Part I

Political framework and institutions

Chapter 2

The concept of water and food security in Spain

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ABSTRACT: Water and food security are tags used widely yet hiding very different meanings depending on the context in which they are used. This chapter looks at what these concepts mean for Spain and across scale linkages due to globalisation. Since food production and access is largely guaranteed in Spain, food security here is linked to the idea of guarantying food safety and food health. As in other European countries, there has been a substantial shift in the dietary habits of Spanish consumers with changes to the recommended Mediterranean diet, with higher meat and processed food consumption, and a drop by half in the intake of cereals, legumes, fruits and vegetables. This chapter argues that dietary shifts have increased the water footprint of an average Spanish diet by 8%, which has been possible thanks the imports of green virtual water from third countries, without compromising Spain's water security. The chapter also reflects on the different dimensions of water security in Spain, and whether some aspects of water security (like protection from hazards or water availability) have been secured others represent important – sometimes contradictory – challenges like securing water for food or the environment. These links can be understood when framed by a global system with feedbacks between food production and consumption, impacting on agricultural production and water resources, food supply capacities, and environmental security.

Keywords: Mediterranean diet, nutrition, globalization, virtual water, environmental trade-offs

1 INTRODUCTION

Water and food security are tags widely used nowadays although these can hide very different meanings depending on the socio-economic context. This chapter sets the frame of what these concepts mean particularly in the context of Spain and its linkages across scales due to globalisation. Also, it emphasises that, in the long term, the overarching goal for Spain and other countries is how to meet water and food security without compromising national and international environmental security.

2 WHAT DOES FOOD SECURITY MEAN GLOBALLY AND FOR THE PARTICULAR CASE OF SPAIN?

The food price crisis of 2008 evidenced the vulnerability to hunger and food shortages of many countries throughout the world, and the need to place global food security as a high priority on the international agenda. In poor countries the effects of this price spike on staple food put at risk sufficient food access, exacerbating the hunger problem. In developed countries the price spike did not compromise food access of households for the most part, although it impacted on consumer's food purchasing power. For example, the average food consumer price index in Spain increased by about 7% compared to only 3% before (CEC, 2008). This differentiated set of consequences from price changes and volatility supports the idea that challenges to increase food security worldwide will vary depending on the socio-political context of countries.

The UN Food and Agriculture Organization (FAO) defines a country as food secure when "all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Hence, the overall goal is not only about ensuring sufficient food production, but also assure a stable access, with the added guarantee of quality at affordable prices. Yu *et al.* (2010) used a set of four different indicators (food intake, food production, trade security and agricultural potential) to quantify the degree of a nation's food security (see Figure 1) after Diaz-Bonilla *et al.* (2000). The dichotomy North-South is once again evidenced, with most Northern developed countries classified as food secure and most African and Andean countries being food insecure due to their insufficient production capacity and unstable market access, despite having a large agricultural potential. This evidences that in developing countries efforts could be placed on increasing agricultural productivity to satisfy the food demand from an increasing population. Ensuring sufficient production but above all a fair and stable access to food are two fundamental prerequisites to bridge the food gap. Also, a greater participation of these countries in world markets could increase their food security, as it will mean larger capacity to buy or sell food and to adjust their production to global price signals, which will generate larger government revenues and overall economic growth, all of which have direct or indirect impacts on the nutritional status of people in the country (Nouve, 2004). However, to reach this target more just and equitable international food trade regulations need to be formulated in the context of the World Trade Organization (Von Braun, 2008). In developed countries like those of EU-27 (and Spain as a full member of the EU), advances in food security are linked to maintaining both production and market access, ensuring the exporting capacity, guaranteeing the quality of products and reducing the environmental impacts associated with production processes (EC, 2010).

