our ability to predict disasters", reducing disaster risks [42]. These authors emphasize using digital technologies, such as cloud-based learning platforms and innovative digital tools like augmented reality (AR), to help students visualize and understand disaster risks. They argue that such digital approaches can be practical tools for achieving broader disaster preparedness and resilience goals outlined in the SDGs [42]. This view is supported by other authors who emphasize the importance of using diverse educational tools and approaches, such as video games, stories, workshops, and technology-assisted learning (e.g., drones), to bridge the gap between DRR policy and practice [43–46].

Therefore, it is imperative to integrate these technologies into the aforementioned educational concepts. Habanik et al. argue that "technology is vital for education" and, therefore, education must keep pace with it [46]. In a case study at Graz University, Brudermann et al. conclude that education for sustainable development must adapt to prepare students for a world shaped by technological advancements and global sustainability challenges [47]. Sung et al. argue that emerging technologies such as VR, gamification, and wearable devices hold immense potential for transforming education for sustainable development by creating engaging, immersive learning environments that influence behavior toward sustainability goals. Technology integration in education offers a promising path forward, fostering a sense of optimism and forward-thinking in the audience [48].

However, it must be noted that the development and use of new technologies in the context of DRRE and ESD are "costly and challenging to produce in a wide variety" [49]. Additionally, the use of new technologies in education requires curriculum revisions and the use of trained educators [50]. According to some authors, there are significant obstacles, such as resistance to change from faculty, lack of resources, financial limitations, and insufficient

institutional support [50,51]. Furthermore, integrating sustainability into various disciplines, as does the need for specialized knowledge, remains challenging [51–53].

In their research, Carrión-Martínez et al. emphasize the importance of information and communication technologies (ICTs) in education to achieve sustainable development and meet the SDGs [51]. However, the authors note that a more widespread and effective implementation of ICT in education is necessary to realize its potential to promote sustainability fully [51]. Studies conducted during the COVID-19 pandemic highlight the opportunities digitalization presents for improving education for sustainable development (HESD), though challenges remain, such as limited digital infrastructure in some regions, technical shortcomings, and differing levels of digital literacy among teachers and students [53].

One of the problems identified is the lack of reporting on educational programs in this area and the development of tools to measure and evaluate the development of sustainability competencies necessary for sustainable education. Many universities have published sustainability reports, but there is no standardized approach for HEIs to follow [23]. One mechanism to address this issue is the Sustainability Tracking, Assessment, and Rating System, developed by the Association for the Advancement of Sustainability in Higher Education [54]. This system provides a transparent self-assessment system for colleges and universities to evaluate their sustainability achievements.

In this paper, we will analyze security studies curricula in higher education in Serbia to assess the extent to which DRRE and ESD are included, particularly in the context of using new technologies.

4. The Nexus Between Security and Defense Studies, Sustainable Development, and Disaster Risk Reduction

Just as there is synergy between sustainable development and disaster risk reduction, there is also interdependence between security and these two areas. To understand this connection, we define security as the condition in which both the sovereignty of a nation and the fundamental rights and freedoms of its people are protected and promoted. It represents a dynamic state of peace, stability, and resilience against threats—whether external or internal, military or non-military—that may harm the nation’s territorial integrity (national security) or undermine the safety, dignity, and well-being of its citizens (human security). Understanding this connection involves recognizing that security is inseparable from sustainable practices, as environmental degradation and economic instability often lead to conflicts and destabilize societies [55]. Namely, sustainable development promotes economic stability, reduces social inequalities, and preserves natural resources—key factors for achieving long-term security [55]. The Integrating Sustainable Development and Security report from the Stockholm Environment Institute emphasizes that sustainable development cannot be achieved without security and vice versa (Figure 1) [56].

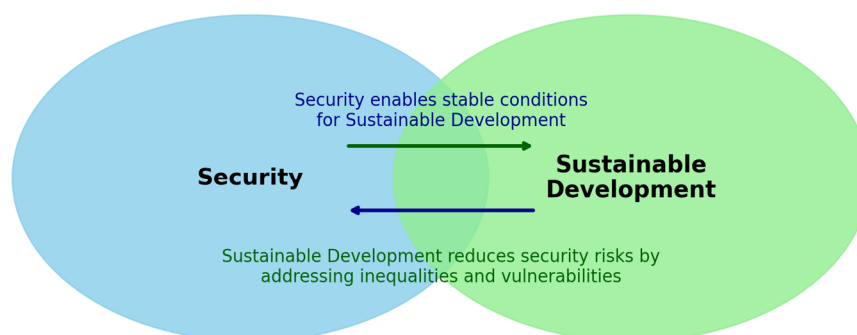


Figure 1. The nexus between security and sustainable development.

In his work, Hettne offers a historical analysis of the intersection between development and security, termed the “development–security nexus” [57]. Hettne’s analysis underscores the urgency and complexity of an adaptable development–security nexus, as it reveals how

security and development have historically intertwined in response to shifting geopolitical and economic contexts. The nexus has evolved from state-focused, industrial-driven security in the 19th century to a globalized, human-centered approach that emphasizes individual well-being and transnational collaboration [57]. This adaptability is essential in addressing today's urgent global challenges—such as poverty, environmental challenges, and conflicts—which transcend borders and require holistic policies integrating local and global solutions. As the world faces unprecedented social and environmental pressures, an adaptable nexus offers a framework for fostering sustainable development that mitigates security risks, advocating for global cooperation while respecting diverse regional needs [57].

Some studies suggest that a common evidence highlighting the interdependence of security and development is that most of the world's 20 poorest nations have faced violent conflicts in the past decade [58]. Countries most impacted by conflict, instability, and displacement have lagged the furthest in poverty reduction. This can create a vicious cycle, as economic shocks—such as environmental pressures, migration, and food price fluctuations—can further diminish security [55]. One of the current examples is Ukraine, which is highlighted by Todorov and Todorova [59]. The authors underscore the necessity for Ukraine to integrate sustainable development principles within its national security framework. They highlight how sustainable development is critical for a resilient national security structure that protects sovereignty and addresses socioeconomic and environmental stability [59].

Therefore, as the New Agenda for Peace 2030 states, peace can only be achieved “alongside sustainable development” [60]. However, as Dowdeswell points out, true peace encompasses more than the absence of war; integrating social, economic, and environmental dimensions to ensure lasting stability and resilience and economic and environmental well-being are fundamental to enduring security [61].

From that point of view, the SDGs effectively demonstrate the connection between security and development. They encompass numerous targets aimed at reducing inequalities and disparities, fostering inclusive societies, upholding the dignity of each individual, and ensuring the solid institutions and sustainability of the economy, environment, and natural resources [62]. On the other side, Farkas delves into security challenges associated with the UN's Sustainable Development Goals (SDGs) from 2016 to 2030. The author identifies 30 specific targets related to security concerns among the 17 SDGs, categorizing these concerns into health, socioeconomic, infrastructural, and environmental risks. This breakdown underscores the intricate and interconnected nature of security and sustainability [63].

Some authors even explore the concept of sustainable security by introducing the Sustainable Security Paradigm, which aims to integrate different security domains (social, environmental, national, and human security) into a cohesive and holistic system. This paradigm is designed to address global security threats in a long-term, sustainable manner [64]. The adoption of this paradigm in policy-making could lead to a more comprehensive and effective approach to security, considering not only traditional military threats but also social, environmental, and human security concern

When discussing security studies, it is essential to note that their development as an academic discipline began in the 1950s. Initially focused exclusively on military threats to national security, by the end of the 20th century, these studies underwent a renaissance in recognizing new security threats. According to Ullman, a threat to national security is an action or sequence of events that (1) threatens drastically and over a relatively brief span of time to degrade the quality of life for the inhabitants of a state or (2) threatens significantly to narrow the range of policy choices available to the government of a state or to private, nongovernmental entities (persons, groups, corporations) within the state [65]. Therefore, security studies address a broad spectrum of threats, encompassing risks from pandemics, environmental degradation, terrorism, and interstate conflicts.

Moreover, the outlined definition of security threats and their scope in security studies reveals a clear link between security and disaster risk reduction. Specifically, as we consider

a disaster as “a serious disruption of the functioning of a community or society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses and impacts” [66]. In line with Ullman’s above definition, it becomes evident that disaster threatens national security. As noted by Gromek, the 21st century is often regarded as an era of disasters, making DRR a pivotal factor in shaping national security now and in the foreseeable future [67].

