TEC BACKGROUND PAPERS NO. 24

Coordinating land and water governance for food security and gender equality

By Madiodio Niasse

Global Water Partnership
Technical Committee (TEC)

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FOREWORD

The scarcity of arable land and freshwater is at the centre of debates about the global food security challenge. As a result, land and water have become strategic resources increasingly disputed at local, national, and international levels. The current context shows more clearly the close interlinkages between land and water – key management decisions and physical interventions about water having major repercussions on land, and vice versa.

This Background Paper explores the benefits of a coordinated approach to land and water governance in efforts to address the global food security challenge and the need to tackle gender inequality in access to and control over land and water.

The paper builds on the GWP Perspectives Paper Coordinating land and water governance (GWP, 2014) and on the outcomes of a workshop co-organised in Pretoria (South Africa) in June 2015 by GWP, the International Land Coalition, and the International Water Management Institute – Responding to the global food security challenge through coordinated land and water governance (Niasse et al., 2015).

The paper contributes to efforts to further operationalise the concept of integrated water resources management (IWRM). Although IWRM formally calls for land to be considered in water management decisions and processes, in practice land (its management and governance) is typically ignored in water discourses, policies, and governance frameworks. The paper contributes also to the water–food–energy nexus debate. Like IWRM, the nexus paradigm recognises and articulates the interlinkages between the governance of water and that of other resources, such as energy and ecosystems in the frame of efforts to address global food and water security concerns. Land issues cut across nexus approaches and strategies. Although the nexus concept is very attractive, the extent to which it can be operationalised to become an effective problem-solving tool is subject to an open debate.

The present Background Paper takes stock of progress made by GWP and the GWP Technical Committee over the last five years in the exploration of the interlinkages between the governance of water and that of land.

The subject is vast, complex, with multiple dimensions and fuzzy boundaries. This is because water permeates all aspects of life whose receptacle is land. This Background Paper only scratches the surface of the subject of coordinated land and water governance. The complexity of the task should not however discourage further investments in the conceptualisation and operationalisation of the need for interlinked governance of land and water.

As shown in this paper, there are clear indications that these two resources will be scarcer in the future and therefore will be more and more strategic, and increasingly interlinked and disputed resources at all scales. The importance of the subject deserves a more comprehensive, long-term, and multi-disciplinary study effort. This paper is a first step in this effort.

Jerry Delli Priscoli
Chair, GWP Technical Committee

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PREFACE AND ACKNOWLEDGEMENTS

Having constantly navigated between land and water all my career – as researcher, former expert at the World Commission on Dams, former chairman of GWP West Africa and, more recently, former Director of the International Land Coalition (ILC) – I have always perceived the delinking of the governance of water and that of land as artificial and abnormal.

Taking advantage of my appointment as a member of the GWP Technical Committee in 2012, while also serving at the time as Director of the ILC (based in Rome, Italy), I advocated for bridging the gap between land and water. This led to the signing of a Memorandum of Understanding between GWP and ILC, with the goal of "promoting integrated water and land management to create a water secure world and equitable and secure access to land". As part of this collaboration a junior position (jointly funded by GWP and the ILC Secretariat) was established from June–July 2012 to the end of 2014 to support the work on land and water management, in the frame of the implementation of the ILC–GWP collaboration.

After the publication of a GWP/TEC Perspectives Paper *Coordinating land and water governance* (2014) and the organisation of a workshop in 2015 on the same theme, this Background Paper is the third main milestone in this collaborative effort.

