


Editorial

Enhancing Security, Sustainability and Resilience in Energy, Food and Water

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Abstract: Our societies build largely on the concept of security and the ultimate justification for our present-day states is to ensure internal and external security of their citizens. While this task has traditionally focused on local and national scales, globalisation and planetary-scale challenges such as climate change mean that security connects also to a variety of sectors and has a stronger global dimension. Security is therefore increasingly connected with sustainability, which seeks to ensure that we as humans are able to live and prosper on this planet now and in the future. The concepts of energy security, food security and water security—as being used separately or together—manifest the burgeoning linkages between security and sustainability. This Special Issue brings together ten scientific articles that look at different aspects of security, sustainability and resilience with an emphasis on energy, food and/or water in the context of Finland and Europe. In this Editorial, we introduce the key concepts of the Special Issue, synthesise the articles' key findings and discuss their relevance for the on-going deliberations on security and sustainability. We conclude that ensuring sustainable security—or secure sustainability—requires systemic, structured processes that link the policies and actors in these two important but still distant fields.

Keywords: security; sustainability; resilience; nexus; linkages; energy; food; water; Finland

1. Introduction: Security, Sustainability and Resilience in Energy, Food and Water

Security and sustainability are increasingly connected. Ensuring internal and external security continues to form the key justification for our present-day states. However, the use of security as a concept has broadened from national security concerns to other sectors and scales, extending to considerations of securities related e.g., to the planet, environment and climate [1–7]. At the same time, sustainability forms a critical objective for modern societies, as exemplified by several national and regional strategies (e.g., [8,9]) as well as by UN Sustainable Development Goals i.e., SDGs [10].

Sustainability and sustainable development (which is supposed to provide the pathway towards sustainability [11]) are traditionally closely linked to natural resources. Today, security policy is rapidly getting more and more intertwined with policies and practices related to the use of natural resources, as can be seen from the booming concepts of energy security (e.g., [12–15]), food security (e.g., [16,17]) and water security (e.g., [18–21]). While energy, food and water are critically important for societies, their availability is becoming more constrained, with drastic differences between regions and actors in accessing them (e.g., [22–24]). Resource flows and value chains crisscross national boundaries, making their governance intersectoral and transnational by their nature (e.g., [25]). These three resource sectors are inherently linked, as is envisaged by different nexus approaches (e.g., [26–29]). All these features encompass the relevance of these resources for both security and sustainability, and call for systemic and future-orientated thinking to understand the complexities and challenges included in such connections.

Closely related to both sustainability and security is the concept of resilience. While security and sustainability can both be understood as goals, or even purposes, for a system (e.g., city, state or planet earth), resilience designates certain characteristics of a system that makes it work. Resilience is thus a measure of a system's ability to survive and persist within a variable environment that sees different kinds of changes over time [30]. The resilience concept is used regularly in relation to socio-ecological systems when describing their ability to withstand and respond to changes—whether environmental, economic, social or political (e.g., [31,32]). Yet, resilience as a concept has been actively used in other fields as well [33], and it is increasingly being used also in relation to (national) security under concepts such as state resilience or societal resilience (e.g., [34–40]).

Despite their centrality to our societies, systematic coupling of sustainability and security remains rare. Instead, both have their own policies and practices, and related actors and scales. We see that the broadened interpretations of both security and resilience can help in analysing and understanding the intricate and fundamentally important linkages between security and sustainability (see also [41–43]). This means that instead of focusing on global development challenges or national security threats separately and through detached policies, the concepts can help to build bridges between them. At the same time, their broadened conceptualisation has arguably allowed different interpretations by various actors, making their practical implementation prone to political loadings.

The call for this Special Issue, “Enhancing Security, Sustainability and Resilience in Energy, Food and Water” in the Sustainability journal was open for multi-, inter- and transdisciplinary research articles that study security, sustainability and/or resilience with a focus on energy, food and/or water. These three concepts and three themes were also the focus of our Winland research project that was funded by the Strategic Research Council at the Academy of Finland (<http://winlandtutkimus.fi/english>). Many of the Special Issue's articles are therefore linked to that project [6,44,45].