Although disaster issues, specifically examining the social and behavioral dimensions of sudden collective stress events (mass emergencies or disasters), have disaster studies [68], it is clear that there is a connection between them and security studies. Namely, disaster studies explore the impacts of such events across all social units, from individuals and households to entire nation-states [68]. However, with the above-mentioned renaissance, security studies not only have the perception and study of threats evolved, but it has also shifted the focus from national security to a more people-centric approach—human security. This shift emphasizes the importance of human well-being in the study of security, as highlighted by Simon Dalby’s focus on the evolving concept of security in the context of global environmental changes [69]. Dalby seeks to redefine traditional national security by including environmental change as a threat to human safety and prosperity [69]. This expanded security concept moves from the Cold War-era focus on nation-states and military defense to a more comprehensive, human-centered approach.

The concept of human security, which encompasses protecting individuals and communities from direct and indirect threats to their well-being, ties sustainability and security together by focusing on well-being, food, energy, and environmental security. The SDGs emphasize human security, particularly for vulnerable populations: ‘The human security approach is crucial to achieving sustainable development’ [70].

With the above-mentioned changes, security studies are increasingly oriented towards disaster risk research, focusing on analyzing societal vulnerability and resilience, especially in critical infrastructure, and developing risk prevention and management strategies to mitigate national and human security threats. Special attention is given to the role of state institutions and the military in disaster response, along with examining the link between disasters and conflicts. Additionally, these studies explore how climate change, through the increased frequency of disasters, poses a long-term threat to security and sustainability, highlighting the necessity of creating sustainable policies and fostering international cooperation to maintain stability.

Unlike security studies, defense studies have a more extended history. Their origins are tied to the establishment of the Imperial Defence College in 1927 in the UK, and they focus on the study of how states prepare for preventing, avoiding, and participating in war [71]. However, the armed forces’ missions have evolved with the changing security environment. Today, armed forces play a crucial role in disaster management, particularly when the scale of a disaster exceeds the capacity of civilian authorities to respond effectively.

Specific threats, such as climate change, now far exceed the scope of merely human security threats. Climate change has also become a national security threat, as evidenced by the National Security Implications of Changing Climate document, where climate change is recognized as an urgent and growing threat to U.S. national security [72]. In 2021, NATO recognized climate change as one of the defining challenges of our times. It is a threat multiplier that impacts security [73]. This global perspective is further echoed by the UN Secretary-General, who stated, ‘Climate change is not the source of all ills, but it has a multiplier effect and is an aggravating factor for instability, conflict, and terrorism’ [74]. The document titled ‘Climate Change and Security,’ published by the UK Parliamentary Office of Science and Technology, underscores the interconnected nature of the security risks associated with climate change and their impact on societies worldwide [75]. The document advocates for integrated global strategies to manage these security implications, focusing on resilience-building, international collaboration, and the development of adaptive technologies [75]. Vogler analyzed 310 white papers and national security strategies

from 93 countries between 2000 and 2020 in his study. He concluded that environmental and climate change issues are referenced in over 70% of national security strategies and similar publications since 2007 [76].

Analyzing the role of armed forces in DRR, particularly within the framework of the Sendai Framework for Disaster Risk Reduction 2015–2030, Gromek identifies five main directions for armed forces in DRR: (1) limiting hazard power through early warning systems and risk assessment, (2) reducing vulnerabilities through community resilience programs, (3) shortening exposure through evacuation planning and land use management, (4) improving resilience through training and capacity building, and (5) strengthening capacities to cope with disasters through the development of response protocols and the deployment of resources [77]. In fact, according to Vij et al., armed forces are often ‘the first responders for relief tasks and measures after a hazard’ [78].

Education emerges as a powerful tool in addressing security challenges, as highlighted earlier in this paper. It is encouraging to note that many universities specializing in security and military studies and international organizations have integrated courses on the security aspects of climate change into their programs [79–82]. The University of Belgrade’s Faculty of Security Studies is no exception. This faculty, the University of Criminal Investigation and Police Studies, and the University of Defence—Military Academy—have incorporated disaster risk management into their programs. In response to the evolving security and geopolitical landscape, numerous private universities have also established security studies programs, including courses on disaster risk reduction and environmental security.

By the Law on Disaster Risk Reduction, these higher education institutions participate in disaster risk reduction and protection efforts through their involvement in specialized task forces, expert-operational teams, and operational headquarters [83]. They also inform relevant organizations about critical scientific disaster risk reduction and protection findings [83].

However, as outlined in the Climate Change Adaptation Programme for the Republic of Serbia 2023–2030, gaps still exist in the education system, particularly regarding raising public awareness and integrating climate education into formal education systems to ensure comprehensive understanding and preparedness for the impacts of climate change [84]. These gaps must be addressed urgently, particularly in raising public awareness and integrating climate education into formal education systems. It is crucial to ensure a comprehensive understanding of and preparedness for the impacts of climate change. Immediate action is needed to bridge these gaps and equip our societies with the knowledge and skills necessary to mitigate the security risks associated with climate change.

5. Materials and Methods

This study delved into the nexus between security, defense, EDR, and DRRE in emerging technologies. The central research questions guiding this study are as follows:

1. To what extent is DRR, as a fundamental component of sustainable development, integrated into the curricula of security and defense studies across Serbian public and private universities, and what differences are observed in terms of coverage?
2. How extensively are new technologies—such as Geographic Information Systems (GIS), drones, and artificial intelligence (AI)—incorporated within DRR curricula in Serbian security and defense studies programs, and how does their integration vary across institutions?

This study employed a qualitative approach to analyze primary documents related to security and defense studies programs, specifically focusing on individual course curricula. A qualitative content analysis method was applied to analyze and interpret the content of textual data, which, in our case, consists of the curricula of security and defense studies programs. This method determined the prevalence of specific analytical categories within the studied material. The analysis was conducted on two levels. First, we analyzed study programs across all levels of education, and then, based on selected criteria, we analyzed individual courses. As the starting point for the analysis, we used the criteria

developed and defined by the Sustainability Tracking, Assessment, and Rating System (STARS). According to these criteria, ESD includes only those courses that primarily and explicitly focus on sustainability, which must be emphasized in the title or the course description [54]. These courses may include those that focus primarily on sustainable development, courses that focus on applying sustainability in another field, or courses that primarily and explicitly focus on a significant sustainability challenge such as climate change. Additionally, sustainability-inclusive courses may focus primarily on other topics but incorporate sustainability content or address one or more sustainability challenges [54].

These criteria have already been applied in previous research to analyze how sustainable development principles and goals are integrated into higher education curricula at three faculties of the University of Belgrade, including the Faculty of Security Studies [85]. Our research focused on the synergy between sustainable development and disaster risk reduction and analyzed courses that primarily and explicitly focus on DRR. Thus, complementary to the essential criteria for analyzing ESD courses, the criteria for analyzing DRR courses were also used. In other words, we analyzed the following:

- Courses that primarily and explicitly focus on DRR, which must be emphasized either in the title or course description;
- Courses that focus primarily and explicitly on significant contemporary challenges, such as climate change;
- DRR-inclusive courses that focus primarily on other topics but incorporate DRR content or address one or more DRR challenges.

It is important to emphasize that DRRE does not have a uniform definition. According to Canlas, DRRE is “a functional, operational, and cost-effective tool for risk management that aims to provide knowledge to individuals and groups to take action, thereby reducing their vulnerability to disasters” [15]. Moreover, inconsistent terminology is used for DRRE, including disaster management education, disaster prevention education, disaster preparedness education, disaster awareness education, risk monitoring, and disaster mitigation education [15]. Since different terminology is also present in Serbia’s curricula, various terms were included in the analysis.

As additional criteria for analysis, we included the following:

- The method of knowledge transfer, i.e., whether traditional or proactive models of education are represented;
- The presence of new technologies in DRRE.