I would like to thank all those who directly or indirectly contributed to the preparation of this Background Paper. Special mention is made of Dr Jan Cherlet who served at Secretariat of the ILC from 2013 to 2015 as Land and Water Consultant, a position then established and jointly funded by ILC and GWP. Dr Cherlet actively supported me in my role as a GWP Technical Committee (TEC) member and we co-authored the Perspectives Paper *Coordinating land and water governance*. Dr Cherlet coordinated the workshop held in June 2015 in Pretoria (South Africa) on the same theme, an event jointly convened by GWP, ILC, and IWMI. This workshop and the 2014 Perspectives Paper are the two pillars upon which this Background Paper is built. I also express my gratitude to GWP/TEC colleagues for their comments, critiques, and suggestions on earlier versions of this paper and on presentations that I made on the land–water theme during TEC meetings. I acknowledge with much appreciation the contributions by authors of case examples that are described and analysed in this paper. Some of these case examples were specially prepared as submissions to the Pretoria workshop or as responses to the joint ILC–GWP call for case stories (circulated in 2016).

GWP and ILC leadership and staff have hence provided critical and highly appreciated support to the preparation of this paper.

That said, the mistakes and imperfections in this paper are my sole responsibility and views and opinions expressed herein are mine and do not necessarily reflect the views of GWP, ILC, IWMI, or any of the individuals mentioned above.

Madiodio Niasse
GWP Technical Committee Member

EXECUTIVE SUMMARY

The world population is growing exponentially – projected to reach 9 billion people in 2050 – and also getting wealthier: the world's middle class which is estimated to represent 20 percent of the total population is projected to increase to 60 percent by 2030 (Kharas, 2017)[1]. As a consequence, food demand is projected to increase dramatically in coming years. To respond to the food security challenge facing humanity will require, by 2050, an estimated increase in food production of 60–110 percent (Alexandratos and Bruinsma, 2012; Tilman et al., 2011). If food is considered as humanity's "ultimate security need for the 21st century" (Carrington, 2011), it is primarily because of uncertainties about the availability of sufficient quality farmland and freshwater to support needed increases in agricultural outputs – land and water being the two pillars of food production. The outstanding performance in crop production in the last half-century, a period during which crop production more than doubled, came at a high cost to land and water. Groundwater levels are dwindling, river and lakes are shrinking, and crop yields are plateauing.

We find ourselves today at a branch point with a constant – the unabated rapid growth in global food demand – and many possible trajectories with regard to water and land use and management. Business-as-usual approaches to water and land are untenable. To meet projected food demand in the next 30–40 years, a business-as-usual scenario will require at least 70 percent increase in freshwater withdrawal – a resource already under severe pressure. The surface area of the arable land is not only shrinking in many parts of the world, including in many leading crop-producing countries, but the quality of soils is also declining. Therefore, alternative approaches are called for.

One possible trajectory is to invest more in and use the untapped potential of a coordinated approach to the governance of land and water, the two key resources on which world food security depends. A coordinated approach to water and land governance is one dimension of integrated water resources management (IWRM), which is defined by GWP as a "process which promotes the coordinated development and management of **water, land, and related**

[1] In this paper, the notion of 'middle class' is defined to "comprise households with per capita incomes between $10 and $100 per person per day (pppd) in 2005 purchasing power parity terms".

resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP, 2000). In reality, land issues have been at best paid lip service in current IWRM theory and practice.

This paper contributes to conceptualising and operationalising in practice the interlinkages between the governance of land and that of water in the frame of efforts to respond to food security challenges at global, national, and household level. It places the emphasis on productive use of water and land, and especially in the agriculture sector.

A coordinated land and water governance offers possibilities of better capitalising on the mutually reinforcing efficiency in land and water use. One key dimension of resource governance pertains to tenure aspects, and it is well documented that land tenure insecurity is a disincentive to investments in long-term productivity-enhancing inputs and practices. Experience from around the world shows that, although not a sufficient condition, land tenure security is key to creating an enabling environment for increasing Total Factor Productivity in agriculture – crop yields per unit of land and water productivity – and improving equity and sustainable resource use.