2. Key Findings from the Special Issue Articles

The Special Issue includes ten articles, all looking at the concepts of security, sustainability and/or resilience in relation to energy, food or water. In terms of study contexts, the articles focus on Finland or Northern Europe, primarily at a national scale, providing possibilities for comparison and complementary findings. In this section, we briefly summarise the main contexts and key findings for each article. Their joint findings and related conclusions are then discussed in the next section.

The first article, by Jaakko Jääskeläinen et al., focuses on energy security, looking at energy trade between Finland and Russia [46]. The authors focus on Finland's dependence on Russian energy and its possible security implications, noting that Finland's complex relationship with Russian energy trade has raised concerns over whether the dependence on one supplier forms an energy security threat. Applying energy policy scenarios and an interdependence framework to analyse the countries' energy systems and strategies, the authors found no acute energy security threats related to the energy trade between the two countries. At the same time, the authors note the critical economic and political importance that energy has for Russia. This makes energy a strategic asset for Russia, indicating that it has close linkages with the country's geopolitical considerations as well as other strategic sectors such as the military. The authors also note that the energy relations and the related concept of energy security between the countries go beyond the flow of fuels and electricity, highlighting the critical societal, political, and economic aspects of energy production and trade.

Ossi Heino et al. look at the role that critical infrastructure has for the security and resilience of modern societies [47]. Defining critical infrastructure as systems whose disruption or collapse would lead to serious consequences and crises of social order, the authors make use of a stakeholder workshop to look at two case studies related to energy (nationwide electricity grid disruption) and water (intentionally contaminated water supply in a city). The authors emphasise the importance of the interdependencies between critical infrastructure systems, noting that such interdependencies occur in various ways, namely between different systems, between different stages of system development, and between different operational and maintenance phases of those systems. The authors conclude

that producing security requires typically continuous interaction and creation of meanings between varying actors and logics. This, in turn, implies a need for changes in thinking—in particular related to problem definition across conventional administrative structures, geographical boundaries and conferred powers.

Elina Lehtikoinen et al. study the role that food production in water-abundant areas could have in combating global water scarcity and resource-efficient food production, focusing on the export potential of water-intensive cattle production from Finland [48]. Using four different scenarios, the authors calculated Finland's virtual water net export potential through a combination of domestic diet change and reallocation of the present underutilized agricultural land. The results indicate that the greatest potential to net exports of virtual water could be achieved when local feed production was maximized for domestic use and export, and bovine meat consumption in Finland was replaced with a vegetarian substitute. This scenario would correspond annual virtual water consumption for food of about 3.6 million people. The results emphasise how water-intensive production in water-rich areas could have a significant impact on global water savings, enhancing both water security and food security.

Related to the previous article, Elina Lehtikoinen and Arto O. Salonen look at food preferences in Finland, focusing on sustainable diets and their differences between consumer groups [49]. Building on the notion that food consumption is not just caloric intake but a profoundly personal matter based on individual preferences, the authors assessed how sustainable food choices vary among Finnish citizens based on extensive questionnaire data. The results indicate differences in personal preferences between men and women, as well as between different age and income groups, with middle-aged men with high incomes being the most reluctant group to adopt sustainable diets. The authors conclude that transition towards more sustainable diets among Finns works out best if people feel that they can combine altruistic factors (e.g., ecological benefits) and hedonistic factors such as health or weight loss in their diet.

Noora Veijalainen et al. carry out a national scale drought impact analysis for Finland, assessing the effects of a severe drought on water resources in Finland [50]. The analysis includes three main phases: simulating water levels and discharges during a severe reference drought, estimating how climate change would alter droughts, and assessing their impact on key water use sectors such as hydropower production and water supply. The results indicate that drought can be a risk multiplier for the water–energy–food security nexus even in water-abundant conditions such as those in Finland. The authors also recognise practical possibilities to enhance resilience to drought in different sectors, and recommend the inclusion of drought into selected regional preparedness exercises that are regularly organised in Finland to enhance preparedness and enhance collaboration between relevant sectors and actors.