The analysis of security and defense studies curricula at selected faculties and universities follows four systematically defined data types, each serving as a specific unit for coding and interpretation. These units enable a structured examination of curricula regarding integrating DRR principles and using digital technologies within educational programs. The analysis began by defining clear coding criteria rooted in the Sustainability Tracking, Assessment, and Rating System (STARS). Courses were categorized based on the following:

1. **Course Title:** Each course title was systematically recorded and analyzed to capture the primary focus and thematic relevance to disaster risk reduction as well as DRR-inclusive courses, which focused primarily on other topics but incorporated DRR content or addressed one or more DRR challenges. Titles served as initial indicators of course intent, helping categorize courses aligning with specific DRR aspects or highlighting significant challenges like climate change.
2. **Content Descriptions:** Short course descriptions were analyzed qualitatively to evaluate each course’s core themes, objectives, and specific areas covered within the curriculum. These descriptions provided insights into the scope of DRR content.
3. **Knowledge Transfer Methods:** The modes of knowledge transfer employed in each course were assessed, documenting traditional versus proactive educational models. This included identifying lecture-based methods, practical exercises, group dis-

cussions, and other pedagogical strategies to understand how each course fosters engagement and skill acquisition related to DRR.

4. Application of New Technologies in Teaching: The use of new technologies, such as GIS software, simulation tools, and other technology-driven instructional aids, was evaluated to assess each faculty's adaptability to modern educational trends. This analysis aimed to identify how technological advancements are incorporated to enhance learning experiences and facilitate knowledge transfer, particularly in areas directly related to disaster risk management and security studies.

Each criterion provided a structured lens, ensuring the curriculum's thematic relevance to DRR and technology use was consistently analyzed. Courses were selected and categorized based on course titles, descriptions, and thematic keywords (e.g., "disaster risk", "disaster management", "disaster protection", "environmental security", "climate change", "crisis management", "protection", "risk management"). By identifying course titles and descriptions that pertain to DRR or emerging technologies, this process successfully highlighted the diversity of educational methods for DRR across different institutions.

Starting with course titles and descriptions that relate to DRR or emerging technologies, the method effectively documented the diversity of educational approaches to DRR across various institutions. The coding was also extended to analyze how technologies were integrated into courses, with a keen focus on practical applications. Practical applications were coded separately to determine their role in fostering proactive, experiential learning approaches that deepen understanding of DRR concepts.

Data Collection

For this study, we conducted a comprehensive analysis of the study programs and curricula for accredited security study programs at all levels of education in Serbia. Following the Law on Higher Education, study programs consist of required and elective courses with defined content that provide students with the necessary knowledge and skills. Course content is an integral part of a document known as the Course Catalog [86]. This document contains all information about courses accredited by the National Entity for Accreditation and Quality Assurance in Higher Education. According to accreditation standards, faculties must make these catalogs publicly available on their official websites [87]. The original documents underlying programs and curricula were meticulously collected from the official websites of universities and faculties between April and November 2024.

We began by analyzing Serbia's oldest public faculty, the Faculty of Security Studies at the University of Belgrade, University of Defense Military Academy, University of Criminal Investigation and Police Studies, and then included private universities: Singidunum University, University Business Academy, Union University, Union Nikola Tesla University, Educons University, Eduka University, and MB University. This inclusive approach ensures that our findings are representative of the diverse educational landscape in Serbia, respecting the contributions of all institutions.

6. Results

Based on the review of study programs from all universities and faculties, we excluded from the analysis those universities and faculties that did not have publicly available curricula, as it could not be determined whether they primarily and explicitly focus on DRR and climate change and especially whether they offer DRR-inclusive courses, nor could the methods and tools for learning be analyzed. Although we stated that, in accordance with accreditation standards, faculties are required to publicly publish catalogs, many private faculties do not adhere to this standard after receiving accreditation approval. Therefore, the following were excluded from the analysis: Union University—Faculty of Law and Business Studies "Dr. Lazar Vrkatić"—MB University, Union Nikola Tesla University—Faculty of International Politics and Security—and the University Business Academy—Faculty of Organizational Studies EDUKA.

6.1. Faculty of Security Studies University of Belgrade

The Faculty of Security Studies, a public faculty and one of the 31 members of the University of Belgrade, the oldest and largest university in Serbia, founded in 1808, has demonstrated its adaptability since its establishment in 1975. It has modified and adapted its curricula in response to the changes in security studies, ensuring that it provides the most relevant and up-to-date education. This ‘renaissance’ shifted the understanding and approach to security, incorporating new and diverse topics. According to available data, the faculty has, over the last two decades, begun incorporating topics from ecology, environmental protection, and sustainable development into its curricula [85]. A new master’s program in Disaster Risk Management was introduced in 2017, and a doctoral program was accredited in 2021. At the undergraduate level, there are 32 required and 32 elective courses. At the master’s level in security studies, there are four required and sixteen elective courses, while at the master’s level in Disaster Risk Management, there are five required and sixteen elective courses. At the doctoral level, there are four required and fifteen elective courses. The faculty also offers a one-year Specialist Studies program on Security Risk Assessment, introduced in 2022. This program includes four required and fifteen elective courses (Figure 2) [88–92]. A National Simulation Center for Security Risks was also established within the faculty. The center is a vital resource, offering students hands-on experience through simulation-based training and preparing them for real-world disaster scenarios [5]. The center’s work will also be presented in more detail as part of the curriculum analysis.

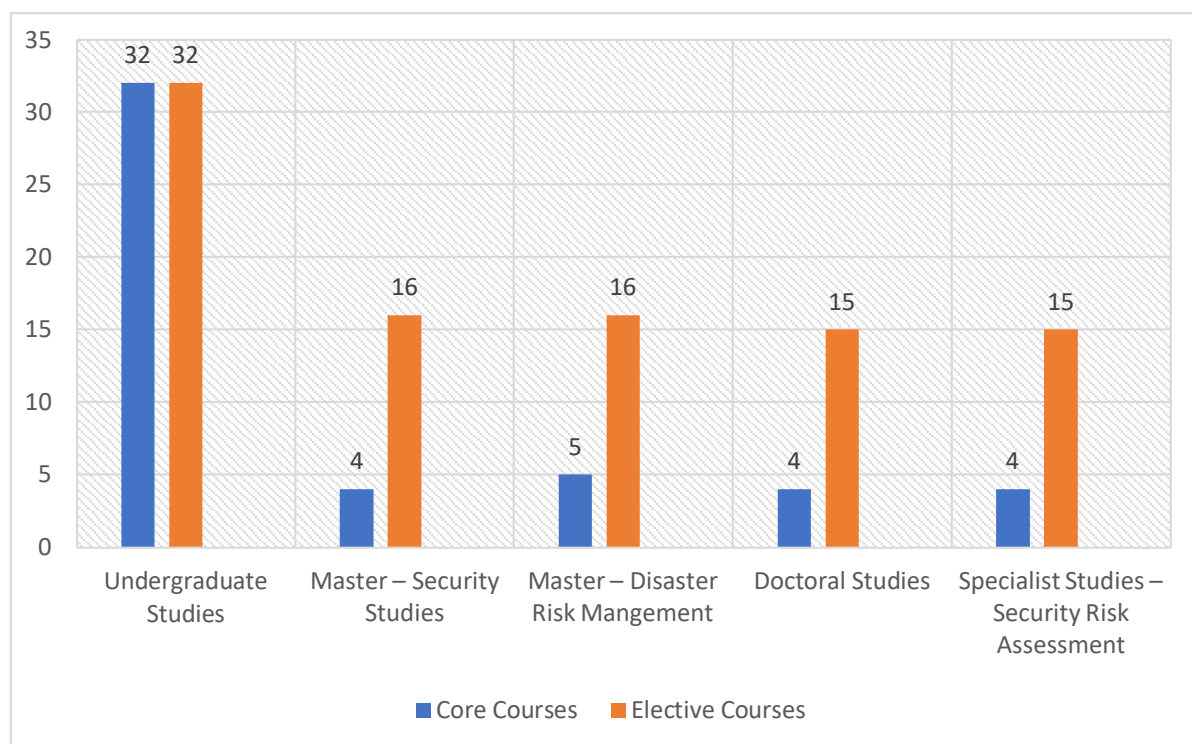


Figure 2. Distribution of courses at all study levels—Faculty of Security Studies University of Belgrade.

The oldest faculty of security studies is also the largest. Following undergraduate study accreditation, the faculty enrolls 400 students each year in the first year of undergraduate studies. Currently, 2200 students are enrolled across all four years of undergraduate studies. The allowed enrollment quota for the master’s program in Security and the master’s in Disaster Risk Management is 50 students. For doctoral studies, the annual enrollment quota is 15 students. Additionally, the Specialist Studies program in Security Risk Assessment allows an annual enrollment of 50 students. However, these enrollment quotas are only sometimes fully met, except for undergraduate studies. For instance, in

the 2024/25 academic year, all 50 spots were filled in the master's program in Security, whereas 24 students enrolled in the master's program in Disaster Risk Management. Since the accreditation of doctoral studies in 2021, 44 students have enrolled in this program [93].