A coordinated land and water governance approach also presents the advantage of helping address social inequities and gender imbalances – which is one of the four pillars of IWRM. In fact, equity and gender concerns of IWRM cannot materialise in the agriculture sector without addressing prevailing inequities in access to and control over agricultural land. Moreover, equity and efficiency are closely linked – experience shows that addressing the equity and gender gap in access to and tenure security over farmland contributes significantly to improving the total output of the agricultural sector.

From a water perspective, a coordinated approach to land and water management and governance contributes to operationalising the key pillars of IWRM and of sustainable development in general. It can help land and water-resource use efficiency; it creates incentives for long-term, sustainable use and stewardship of land and water resources; and it gives the opportunity to reduce inequities and close the gender gap in land and water resource control and access. Overall, a coordinated approach to land and water opens new and more promising perspectives in efforts to address the food security challenge at global, state, and household levels.

From a land perspective, adopting a coordinated approach can be justified from various angles. First, where water is absent or water rights are lost – for example, when water flow is diverted away from farmland – the value of the land drops and the rights to the land tend to erode over time. Second, investments in water development infrastructure such as small- and large-scale irrigation schemes are often opportunities to redefine and allocate land in a fairer manner compared to rain-fed and floodplain farmland where existing social inequalities tend to be replicated. Third, in many contexts, physical investment in the land (such as through soil and water management techniques) contribute to strengthening land tenure security. This means that the many initiatives aimed at promoting pro-poor, people-centred land governance can benefit by factoring in the water-resource management and governance dimension.

The section on gender shows that the IWRM principle on improving gender equity in water management cannot be fully put into practice without completely taking into account water for productive use, in particular for agriculture. Indeed, agriculture is responsible for 70 percent of freshwater withdrawals. Improving women's control over and access to water use in agriculture requires improving women's access to secure rights over the agricultural land. The paper provides illustrative examples supporting the view that gender equity in agricultural production – through more equitable access to farmland and freshwater – is not only relevant from a social-justice point of view, but also contributes to improving agricultural performance and household food security.

The paper finally reviews succinctly several case examples from around the world – with emphasis on sub-Saharan Africa – to illustrate the relevance and benefits of coordinating land and water, to strengthen resource tenure security and achieve better outcomes in terms of resource use efficiency, equity, and sustainability.

The added value of a coordinated approach to the governance of land and water is shown as gains in resource use efficiency (improved water and land productivity), sustainable exploitation (implying the long-term protection and stewardship of the resource base), and equitable access to and control over land and water (particularly considering gender). It is true that efficiency gains are still possible and are being achieved to some extent under current single-sector approaches to land and water. These gains are however not only sub-optimal but also often perpetuate and even amplify social and economic inequity and unsustainable resource use. The soundness and added

value of a coordinated approach to land and water is even clearer from a gender perspective. Closing or reducing the gender gap in access to water for productive use is impossible without addressing gender inequalities in access to secure land rights.

Although this paper only touches the surface of a complex subject – which therefore needs further research – it demonstrates the continued relevance of IWRM. However, IWRM needs to deliver more tangibly by contributing to addressing challenges facing humanity. Among these, food security is paramount. Challenges also include inefficient and unsustainable natural resources use, of water in particular, as well as inequalities and gender imbalances in resource access. This paper shows how IWRM, understood to embrace water as well as land management and governance, can contribute to addressing these challenges.

1 INTRODUCTION

In day-to-day life, land and water are highly interlinked and in some cases appear as congruent resources. This is even clearer in the farming sector. Natural processes affect the landscape (soil erosion and deforestation) and anthropogenic land use changes have direct impacts on water availability (e.g. soil retention capacity, groundwater recharge, pace and patterns of water runoff, and water quality). Similarly, rainfall and hydrological conditions, as well as water development interventions and management practices, can have important effects on the availability and productivity of soils. However, in development discourses and practices as well as in policy processes, land and water issues have been and are increasingly dealt with separately. This is particularly true for the governance and management of the two resources.