Lauri Ahopelto et al. build on the work by Veijalainen et al., identifying areas of Finland that are water-stressed and vulnerable to drought [51]. The authors apply a water use-to-availability analysis that makes use of national water permits and databases, and compares them with estimates from global models on Water Depletion Index. The results indicate that while most areas in Finland would have enough water also during drought, South and Southwest Finland would have difficulty securing sufficient water availability for all sectors, requiring water use prioritisation. As a result, the authors recommend that to enhance water security, Finland's water resources management system should include Drought Management Plans in most drought-prone areas. The most convenient way to do this would be to incorporate such plans into the EU River Basin Management Plans.

Emma Hakala and her co-authors contributed two articles to the Special Issue, both analysing the concept of environmental security and its linkages to general security discourse in Finland and Sweden. Their first article looks at the environmental threats through a novel three-level framework that brings analytically together local, geopolitical and structural impacts related to such threats [52]. Through exploration of the interactions between environmental change and society at different levels, the authors emphasise the importance of geopolitical and structural factors. The authors note that environmental security impacts have an interesting dual nature: while they unquestionably influence

societal security, they cannot be understood strictly as a matter of security policy. As a result, new kinds of (environmental) threats indicate that the security sector should adopt new modes of action, utilising, for example, risk assessments and preparedness activities as a means to take into account the security implications of environmental change.

In their second article, Hakala et al. use their three-level framework to study environmental security policies in Finland and Sweden and propose practical ways for developing more effective measures to tackle environment-related threats [53]. While acknowledging that environmental issues—and first and foremost, climate change—have become an increasingly established part of security and foreign policy discourse, the authors argue that the value of environmental security as a concept for policy practice has not gained the momentum it would deserve. Based on their analysis, the authors call for a development of a new policy approach to tackle environmental security impacts in a comprehensive manner. Such an approach should build on close interaction between different sectors as well as between researchers and policy-makers, should make use of risk assessment and scenario processes, and would ultimately require strong strategic intent due to multi-sectoral character and novelty of the concept of environmental security.

Mika Marttunen et al. look at the concept of water security, arguing that policies promoting it should build on a systemic understanding [54]. Consideration of the current and future state of water security as well as its linkages to food security and energy security are all needed. To facilitate this, the authors developed a novel assessment framework that defines water security through a criteria hierarchy consisting of four main themes, and then studies these in terms of their current state and trends, functionality of legislation as well as water–energy–food security linkages. Applying the framework to a national water security assessment in Finland, the authors note that the framework provides a systematic and visual way to assess water security. The authors conclude that using the framework collaboratively with different stakeholders enables identifying issues that may not otherwise be covered, facilitating discussion on water security and, importantly, recognising actions needed for its improvement.

The article by Antti Belinskij et al. focuses on the role that regulation has in the governance of water–energy–food linkages [55]. Building on the adaptive governance theory related to common pool resources, the authors look at how regulation can both enable and prevent innovative solutions for sustainability. The authors focus on one bottom-up solution, namely the plans of Finland’s largest dairy processor to establish novel manure treatment facilities. Such facilities would enhance the overall sustainability of animal agriculture by enabling biogas and fertilizer production, and reducing agricultural loading to waters, providing one example of synergies between water, energy and food security. Such plans would, however, also change the regulatory framework applied for manure treatment, as a treatment facility is a point-source pollution source that is regulated more strictly than diffuse pollution sources. The authors conclude that traditional top-down regulation related to food security in EU-Finland seems not to have the adaptive capacity to facilitate new, bottom-up solutions. This, in turn, points out the need to rethink some of the regulative practices related to environmental protection and food security and, more broadly, to water-energy-food security nexus.