Based on the established criteria, three core and five elective courses at the undergraduate level were thoroughly analyzed. At the master's level in security studies, none of the core courses meet the defined criteria, unlike five elective courses. On the other hand, in the Master's in Disaster Risk Management program, all core and six elective courses meet the research criteria. None of the core courses aligned with the defined criteria at the doctoral level, while two elective courses were selected. Finally, at the last level of analysis, the specialist studies, two core, and four elective courses meet the established criteria (Figure 3).

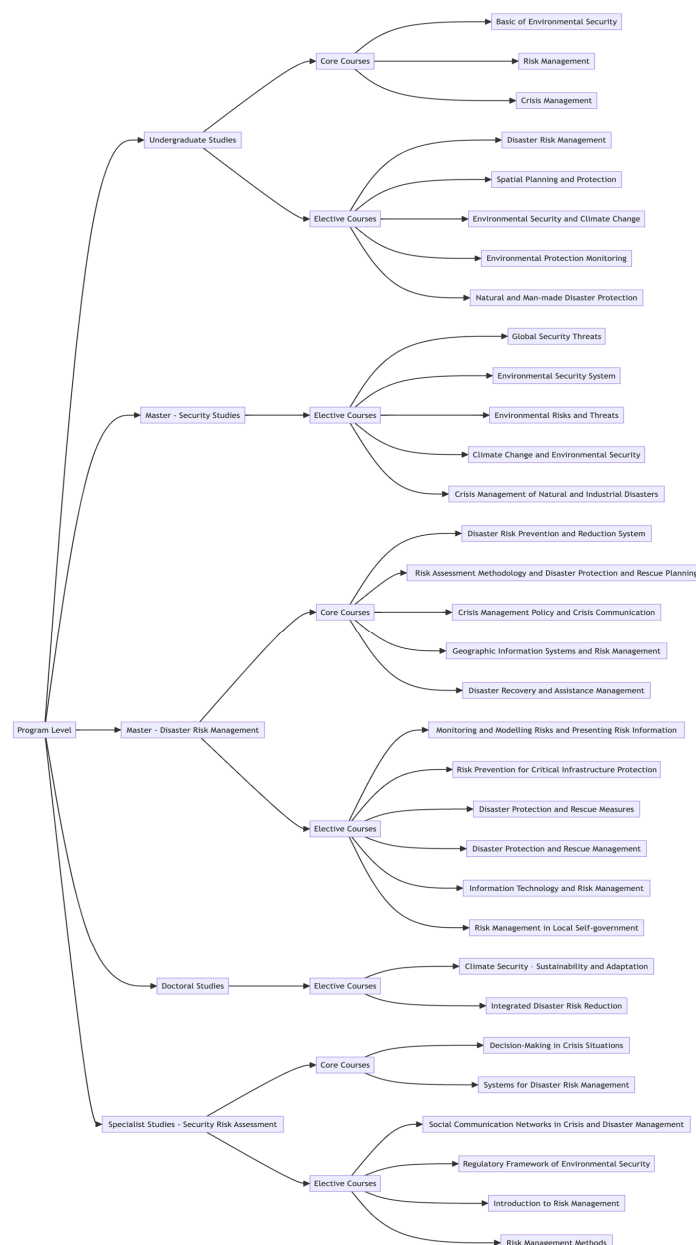


Figure 3. Selected courses at the Faculty of Security Studies University of Belgrade.

6.1.1. Curriculum Content Analysis

Analyzing the curricula, particularly the content, defined objectives, and learning outcomes for the selected courses at the undergraduate level, it can be concluded that they

provide basic theoretical knowledge in the areas of environmental security, emergency management, climate change, and disaster risk reduction. A traditional teaching method is applied, while only two courses—Disaster Risk Management and Spatial Planning and Protection—involve students using new technologies, particularly event simulations and GIS.

At the master's level in security studies, the trend of a theoretical approach to disaster risk reduction education continues, though the course Crisis Management of Natural and Industrial Disasters includes the organization of simulation-based crisis management training for various natural and industrial-technological hazards. Despite the expectation that the Disaster Risk Management master's program would involve a more proactive teaching approach and a more significant application of new technologies, only a few courses incorporate active teaching methods such as simulations, interactive workshops, GIS applications, simulation-based training, and an introduction to emergency management software (Information et al., Risk Prevention for Critical Infrastructure Protection, Geographic Information Systems and Risk Management, Crisis Management Policy and Crisis Communication, and Disaster Protection and Rescue Management).

The analysis of both doctoral-level courses reveals that they offer exclusively theoretical knowledge in the analyzed fields. A similar situation exists in specialist studies, where the primary teaching method remains traditional—knowledge transmission.

6.1.2. National Simulation Center for Security Risks

To bridge the evident gap between knowledge and behavior, particularly in the context of applying new technologies, the Faculty of Security Studies established the National Simulation Center for Security Risks. Based on new technologies, primarily software, this center is a significant step forward, allowing for modeling and simulating crises. According to the Regulations on the Operation of the National Simulation Center, its services are not limited to the Faculty of Security Studies. They are available to academic community members, scientific research and educational institutions, professional associations, and students of the Faculty of Security Studies and related higher education institutions, making everyone part of the solution [5]. The National Simulation Center's advantages lie in its organizational unit as a state university. The center possesses technological capabilities, including equipment and software dedicated to security research and problem-solving, that are not available in other units of universities (public or private) in Serbia. At the same time, the center serves as a project hub for all universities in the country, bringing together project teams that research and address security issues, making it unique in its role and function.

At the Third Memorial Conference “Predrag Marić”, dedicated to emergencies, the center, in collaboration with members of the firefighting and rescue units, presented a live simulation of fire extinguishing [5]. The establishment and operation of the center not only mitigate the gap between knowledge and behavior but also fulfill the legally defined tasks of higher education institutions—to actively participate in disaster risk reduction through their work. This active participation, a significant step towards effective disaster risk reduction, reassures the audience of the Faculty of Security Studies' commitment to this crucial field.

6.2. University of Defence Military Academy

Although the University of Defense was established in 2011, the Military Academy boasts a 174-year-long tradition [94]. In addition to the Military Academy, the University also includes the Military Medical Academy. The primary goal of the University of Defense is to provide professional education to meet the needs of the Ministry of Defense and the Serbian Armed Forces. However, in line with the changes in the security environment, the identification of new security threats, and military reforms in the early 21st century, a new mission for the Serbian Armed Forces was defined: assisting civil authorities in natural disasters, technological incidents, and other emergencies. As part of this mission,

the Serbian Armed Forces and the cadets of the Military Academy made a significant contribution during the catastrophic floods that struck Serbia in 2014 [95]. Military education underwent reforms by this mission, leading to the accreditation of a new master's program in Natural Disaster Risk Management at the Military Academy in 2019. This program aims to improve environmental protection through education, which aligns with sustainable development. The master's program offers four core courses and seven elective courses (Figure 4) [96]. Although, according to available information, there are 617 students enrolled at the University of Defense, the enrollment quota for the Natural Disaster Risk Management program is only 25 [97].

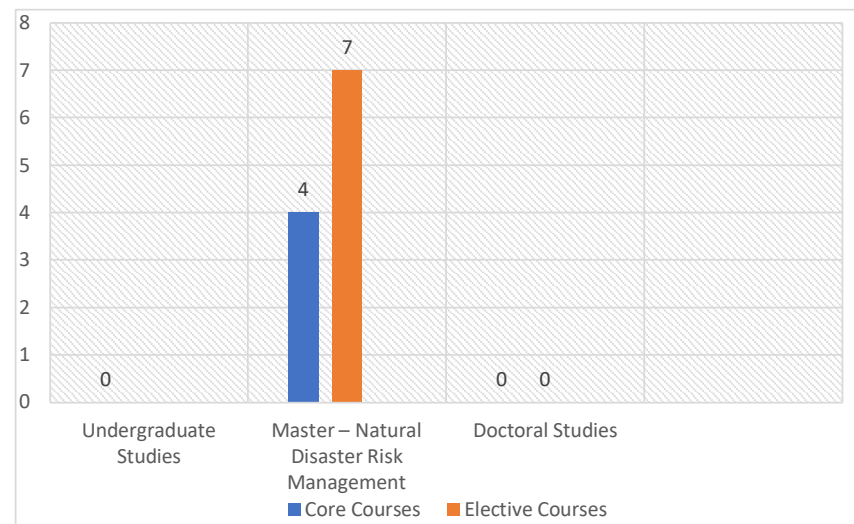


Figure 4. Distribution of courses at all study levels—University of Defense Military Academy.