Yet the food security debate at the global level is very much focused on the quantitative side, although more recently the FAO is turning increased attention to the importance and potential for quicker progress by considering the qualitative aspect of "safe and nutritious food" and "food preferences for an active and healthy life". In countries like Spain production and access are largely guaranteed, and food security is linked to the idea of guarantying food safety and food nutrition. Figure 2 offers a

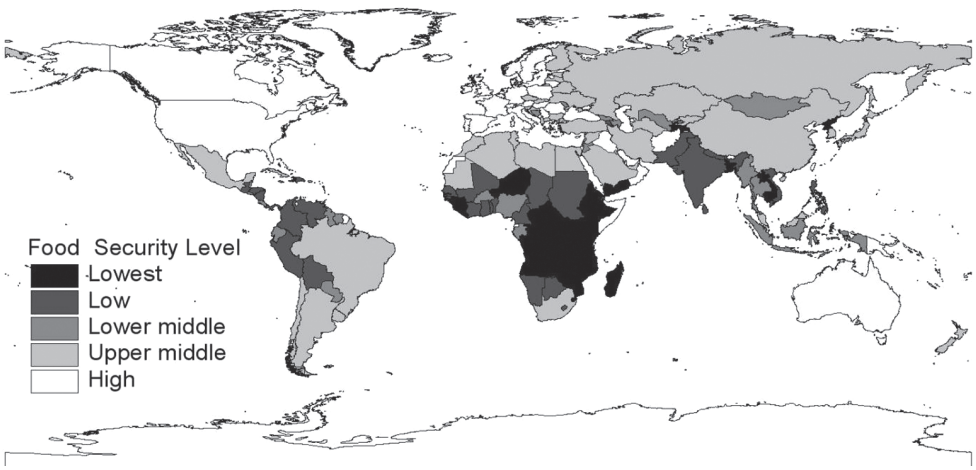

Figure 1 Global Food Security. (Source: Yu *et al.* (2010); calculation based on FAO (2009)).

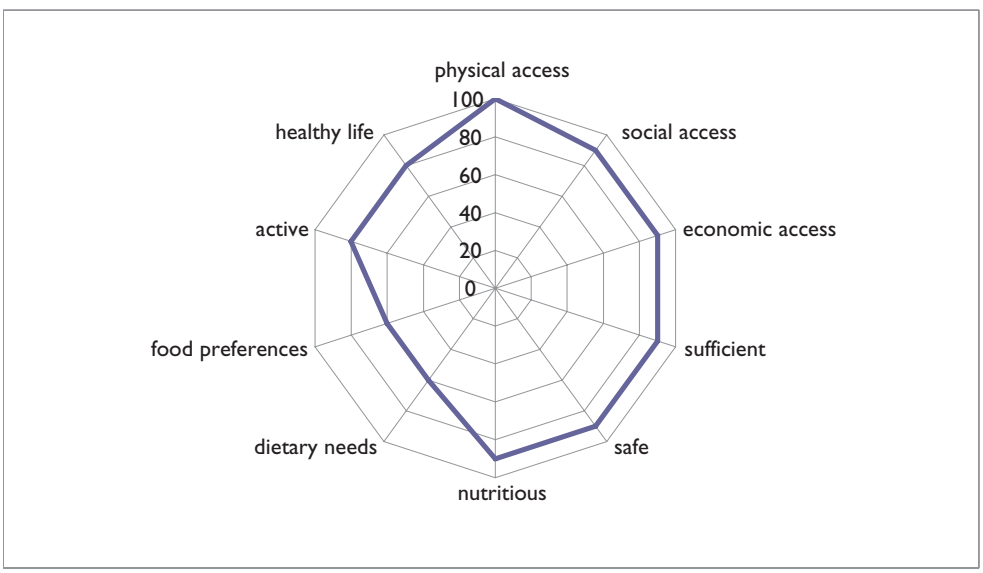

Figure 2 Different dimensions of food security applied to Spain on the basis of FAO definition. (Source: Own elaboration).

conceptual diagram to consider all the different qualitative aspects of food security definition applied to Spain.