The spectacular achievements in recent decades – in terms of resource use efficiency – seem to vindicate current approaches that treat water and land as two distinct and unconnected sectors. Thanks to the application of Green Revolution solutions, agricultural productivity, especially per unit of land, increased dramatically. Hydraulic engineering solutions helped mobilise huge quantities of ground and surface waters, by taming the big rivers to respond to growing food, energy, industrial, and domestic water needs. Since the new century, and especially the last decade, with agricultural yields plateauing, wells drying out, and surface water bodies shrinking, the silo approach and mentality is clearly running out of steam.

There are many alternative pathways to consider. On the water side, available options include scaling up rainwater harvesting efforts, grey-water treatment and reuse in agriculture, improving water productivity (Kijne, 2003), and desalinisation of seawater. On the land side, options range from expanding agricultural land through conversion of forest land, reclaiming degraded land, and applying Green Revolution techniques to increasing crop yields.

Although important progress is noted for each of the above responses, this paper stresses that a coordinated approach to the governance of water and land offers untapped potential for addressing the challenge of food security in a context of scarce freshwater and shrinking farmland. Moreover, a coordinated approach to land and water is necessary if inequities within the land and water sectors are to be addressed.

The proposed approach implies moving away from management to governance, and linking land and water. Paraphrasing Hodgson (2016), water or land management is concerned with the actions necessary to implement water- or land-related decisions, but the governance of these resources deals with the processes through which decisions are made, enforced (through management), and monitored. Management is more technical and technocratic, whereas governance is more social and political. In contexts where the resource is physically abundant but requires heavy, sophisticated means to make it accessible to humans and available for productive use, management responses tend to prevail. For water as well as for agricultural land, this scenario has applied until recently. Hence, land and especially water management practices still give priority to technical solutions, while remaining confined to a single sector – land or water. Indeed, water has long been considered a resource to be developed which emphasises supply-side approaches and technical solutions to challenges at hand, such as floods and water quality deterioration, with engineers in the driving seat. This approach is referred to as the 'hydraulic mission' (Moore, 2013). The same applies to land as a productive resource, especially in agriculture where efforts to expand arable land or increase productivity per unit of land have focused on high-yielding crop varieties, and the use of fertilisers and pesticides.

A common characteristic of these technical approaches is that they tend to ignore the unequal power relations surrounding land and water resources at local and international level, and the resulting uneven distribution of these resources and the intensified (or increased) competition for them. The politics and geopolitics of land and water resources represent an increasingly critical dimension of the equation we face. A coordinated governance perspective allows factoring in the political as well as the technical and managerial aspects of water and land resources used to feed to world and to respond to the needs of other sectors that depend on these increasingly contested resources.

The notion of governance is, however, too broad to embrace in this paper. It relates to processes of water- or land-related decision-making involving the engagement of various types of actors, the use of rules, mechanisms, and procedures at various levels to organise the conditions of access, use, control, and transfer of land or water resources and to manage related conflicts.

This paper places the emphasis on resource access and use rights, i.e. on 'resource tenure', which is a key component of resource governance. Resource tenure, and particularly land tenure, refers to policies, laws, and other

institutional arrangements of formal or non-formal rules, procedures, and practices whereby society or communities define control over, access to, and management and use of land or the resource considered. It determines who can use the land, for how long, and under what conditions (Dekker, 2005; FAO, 2012). Similarly, water tenure refers to policies and institutions through which the modalities of access to and control over water rights are defined.

In the last two decades, there has been a revival of land and water governance reform in all regions of the world. These reforms, largely triggered by the context of scarcity of freshwater and fertile land, are typically conceived in ignorance of the interlinkages between the two resources. Although this silo approach has generated tangible gains – in land productivity (crop yield per unit of land) and water efficiency – the magnitude of the challenges to feed the world are such that more significant increases in food production will be needed in the coming decades.