3. Discussion and Conclusions: Ensuring Secure Sustainability and Sustainable Security?

What can we conclude jointly from the ten Special Issue articles—and more generally, from our Winland research project [44]? Our conclusions are threefold; related first, (thematically) to energy, food and water and their role for security and sustainability; second, (theoretically) to the connections between the concepts of security and sustainability; and third, (methodologically) to the need to address the security–sustainability connection in a systematic, structured manner. We next discuss these three aspects separately, and then conclude with some synthesising thoughts with Finland, the main study context in most articles, as a reference context.

First, it is clear that the three “resource sectors” of energy, food and water are closely linked, with each of them having strong implications to the other two sectors. While most of the articles focused

on just one or two of these sectors, practically all of them also emphasised the close connections that the three sectors have. Such a finding puts further emphasis on the significance of so-called nexus approaches that aim to find synergies and enhance policy coherence between these (and other) themes and their governance [25–27,56].

The articles also emphasise that energy, food and water have linkages to both security and sustainability, providing possibilities for connecting the two concepts. While all three sectors are in the core of sustainability, they are also critically important for societies' security, including preparedness and resilience to future changes. Related to this, the articles note that climate change, increasingly portrayed as a climate crisis or climate breakdown (e.g., [57]), puts an additional future pressure on the three themes. Climate change can even be seen to manifest itself through the energy–food–water nexus. While climate change mitigation depends critically on energy transition to a carbon neutral and carbon negative society, the main impacts from climate change will be felt through changes in the hydrological cycle and a major adaptation challenge is caused by its negative impacts to food security.

Second, the findings from the articles support the hypothesis of the Special Issue that security and sustainability are increasingly connected—and that such connections are particularly strong in relation to energy security, food security and water security. While most articles do not explicitly address the security–sustainability linkage, a great majority of the articles considers both sustainability and security related to energy, food and/or water, focusing on the use and management of these three resources for the well-being and development of societies.

The articles can thus be seen to link to the concept of the security–development nexus [1], and, in particular, to the period of development that has, during the 21st Century, been characterised by increased globalisation and emphasis on sustainability [2,10]. In this way, the Special Issue's articles also contribute to the discussion of the scale of security–sustainability linkages. While security and sustainability increasingly connect (and arguably also conflict) at a global scale, the articles remind us that such connections are pertinent also at lower scales, from regional to national and local.

Consequently, we conclude that resilience can be used as one connecting factor between security and sustainability. We have studied the different dimensions of resilience in our Winland research project [44,58–62], noting that resilience seems to have an increasingly important, although partly contested, role in both sustainable development and security discourses. Given that both sustainability and security policies need to address different changes, resilience as a system characteristics (and as a boundary object [63]) provides, therefore, one possible connection between security and sustainability.

Third, the findings documented in the articles support the idea that addressing security and sustainability, particularly if addressed together, requires systemic views and comprehensive policy approaches. While both security and sustainability cross several sectors and scales, the current policies focus too easily on local and national scale implications and largely neglect broader (and more complex) geopolitical and structural/systemic aspects [53]. Such a focus is, as such, understandable, as assessing comprehensively just one thematic area, such as water security [54], requires a major effort that is also subject to many interpretations and therefore easily contested. This indicates that instead of one fixed framework, comprehensive policy approaches promoting security–sustainability linkage should build, first and foremost, on enhanced interaction and co-creation between different actors, with such interaction being focused through common activities and shared interests [6] as well as strong strategic intent.

Establishing this kind of comprehensive policy approach embracing sustainability–security linkages is by no means easy. Yet, we see that Finland, the main study context of this Special Issue, is well-positioned to develop and promote such approaches. Finland already has advanced policies related to both sustainable development [64] and comprehensive security [7,65], and close collaboration between different societal sectors—many of whom are engaged in both sustainability and security-related planning and policy making. We hope that findings from this Special Issue will, for their part, encourage paying closer attention to the security–sustainability linkages, both in Finland

and more broadly. It is clear that our current challenges do indicate the need to enhance such linkages, be it under the synthesising concept of sustainable security or secure sustainability.

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