Three core and six elective courses were selected based on the established criteria (Figure 5).

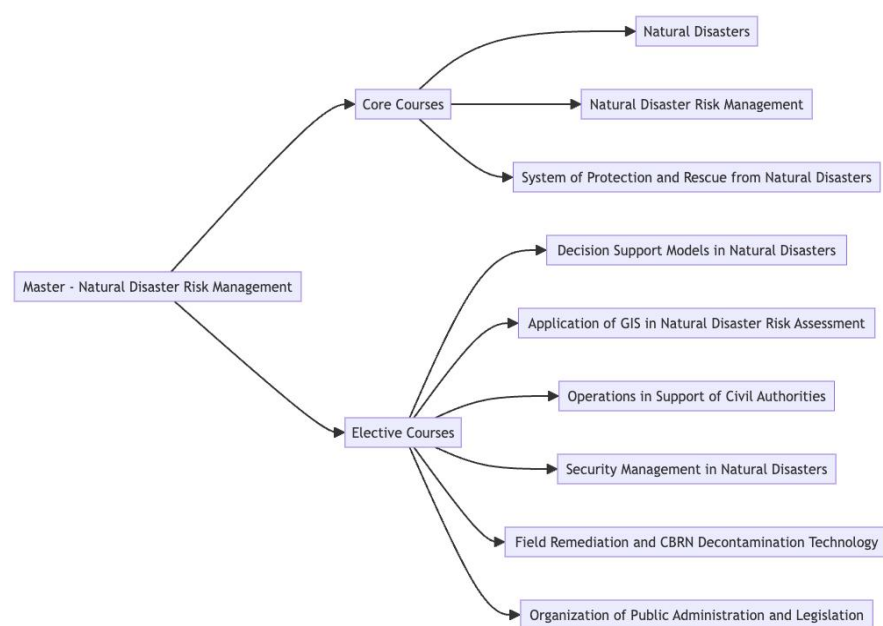


Figure 5. Selected courses at the University of Defense Military Academy.

Curriculum Content Analysis

Upon analyzing the curricula, particularly the content, defined objectives, and learning outcomes for the selected courses at the master's level, it is evident that they strongly focus

on developing general competencies for students. The curricula offer a comprehensive understanding of environmental security, emergency management, climate change, and disaster risk reduction, and a traditional learning approach is applied. The only exception is in courses that deal with solving specific risk management problems, where the use of GIS, appropriate simulation models, and CBRN technologies (Chemical, Biological, Radiological, and Nuclear) for field decontamination is emphasized. This focus on developing general competencies reassures the audience about the skills their students will acquire.

6.3. University of Criminal Investigation and Police Studies

This state university was officially established in 2018, although education in police work dates back to 1921. The university comprises three departments: the Department of Criminology, the Department of Informatics and Computing, and the Department of Forensic Engineering. In line with the classification of these departments, courses in criminology, forensics, and informatics are offered at the undergraduate, master's, and doctoral levels. The Department of Criminology also offers courses in study-abroad programs and undergraduate vocational and specialist studies. The master's program in criminology includes three distinct specializations: Criminal Investigations, Criminology and Legal Response to Crime, and Contemporary Challenges and Police Unit Management. In addition to these programs, separate master's programs in National Security and Natural Disasters Security Risk Management are also offered.

Although this university provides specialized education for police work, the criminology, forensics, and national security programs include courses that provide foundational theoretical knowledge in environmental security, environmental protection, and environmental crime [98].

From a research perspective, the master's program on Natural Disasters Security Risk Management is particularly significant. This program has been developed through the university's international collaboration with the Erasmus+ program of the European Commission, titled "Development of Master Curricula for Natural Disaster Risk Management in Western Balkan Countries". The program was accredited in 2019, with an enrollment quota of 16 students per year [99]. It also aligns with the fact that Serbia's most prominent national body in the field of emergencies—the Sector for Emergency Management—is under the jurisdiction of the Ministry of Internal Affairs of Serbia.

Given the complexity of the organizational structure and the numerous courses across study programs, a figure will depict only the distribution of courses within the master's program in Natural Disasters Security Risks Management [100] (Figure 6).

Two core and three elective courses were selected based on the established criteria (Figure 7).

Curriculum Content Analysis

By analyzing the curricula, particularly the content, defined objectives, and learning outcomes for the selected courses, it can be concluded that both compulsory courses provide foundational theoretical knowledge on the concept and classification of natural disasters, climate change, protective measures, and risk analysis. While traditional lecture methods are predominantly used, the course on Natural Disasters stands out with its practical instruction on applying GIS in natural disaster risk assessment.

An analysis of the elective courses reveals a comprehensive approach, with a continued trend toward theoretical instruction and an increased application of new technologies. Particularly in the courses Modeling and Simulation of Natural Disaster Security Risks and Information and Communication Support for Managing Natural Disaster Security Risks, students are exposed to a wide range of technologies aimed at DRR, including sensors, satellites, GIS, global navigation satellite systems, drones, mobile applications, software, and similar tools.

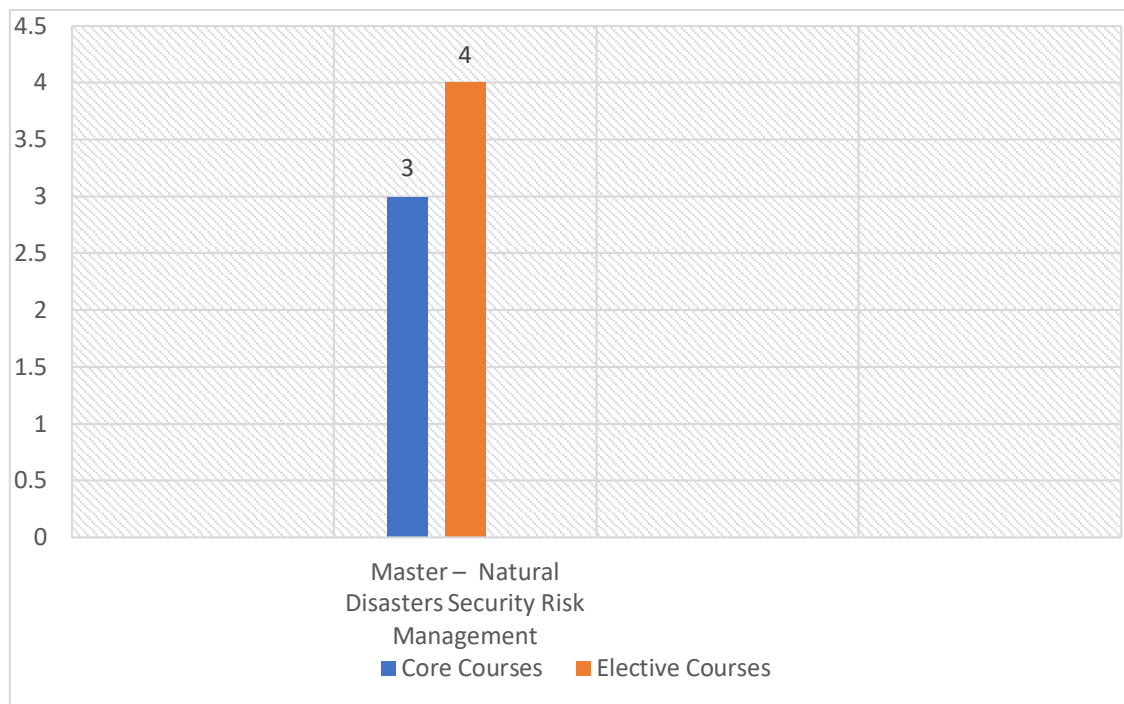


Figure 6. Distribution of selected course—University of Criminal Investigation and Police Studies.