This paper submits that a coordinated approach to the governance of land and water is an untapped opportunity toward the goal of boosting land and water productivity. The notion of coordination here refers to the acknowledgement of the need for, or the actual establishment of, some form of interrelationship between land and water. The desirable level of interaction depends on the context, scale, and nature of the challenges addressed.

The objective of this Background Paper is to articulate and contribute to operationalising in practice the interlinkages between the governance of land and that of water in the frame of efforts to respond to food security challenges at global, national, and household level. It places the emphasis on productive use of water and land, especially in the agriculture sector.

The paper is structured around the five following sections. Section 2 analyses the nature of the food security challenge facing humanity in coming decades. This section explains why business-as-usual in the way that land and water resources are managed is not an option if the challenge is to be addressed.

Section 3 links the revival of land and water reforms, which is occurring today, with efforts to address the need to increase water efficiency and crop productivity per unit of land. It analyses the gains as well as challenges from selected reform experiences.

Section 4 relates to the value proposition and analytical framework used. It explains the value added, with an emphasis on what a coordination approach would contribute to reform efforts discussed in the previous section. The

analytical framework articulates the logic used in this paper and the linkages between the different sections.

Section 5 analyses the rationale and potential benefits of a coordinated approach to land and water from a gender perspective.

Finally, Section 6 describes and analyses a series of illustrative case examples from around the world (with an emphasis on the Global South, especially Africa) about how the gains in efficiency/productivity, equity (including gender equity), and sustainable resource use can derive from a coordinated approach to land and water. Some of the case examples also show what can be lost when the interlinkages of land and water are ignored.

2 THE FOOD SECURITY CRISIS AND THE NEED FOR A PARADIGM SHIFT IN LAND AND WATER MANAGEMENT

Land (especially agricultural land) and water have long been perceived as abundant resources, and that with appropriate technical solutions they can be developed and managed to respond to limitless land- and water-based needs of humanity. In the decade since the 2007–2008 food crisis, the full consequences of decades of unsustainable freshwater use and conversion and degradation of large proportions of agricultural land have begun to be experienced. This seems to be a new era, that of water scarcity and rapidly shrinking farmland.

2.1. Uncertainty about how to solve the global food security equation

Since the 2007–2008 food price hikes, which occurred in a context of financial and energy crises, the question as to whether the world will be able to feed itself in the coming decades has agitated international and national policy debates, the academic world, and the media.

The current global anxiety about food security may not be justified, given that global agricultural production increased 2.5-fold during 1960–2000 (FAO, 2011a) and food commodity prices continue to fall (Baffes and Dennis, 2013). If this trend could be maintained, i.e. if past performance could be replicated, there would be no reason for concern about global food security in the coming decades. The past achievements in agricultural production resulted not so much from increased cultivated area, which only increased 9–16 percent (FAO, 2011a; Godfray et al., 2010), but rather from significant increase in the productivity of existing cultivated land. Intensifying production came from Green Revolution technologies, such as high-yielding crop varieties, intensive use of fertilisers and pesticides, and irrigation. Since 1960, the land under irrigation has doubled to 300 million ha (ICID, 2014), representing one-fifth of the total arable land[2]. This translated into the doubling of freshwater withdrawals in the past 50 years (MEA, 2005).

[2] FAO defines **arable land** as the land under temporary agricultural crops, **cultivated land** as the sum of arable land and the area for permanent crops, and agricultural land as the sum of cultivated land and the area of permanent meadows and pastures. On this basis, according to FAOSTAT data for 2014, there are 4,900 million ha of agricultural land, 1,584 million ha of cultivated land, and 1,417 million ha of arable land.

Current concerns about the future stem from uncertainties as to how food production can be increased at the pace needed to respond to additional demands induced by demographic growth and changing patterns of food consumption. Estimates suggest that, to respond to projected demand, food production will need to increase by 60–110 percent above current levels in the next 40 years (Alexandratos and Bruinsma, 2012; FAO, 2011a; ICID, 2014; Tilman et al., 2011).