The main initiatives taken on food safety in Spain so far refer to issues related to food labelling, and risks associated with the whole food chain. Thus, improving food safety in Spain is very much focused on increasing consumer's confidence after scares related to e.g. BSE *Bovine spongiform encephalopathy*, colza oil, and

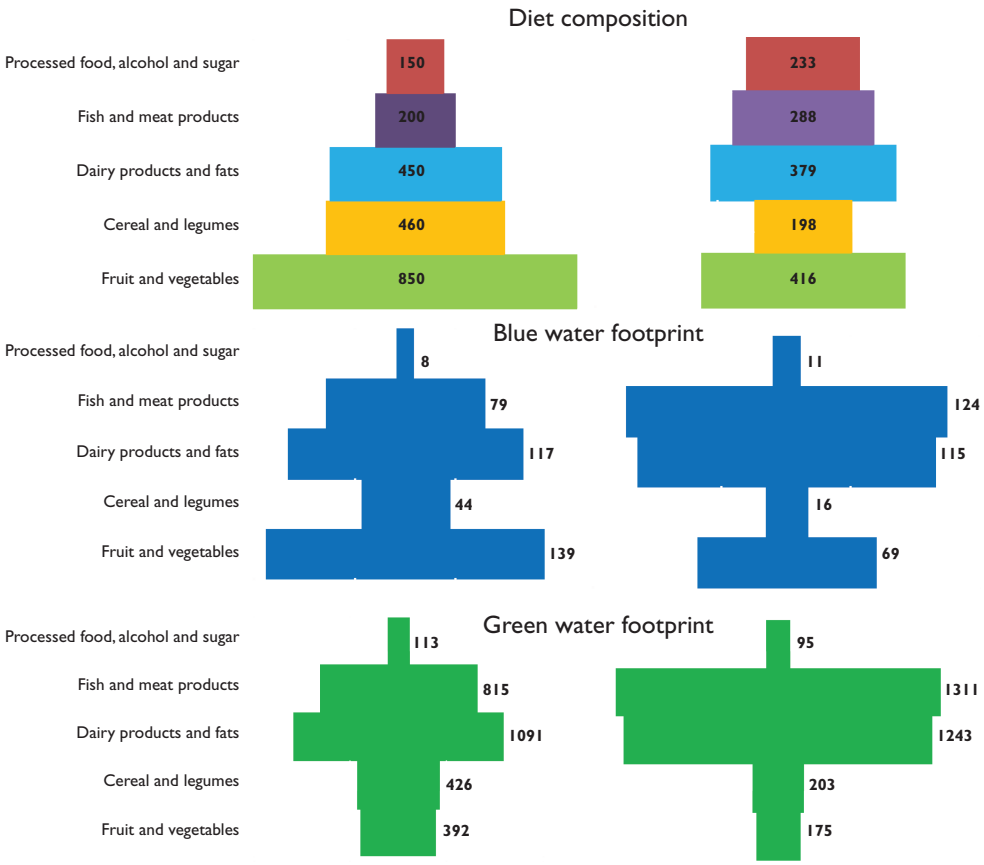

Figure 3 Composition (gr/person/day), blue and green water footprint (L/day) of the recommended Mediterranean diet (left) and the current average diet (right) of a Spanish adult consumer. (Source: Own elaboration based on data from SENC (2005) and AESAN (2006)).

more recently E-coli. To this end Spain set up in 2002 a National Food Security and Nutrition Agency (Agencia Española de Seguridad Alimentaria y Nutrición, AESAN). This agency is in charge of promoting food safety and the health of citizens, by adopting precautionary principles in food consumption and production, e.g. in relation with Genetically modified organisms or GMOs and food traceability to minimize food risk. Despite the efforts, Spain is confronting a nutritional problem, as 12.9% of the Spanish population is now obese, compared to e.g. 20% in the USA and 5% in countries like China or Japan (Aranceta-Bartrina *et al.*, 2005). As in other European countries, there has been a substantial shift in the dietary habits of Spanish consumers in the last decades (see Figure 2). Today Spanish consumers eat 30% more animal proteins and 60% more processed food (sugar, bakery, fast food) and alcohol compared to the gold standard Mediterranean diet, a diet officially recognized by the World Health Organization for its health benefits and its