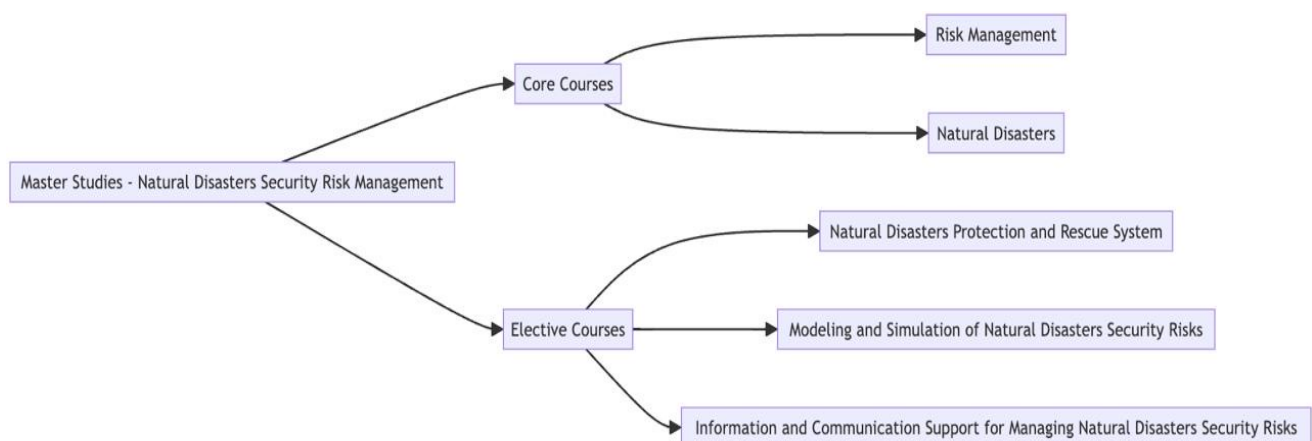


Figure 7. Selected courses at the University of Criminal Investigation and Police Studies.

In the Modeling and Simulation of Natural Disaster Security Risks course, theoretical instruction covers the theoretical aspects of natural disaster variables essential for modeling, mathematical and statistical models, and an introduction to modeling software. The course also strongly emphasizes the practical component, which is based on using GIS for hazard assessment and software for simulation and risk assessment. In the course Information and Communication Support for Managing Natural Disaster Security Risks, students learn about the theoretical aspects of new technologies (GIS, sensors, satellites, drones, etc.) and their practical application through case studies.

6.4. Singidunum University

Singidunum University is a private University founded in 1999. The University represents an integration of eight faculties and two centers, offering thirteen undergraduate study programs, twelve master's programs, and five doctoral programs. According to available documents, security studies were accredited in 2024, while the environmental protection and sustainable development programs were accredited in 2019 [101,102]. That

same year, the master's programs were accredited, followed by the doctoral programs in 2020 [102–104]. Within the security studies program, 20 core and 19 elective courses were analyzed, while in the environmental protection and sustainable development program, 26 core and 12 elective courses were examined. There are four core and four elective courses at the master's level and three core and six elective courses at the doctoral level (Figure 8). According to accreditation, 100 students can enroll in the first year of the security studies program, while the enrollment quota for undergraduate environmental protection studies is 75. The allowed enrollment quota for the master's program in environmental protection is 25 students; the exact number applies to doctoral studies [105,106].

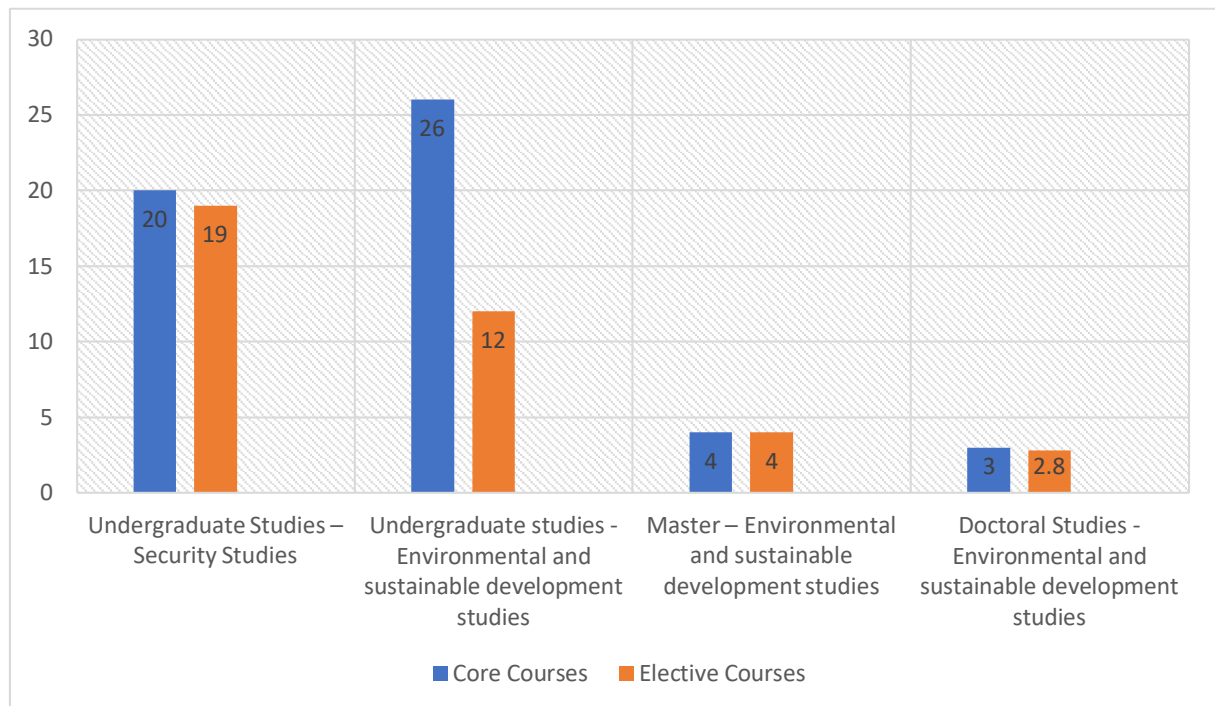


Figure 8. Distribution of all courses at all study levels—Singidunum University.

Based on the established criteria, one core and three elective courses were selected from the existing security studies courses, while four core and two elective courses were chosen from the undergraduate programs for environmental protection and sustainable development. One core and two elective courses were analyzed from the master's program, and two core and one elective courses were examined from the doctoral program (Figure 9).

Curriculum Content Analysis

The analysis of the available descriptions for the selected security studies courses indicates that most subjects provide theoretical and basic knowledge about ecology, crises, disasters, and sustainable development. However, the potential of modern technologies to revolutionize disaster risk reduction has yet to be fully explored in these courses. A similar conclusion is drawn from the analysis of the available information on the courses in the Environmental and Sustainable Development Studies program at the undergraduate level. There is a clear need to incorporate these technologies into the curriculum to inspire students with the possibilities they offer.

On the other hand, the curricula for courses at the master and doctoral levels in environmental and Sustainable Development Studies include subjects such as Contemporary Data Processing Methods in Environmental Science and Data Science in Environmental Studies. These courses are designed to equip students to understand and apply modern statistical methods and machine learning algorithms. The urgency of updating our knowledge in these areas is clear, and the aim is for students to interpret the obtained results effectively.