Past successes came at a high cost to the natural resource base. Traditional high-performing agricultural regions are facing dwindling groundwater resources and closing of river basins[3], and productivity levels are plateauing. In such a context, it is uncertain that the yield gains of the past century can be replicated. Doubling agricultural production in the next 30–40 years will require annual crop production to increase by 2–4 percent. Yet, average annual yield increases for key crops such as maize, rice, wheat, and soybean are only about 0.9–1.6 percent (Ray et al., 2013). If current production practices persist, estimates suggest that by 2050 an additional 5,000 km^3 of freshwater (blue and green water combined) will be needed to meet global food demands. This is a 70 percent increase on current agricultural water consumption of 7,130 km^3/year (de Fraiture and Wichelns, 2010; Molden, 2007). This increase in demand is likely to cross the planetary boundary of sustainable water resources use (Rockström et al., 2009).

Although expanding the area of agricultural land is in principle an option, it involves high environmental costs, such as deforestation, higher greenhouse gas emissions, and loss of biodiversity. At current levels of productivity, 20–30 percent (1–1.4 billion ha) more agricultural land will be needed to add to the existing 5 billion ha (de Fraiture and Wichelns, 2010; Tilman et al., 2011). However, only 445 million ha are available globally for expanding potential cropland, while minimising ecological costs of land conversion (World Bank, 2010a). Moreover, most of this land is concentrated in a few countries – ten in sub-Saharan Africa share more than half of the potential land area (World Bank, 2010) – leaving little for the rest of the world. According to Foresight (2011), the wisest attitude is to assume that there is little new land available for agriculture.

[3] Relates to rivers where the flow has shrunk to such a level that the river water virtually no longer outflows to the sea or outside the basin. Apart from abstractions through dams and irrigation channels, basin water is only lost through evaporation.

2.2. The shrinking global farmland – the Japan Syndrome

Instead of expanding, land available for agriculture is in fact shrinking in many regions of the world, because of multiple factors. These include, on the one hand, the conversation of agricultural land to other higher-value non-agricultural uses and, on the other hand, water scarcity.

The current trend of conversion of large proportions of the world's agricultural land to other higher value uses is linked to what Lester Brown termed the 'Japan Syndrome'. This syndrome manifests itself in the form of a rule of thumb that can be summarised as follows: when densely populated countries begin to industrialise rapidly, they experience dramatic increases in food consumption as incomes rise, as well as the shrinking of grain-producing land, and decline of grain production (Brown, 2004). Japan was virtually grain self-sufficient in the mid-1950s, but has imported around 70 percent of its grain consumption since the 1970s, and its annually cultivated land shrank from 5.3 million to 3.5 million ha (Tatsuya, 2011). The same syndrome affected Taiwan and South Korea. For the latter country, the total farmland declined by 25 percent from the 1970s to 2010, and its grain self-sufficiency declined from about 70 percent in the 1970s to about 20 percent today (Honma and Hayami, 2007; Yoon et al., 2013).

Even more consequential is that a similar pattern is observed in China and to a lesser extent in India, two demographic giants enjoying fast-growing economies. In China, the combined effects of the Japan Syndrome and unsustainable exploitation of the country's land and water resources led to the loss of more than 8 million ha in a decade (Hofman and Ho, 2012). China lost its food self-sufficiency in 2004 and is increasingly dependent on food imports, with serious repercussions on global food markets (see Box 1). In India, the agricultural land and its productivity is under the pressure of dwindling aquifers, degrading soils, and the Japan Syndrome, being felt through rapid urban expansion and the multiple new Special Economic Zones (SEZs). In both countries, resolute measures are being devised to ring-fence the remaining agricultural land. In China a 'red line' of 120 million ha has been defined as the minimum size of arable land to be safeguarded in order to protect the country's national food security needs or minimise its dependency on imports (see Box 1). India's 160 million ha of agriculture land is decreasing at a rate of 30,000 ha per year (Dabas, 2016), which is rather modest. However, various policy instruments at national and state-level such as the National Policy for Famers (2007), the National Land Acquisition Bill (2013), and the Draft National Land Utilisation Bill (2013) have been enacted or envisaged to prevent or limit the loss of arable land.