equilibrated nutritional balance (Padilla *et al.*, 2006; 2010), and also considered part of Humanity's immaterial cultural heritage by UNESCO in November 2010. Meanwhile, the intake of cereals, legumes, fruits and vegetables has dropped by half. This has been possible to a large extent because of Spain's animal feed imports from third countries (mostly from Latin America), which have allowed the development of a growing livestock sector. From a water-requirement perspective, Spain can maintain its rate of livestock production thanks the imports of virtual water embedded in the soybean produced in countries like Brazil or Argentina. According to Fereres *et al.* (2012) the changes in the Spanish diet in the period 1964 to 1991 were about 20% of the water footprint in the average diet, whereas from 1991 the increase in the water footprint has been smaller (less than 5%). This is mainly attributed (as can be seen in Figure 2) to an increased consumption in animal proteins and fats (Fereres *et al.*, 2012). Comparing the water footprint of the current Spanish average diet with the recommended Mediterranean diet, our preliminary results show that following the recommended diet would mean a reduction of 8% of the total water footprint (WF) (green and blue) (from 1.1 to 1.0 hm^3/person/year). This decrease would be largely driven by a decrease in the green WF embedded in the current consumption of a greater quantity of animal proteins. However, the blue WF would rise (around 12%) as a result of a higher intake of fruits and vegetables, which is nowadays largely produced with blue water resources. The link can be interpreted as a feedback system between food consumption, production and linkages with global agricultural production and water resources, which affect food supply capacities and food consumption.

3 WHAT DOES WATER SECURITY MEAN GLOBALLY AND FOR THE PARTICULAR CASE OF SPAIN?

The concept of water security is relatively young, and has evolved since it first appeared in the literature at around the turn of the 21st century. Originally, the water security concept was approached from a physical perspective linked to national security, a concern over potential *green wars* and to cases where water could be a potential cause of conflict between neighbouring countries. Therefore, securing sufficient water resources and guaranteeing access was seen as strategic for national security (Houdret, 2004). More recently, attention has shifted to domestic conflicts, between groups or users. In Spain this in some ways echoes domestic trade-offs and regional conflicts that will have to be faced in the re-allocation of water between sectors and regions (Fereres *et al.*, 2012) and the potential securitization of water. This highlights the inherent scale specific nature of water security as discussed by Cook & Bakker (2012). Lately, the term has also been associated to virtual water as a means for a State to ensure *water security* through food imports (Allan, 2002; Guodong, 2003).

A more modern acceptation refers to the ability to assure the good functioning of the water cycle and all the functions associated to water, to allow the perennial use of water for all dependent activities and particularly the production of food and services associated to the good health of water-related ecosystems. In this sense ensuring *water security*, is seen as synonymous to providing resilient systems. Thus

Table 1 Definitions on the concept of water security.

	Water security: definitions
UNEP (2009)	"[…] water security represents a unifying element supplying humanity with drinking water, hygiene and sanitation, food and fish, industrial resources, energy, transportation and natural amenities, all dependent upon maintaining ecosystem health and productivity."
UNESCO-IHE (2010)	"Water security involves protection of vulnerable water systems, protection against water related hazards such as floods and droughts, sustainable development of water resources and safeguarding access to water functions and services."
Global Water Partnership (2010)	A water secure world harnesses water's productive power and minimizes its destructive force. It is a world where every person has enough safe, affordable water to lead a clean, healthy and productive life. It is a world where communities are protected from floods, droughts, landslides, erosion and water-borne diseases. Water security also means addressing environmental protection and the negative effects of poor management. A water secure world means ending fragmented responsibility for water and integrating water resources management across all sectors – finance, planning, agriculture, energy, tourism, industry, education and health. … A water secure world reduces poverty, advances education, and increases living standards. It is a world where there is an improved quality of life for all, especially for the most vulnerable – usually women and children – who benefit most from good water governance.