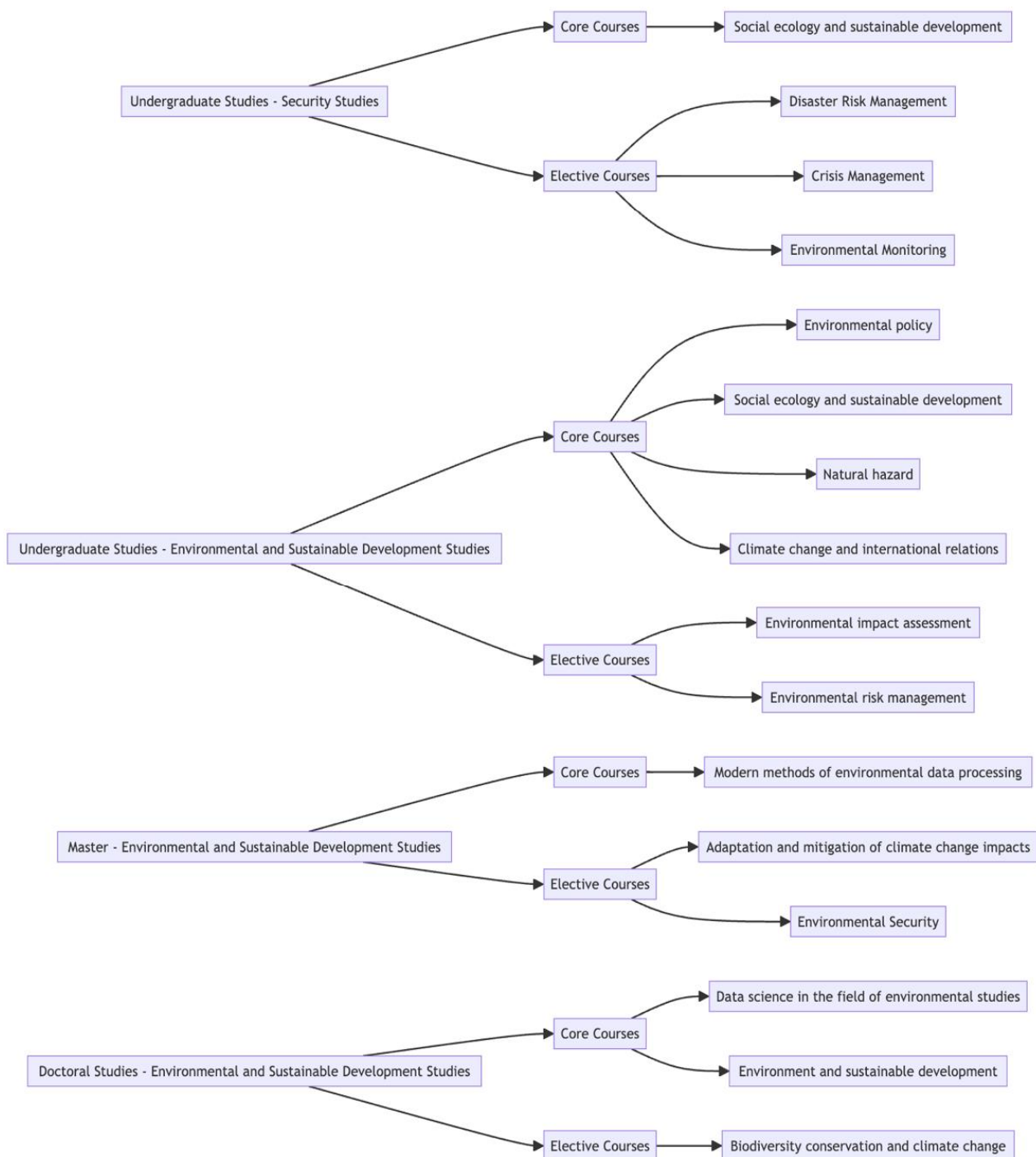


Figure 9. Selected courses at the Singidunum University.

6.5. Educons University—Faculty of Security Studies

Educons University is a private University established in 2008 and has seven integrated faculties, one of which is the faculty of Security. The university's commitment to excellence was recognized with its accreditation in 2019 [107]. The Faculty of Security offers programs at all three levels of study—undergraduate, master's, and doctoral. The undergraduate program includes 23 core and 14 elective courses, the master's program offers three core and six elective courses, and the doctoral program features one core and 13 elective courses designed to meet the highest educational standards (Figure 10) [107]. According to accreditation documents, the enrollment quota for undergraduate security

studies is 120 students, for the master's program, 25 students, and for the doctoral program, the quota is 10 students [108,109].

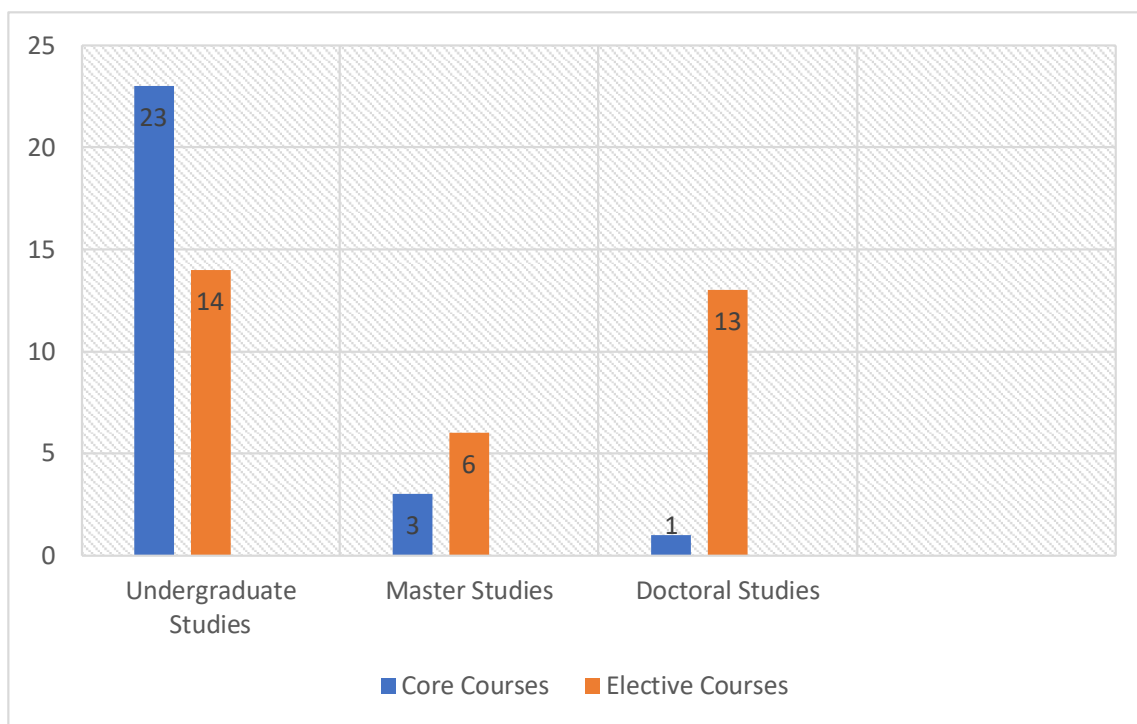


Figure 10. Distribution of all courses at all study levels—Educons University—Faculty of Security Studies.

After analyzing the available course materials and based on the established criteria, a selection of courses was made. From the undergraduate program, three core and one elective course were selected. At the master's level, no courses were identified that meet the criteria, while at the doctoral level, one elective course was chosen (Figure 11).

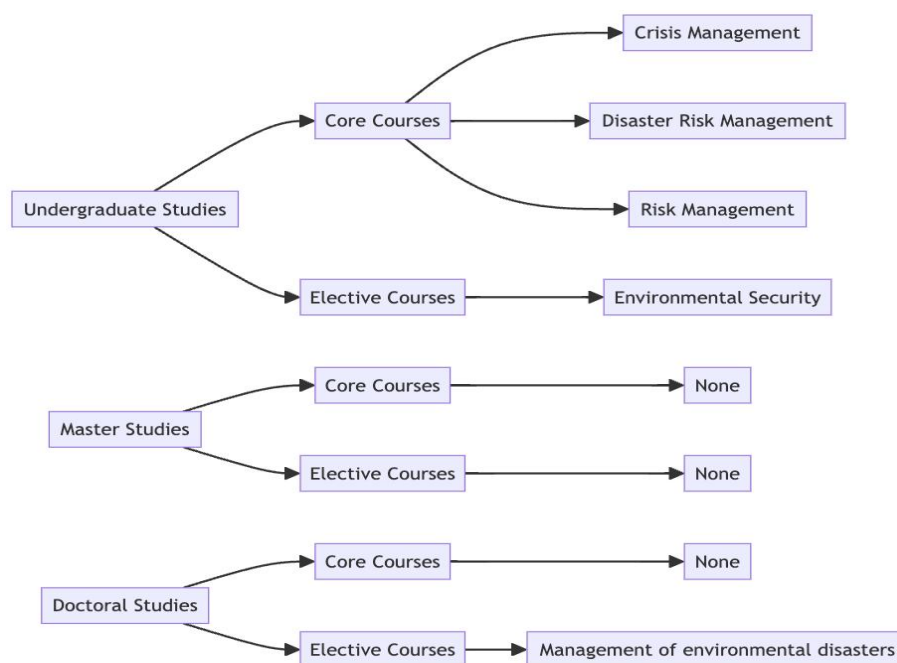


Figure 11. Selected courses at the EDUCONS University—Faculty of Security Studies.