The shrinking of the most productive agricultural land is a global phenomenon, affecting primarily the traditionally high-performing agricultural regions of the world. Resulting partly from the dramatic increase in the value of land and intensified domestic and international land transactions, the phenomenon is more marked in developed countries (Europe, North America, North-East Asia and in emerging economies) than in poor countries. In France, 110,000 ha of agricultural land was lost annually during 1960–2007 (Pointerau and Coulon, 2009). It is estimated that 2–3 million ha of agricultural land vanishes each year in the bread-basket regions of the world: East Asia, Western and Central Asia, Europe, and North America. However, the tropical regions of Africa and part of Latin America have witnessed an expansion of their agricultural land area – the net gain in agricultural land in tropical low-income countries was estimated at 6 million ha during 2000–2010 (FAO, 2016). The 12 percent global increase in total cultivated area in the last 50–60 years (FAO, 2011b) masked the constant decline in the most fertile and highly productive agricultural land; and all signs indicate a continued loss of these types of farmland in the coming decades.

Box 1. China and the challenges of the Japan Syndrome

China, host to 20 percent of the global population, is endowed with 8.5 percent of the world's arable land and 6.5 percent of its freshwater (Hofman and Ho, 2012). Green Revolution solutions, coupled with improved land tenure security for farmers and heavy investment in water infrastructure helped the country achieve food self-sufficiency in the 1970s. The downside of this process is that the natural resource base suffered heavily, manifesting itself through over-abstraction of freshwater resources leading to declining groundwater tables and closing river basins, land degradation and loss of fertile land, narrowing of the yield gap in cultivated land, and reduced scope for further intensification per unit of land. In parallel, the country with its fast-growing economy started to experience the Japan Syndrome, with the conversion of massive swathes of agricultural land to other uses. This led to a downward evolution of China's agricultural land areas (Fig. 1). It is estimated that the country lost more than 8 million ha of arable land during 1997–2010 (Hofman and Ho, 2012). The country has been a net food importer since 2004, translating into enormous pressure on the global food market. China is responding to these trends through various measures, including by (a) going global, including in the farming sector, with state firms engaging in land acquisitions in Asia (Laos and Cambodia), Oceania, Latin America (Argentina), and Africa. China is one of the top-ten leading foreign land acquirers; (b) setting a red-line of 120 million ha of arable land to be safeguarded in a context of growing land conversion for urban expansion and/or commercial and industrial use; and (c) promoting massive investment in land and water development infrastructure. Despite these efforts, the question as to whether China will be able to feed itself in coming

decades is still hotly debated, although all agree that if China follows a path toward heavy reliance on food imports, the implications on the global food market and on global food security could be far reaching.

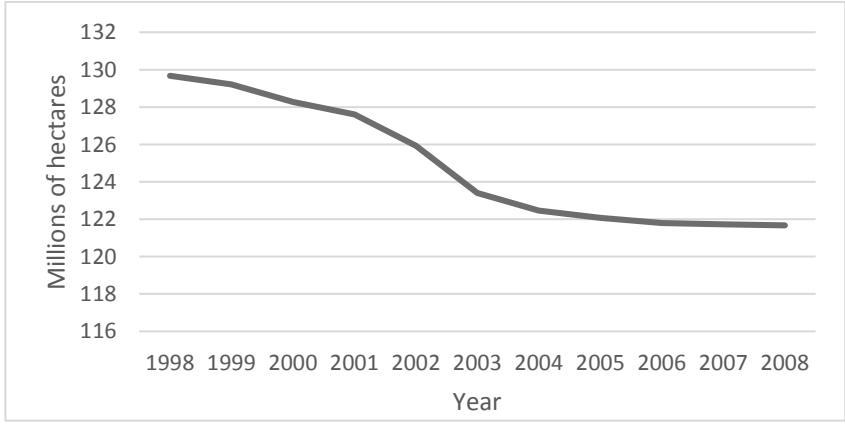

Figure 1. Trends in China's cultivated land area. Source: adapted from Zhao et al. (2014).