this coincides with the definition of Grey & Sadoff (2007) which defined water security as: "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies". Throughout history, the improvement of water security has been associated to the development of storage capacity, with Spain as a paradigmatic case. However, an integrated view of the way to achieve water security has emerged more recently, particularly associated to the *ecosystems services* concept, where the *good functioning* of the hydrological cycle and associated ecosystems can bring resilience and security (Willaarts *et al.*, 2012). Thus in the most recent acceptations water security (and food security as was previously shown) are now encompassed within the wider concepts of human security, in turn ultimately sustained by environmental security (López-Gunn *et al.*, 2012) (See Table 1).

As Cook & Bakker (2012) summarize, there are four interrelated themes that dominate water security: water availability, human vulnerability to hazards, human needs, with a special emphasis on food security and sustainability. All these threads are present in the kaleidoscope that is water security in Spain. First, in terms of water availability, from a historical standpoint water security has been a concern for its inhabitants from early times. This is only to be expected in a region subject to a semi-arid climate. Even today, Roman aqueducts and Arabic waterwheels scattered across Spain bear witness to the country's long-standing water management traditions. So do relatively sophisticated water supply networks such as Madrid's *qanats*. In other words, the *official* strategy was to alleviate scarcity by increasing the supply through dams and canals. This explains why Spain was one of the pioneering countries to

institute river basin authorities. It also explains why Spain ranks fourth, one of the world's leading countries in number of dams per million inhabitants. Second, from the perspective of human vulnerability to hazards, these are included into Spanish planning as a country vulnerable to climate variability and extreme events. For example, according to Estrela (pers. comm.), ex deputy director for water planning in Spain, the EU Directive 2007/60/EC on the assessment and management of flood risks, requires Member States to assess if all water courses and coast lines are at risk from flooding to map the flood extent, assets and humans at risk in these areas, and to take adequate and coordinated measures to reduce this flood risk. Its aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. In a new concern over climate change, there is now added interest on the intensification of the water cycle and protection against extreme events, principally floods and droughts (see Chapter 15). Third, in relation to human needs, with a special emphasis on food security, there has also been an on-going concern in Spain for *crop water security* marked by the importance of irrigation and securing water for the dominant water consumptive sector. However, the most predominant and on-going challenge for Spanish water security, as highlighted in Chapters 3 and 12, is environmental sustainability and the ecological functions aspects of water security.

The transposition of the EU Water Framework Directive (WFD) into Spanish law brought about certain paradigm shifts in water security, including the emphasis on the need to enforce environmental sustainability in water management practices. In this regard, the first step consists in establishing the baseline conditions of water bodies. This implies delineating the water bodies and establishing the uses and pressures these are subject to, as well as the economic value of water and a series of environmental objectives and measures to attain them. The WFD also establishes the mandate to maintain the *good status* of water bodies, and demands the restoration by 2027 of those that have been subject to severe modifications by human beings (see Chapter 3 on the WFD).

As explained earlier, the concept of water security is manifold. If water planning is broadly described as the process whereby water security is attained, then the nature of the water planning process is both technical and political. It is technical because it implies a series of objective studies to establish the status of water bodies and monitor their evolution, and it is political because it implies a process of negotiation on what the priorities are and whether exceptions need to be made. Regarding water security, the implementation of the WFD brings about changes that are far from subtle. This is because water security is no longer understood as *guaranteeing water supply for all human activities*. Rather, water security is now described as the simultaneous achievement of three general objectives. The first one relates to maintaining the *good status* of water bodies, the rationale being that water security begins by protecting the resource base on ecological functions. In second place, water planning should aim at meeting demands as identified by basin plans; finally, the law establishes that water management practices should strive to harmonize both principles by making a rational use of water. In other words, the water security concept has become richer at the cost of losing some focus. While this can be perceived as adequate in some ways, it also implies that water security is now subject to interpretations as to what *a [sufficiently] good status* means.