Curriculum Content Analysis

The analysis of the available descriptions for the selected security studies courses indicates that most courses provide theoretical and basic knowledge about ecology, crises, disasters, and disaster risk reduction. Most undergraduate courses follow a traditional model of delivering theoretical knowledge. However, the Ecological Security course stands out with its unique approach, which includes practical student engagement by simulating event chains leading to emergencies, sparking curiosity and interest among students.

Unlike the other institutions analyzed, none of the master's courses are dedicated to disaster risk reduction. At the doctoral level, one elective course, Management in Ecological Disasters, fits the research criteria. While this course includes a traditional approach to theoretical knowledge transfer, it also features a presentation on the use of drones for fieldwork after disasters. However, it is crucial to note that this presentation underscores the need for student training in using these technologies, highlighting the importance of practical skills in disaster management.

7. Discussion

Analyzing publicly available curricula for security and defense study programs in Serbia reveals the connection between security, defense, sustainable development, and DRR. It underscores the significance of the current 'renaissance' in security and defense studies. This resurgence is a response to recognizing new security threats and emerging innovative security concepts. Almost all analyzed study programs and selected courses provide students with foundational knowledge in environmental security, emergency management, climate change, and disaster risk reduction, reflecting this evolving landscape.

The predominant reliance on traditional teaching methods is noticeable across all faculties, commonly called the "transmission paradigm". At the undergraduate level of the Faculty of Security Studies, University of Belgrade, only two of the analyzed courses actively engage students in practical applications, particularly in using technologies for disaster risk reduction, with a primary focus on GIS. The situation improves slightly at the master's level, particularly in the Disaster Risk Management program, where five of the analyzed courses incorporate active teaching methods, such as simulations, interactive workshops, the application of GIS, simulation training, and exposure to emergency management software. However, traditional teaching methods dominate at the doctoral and specialist study levels. The Faculty of Security Studies made a significant step forward in using new technologies by establishing the National Simulation Center for Security Risks, which relies on software that enables the modeling and simulation of crises.

At the University of Defense—Military Academy, disaster risk reduction education is conducted only within one master's program. Even in this program, traditional teaching methods are dominant, except for two courses that address specific risk management challenges using GIS, relevant simulation models, and CBRN technologies for field decontamination.

Within the University of Criminal Investigation and Police Studies, the most significant program from the standpoint of defined research and established criteria is a distinct master's program developed through international cooperation—Natural Disaster Security Risks Management. Although theoretical teaching methods also predominate in this program, it is more oriented toward a theoretical understanding of new technologies. Additionally, three courses include practical applications of GIS and software for risk assessment and simulation.

At Singidunum University, the analysis of selected courses revealed a need for more content related to using new technologies in disaster risk reduction. However, the curricula of master's and doctoral studies in Environmental and Sustainable Development Studies offer a glimmer of hope. These programs allow students to learn modern statistical methods and artificial intelligence (AI) techniques, paving the way for the future application of these methods and algorithms in data analysis. These are the only courses across all analyzed faculties covering AI in disaster risk reduction, indicating a potential for significant improvement in this area in the future.

At the last analyzed institution, Educons University, most courses are based on the traditional knowledge transfer model, except for one undergraduate course that involves practical student engagement through scenario simulations of events leading to emergencies. Additionally, one doctoral course includes a presentation on the use of drones for post-disaster fieldwork. However, this presentation does not include actual student training in using these technologies, so this course can also be categorized as following the traditional knowledge transmission model.

8. Conclusions and Recommendations

This study highlights the increasing relevance of DRR within the context of security studies and sustainable development in Serbia. As climate change continues to attract attention, natural hazards such as floods, wildfires, and extreme weather events pose significant threats to the environment, national security, and social stability. As security threats diversify, security studies in Serbia have begun to address the broader scope of human security, acknowledging that disaster risks, environmental degradation, and resource scarcity are interconnected and critical to national stability.

Our analysis of the curricula at public and private universities in Serbia reveals a growing but uneven incorporation of DRRE. Notably, the Faculty of Security Studies at the University of Belgrade, the Military Academy of the University of Defense, and the University of Criminal Investigation and Police Studies strides away in this area. However, private universities such as Singidunum University and Educons University, while offering environmental studies and sustainable development programs, have more limited inclusion of DRR-specific courses. The application of new technologies for disaster risk reduction also needs to be revised across these institutions.

One significant step forward is establishing the National Simulation Center for Security Risks at the Faculty of Security Studies. This center represents a pivotal initiative to bridge the gap between theoretical knowledge and practical disaster management skills. It utilizes simulation-based training to offer students hands-on experience in crisis management, preparing them to respond effectively to various disaster scenarios. Despite its potential, the adoption of simulation-based and technology-enhanced learning methods still needs to be improved in other Serbian institutions, particularly private faculties.

Traditional teaching methods still dominate in most public and private institutions. Students need more opportunities to engage actively with new technologies such as GIS, drones, and AI, which are critical for effective disaster risk management in today's security environment.

Certain limitations of this study must be taken into account when discussing the topic of education for DRR. First, this study includes only accredited security and defense programs with publicly available curricula. Based on the curricula, it is impossible to determine the instructors' competencies for conducting DRR education, especially for practical teaching. Such research has yet to be carried out.

It is crucial to note that, unlike research focused on primary and secondary education [110–112], no studies are available that assess students' perceptions of the competencies they acquire during and after their education or their practical application. This lack of data underscores the urgent need for more comprehensive reporting systems from higher education institutions regarding ESD and DRRE. The absence of such systems is highlighted by the fact that SDG 13 and its related targets are not monitored in Serbia and are, therefore, absent from official reports on achieving sustainable development goals in the country [113].

To enhance the role of security studies in addressing disaster risk reduction and sustainable development, the following recommendations are proposed:

- **Standardized DRR Course Requirements Across Institutions:** To bridge the gap between public and private institutions, a national framework could mandate a minimum level of DRR content across all security and defense studies programs. This would

ensure that all students, regardless of their institution, receive foundational knowledge and skills related to DRR.

- **Identifying Course Objectives and Outcomes:** Courses should clearly outline measurable objectives and outcomes aligned with real-world skills and knowledge applications. This can ensure that students acquire theoretical knowledge and understand how to apply it practically, thereby bridging gaps between academic knowledge and professional expectations.
- **Incorporation of Emerging Technologies:** Curricula should incorporate modern technologies, such as Geographic Information Systems (GIS), drones, video games, virtual reality, and artificial intelligence (AI), as essential tools in DRR education. Technology integration should not be limited to select courses but embedded across various DRR-related subjects to ensure students gain practical skills in managing complex disaster scenarios. Universities should strengthen their investment in these technologies to stay aligned with global trends in disaster management.
- **Active Learning Methods to Replace Traditional Teaching Models:** To encourage proactive behavior among students, a shift from traditional knowledge transmission to interactive learning approaches, such as scenario-based simulations and workshops, is recommended. This shift may promote practical understanding, bridging the gap between theoretical knowledge and real-world applications. Both public and private institutions should embrace interactive teaching techniques that allow students to apply theoretical knowledge in real-life scenarios, improving their readiness to respond to emergencies.
- **Promote Access to the National Simulation Center for Security Risks:** The National Simulation Center at the Faculty of Security Studies is the national resource for training students from public and private universities. Establishing cooperation between universities and expanding access to the center will allow students from all institutions to benefit from simulation-based disaster management training. This will enable more students to gain practical, technology-driven experience in disaster risk management. Simulations can be critical in preparing students for real-world disaster scenarios and fostering decision-making skills in high-stakes environments.
- **Strengthening faculty development and training programs** is critical to improving DRR education in Serbia. Faculty members must be trained to effectively incorporate new technologies and innovative teaching methods into the curriculum. This investment in faculty development reassures the audience about the commitment to providing high-quality education that prepares students for modern security and sustainability challenges.
- **Develop Reporting and Monitoring Systems for DRRE Outcomes:** Since student competencies and practical skills acquired through DRRE are currently unmonitored, Serbian universities should implement systems to track and report DRRE-related competencies and outcomes. This data collection can contribute to a clearer understanding of the effectiveness of DRRE in Serbia and support evidence-based improvements.
- **Encourage Research on Student Perceptions and Skill Application:** The absence of research on student perceptions of DRRE competencies underscores the need for studies examining how students perceive and apply their DRR knowledge post-graduation. Such research can provide critical insights for curriculum enhancement and practical training development.

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