4 CONCEPT OF FOOD SECURITY AND VIRTUAL WATER TRADE IN SPAIN IN A GLOBALIZED WORLD

Food security and water security, as discussed earlier, are highly interconnected concepts. From a production perspective, one question is how to fill this water gap in order to achieve global food security goals. One important solution to close the supply and demand gap lies in technological innovation to increase yield (the yield gap), e.g. via agronomy and plant breeding (Fereres *et al*., 2012), and also by improving water productivity. In addition, fostering international food trade is another piece of the puzzle in global food security. Trade – if adequately regulated – has the potential to bridge the mismatch between areas with the largest production potential and those with large populations without the capacity to increase production (Rockström *et al*., 2009). Generally speaking, food trade improves physical and economic access to food by increasing food availability and lowering food prices for domestic consumers. From a water perspective, food trade can be described as the virtual flow of water from producing and exporting countries to importing and consuming countries. Several authors (Allan, 1993; Niemeyer & Garrido, 2011) have described how water short countries can enhance their food security by substituting national production by imports of water intensive food crops. However, from a natural resource point of view, the increased reliance on farm trade raises some crucial issues as exporting countries might not have the capacity or political willingness to curtail powerful exporting sectors on the basis of environmental constraints, compromising their natural capital or increasing the pressure on already stressed water ecosystems. Therefore, the consequences of globalisation on water and food security have to be examined on a case-by-case basis and cannot be generalised.

The study by Garrido *et al*. (2010) on the Spanish water footprint and nationwide virtual water trade showed that the Spanish water footprint amounts to about 45 km^3, of which 85% is from agriculture. From a water management and food security point of view, in absolute terms, Spain is a net importer of virtual water (Garrido *et al*., 2010). A high proportion of these virtual water imports result from feed stuff produced in Brazil and Argentina. This is in line with the changing dietary habits discussed earlier. The shift towards a more meat oriented diet leads to higher water (and land) resource requirements that cannot be fulfilled through self-sufficiency. Imports of animal feedstuff with low economic value and high water content are used as feed for high economic value livestock, which are then exported to large parts of Europe. In this regard international trade has contributed to national food security in Spain, at least in quantitative terms, but it has also brought other important issues that cannot be obviated: a growing health problem and a greater pressure on the natural resources of production countries (Willaarts *et al*., 2011).

5 CONCLUSION

According to FAO/OECD (2011), the rise in price commodities experienced in 2007/08 is predicted to continue to increase over the next decade by 20–30% compared to the period 2001–2010. The FAO/OECD attribute these predictions to several causes, such as a slower annual growth in agricultural stock levels and other

compounding factors like climate variability, energy prices, exchange rates, growth in demand, and potential trade restrictions and speculation. Current drivers of change include globalization, the rise of new powers in the emergent economies, the erosion of international institutions, and the rising geopolitics of energy, increasingly tied up with water through the water/energy nexus (see Chapter 14). This new emerging global system is multi-polar, with potential future rivalries predicted over trade, investments and technological innovation. The transfer of wealth, from old economies to new economies is happening at a speed and size (an *accelerated* phase) never witnessed before, in the so called era of *the anthropocene* (Steffen *et al.*, 2011). All these changes in the world balance have deep ethical implications for global water and food security (Lopez-Gunn *et al.*, 2012). In this context Spain is, in many ways, in a relative solid position thanks to a relatively strong water and food security. The main challenge lies on how to make the long term viability of water and food security, fit in with national and international environmental security, understood as securing that water and food security are not at the expense of environmental capital, either in Spain or as an external impact, through the import of food (virtual water) which could affect the achievement of water and food security in other nations now linked through international trade. As the FAO (2011) states, in many ways emergent and developing countries are, and will become, the engines for growth, while developed countries have a lot to offer in terms of food safety and environmental standards. The challenges are global regulations to prevent environmental and social dumping at a global scale.

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