2.3. Water scarcity

Water scarcity is another major driver of shrinking agricultural land and a key constraint to increasing food production to cope with the expanding global demand. Rain-fed agriculture – 80 percent of the world's cultivated area – is entirely dependent on rainfall conditions. Because of climate change and variability, many regions of the world, especially tropical zones, are experiencing reduced levels of annual rainfall, higher temperatures which intensifies evaporation from water bodies and the vegetation, as well as a higher frequency of extreme events (e.g. heat waves and severe droughts or floods). These factors contribute to land degradation which translates into declining crop productivity, frequent crop failure, and abandonment of rain-fed agricultural land. FAO's 2011 State of Land and Water report projects that Africa's agricultural land classed as semi-arid and arid will increase by 60–90 million ha by 2080 (FAO, 2011b).

Similarly, the future of irrigated agriculture (representing 20 percent of agricultural land) faces the challenge of water scarcity. Irrigated agriculture accounts for more than 70 percent of all freshwater withdrawn from surface water bodies and aquifers (FAO, 2011b). Today, there are declining levels of water flows in many river systems, resulting largely from higher levels of water abstraction through reservoirs, irrigation canals, and inter-basin transfer schemes. Similarly, groundwater resources are dwindling in the many regions where water drawn from aquifers through wells and boreholes

outpaces recharge levels. These trends are compounded by more erratic and declining rainfall, resulting from climate change and variability. Although the irrigated area is expected to increase globally in the coming decades, some regions facing water scarcity may be forced to scale back investments in irrigation. Increased pressures on freshwater will be a challenge to increasing the productivity of irrigated agriculture.

2.4. Climate change and variability

Climate change and variability affect water and land, and hence food security in two ways. First, as shown earlier, climate change and climate variability affect water availability – rising temperatures, changes in rainfall conditions, changes in river discharge, and higher frequency and intensity of extreme weather events – with repercussions on agricultural productivity and hence food security. These factors, combined with unsustainable land use practice accelerate land degradation. In sub-Saharan Africa, estimates indicate that by 2080 the area experiencing severe climate or soil constraints will increase from 35 million to 61 million ha (9–20 percent of the region's arable land) (Fischer et al., 2005; World Bank, 2010). If current trends persist, 320 million ha – more than the combined arable land of India and China – will be lost by 2050.

Second, some of the current responses to climate change also affect the availability of land for food production. Large areas of farmland and rangeland, for example, are used for carbon sequestration projects (e.g. afforestation) or for reforestation and/or biodiversity conservation purposes. The FAO found that although 93 mostly tropical and developing countries lost 242 million ha of forest during 1990–2015, more than 80 countries – mostly developed countries in temperate regions – had a net gain of 113 million ha of forest in the same period, made at the expense of agricultural land (FAO, 2016).

2.5. Responses to the energy crisis

The 2007–2008 food price hikes coincided and were aggravated by record oil prices. Increases in energy prices affect agricultural production costs, as well as food transport and processing costs. Although these are typically quasi-immediate effects, sustained increases in oil prices can also make investments in alternative energy sources such as biofuels more attractive. This energy price factor combined with concerns about climate mitigation led to promoting alternatives to fossil fuels and contributed to the expansion of agrofuels. In the last three decades, the agricultural land area devoted

to agrofuels has steadily increased at the expense of food crops. During 2004–2008, the estimated total agricultural area devoted to agrofuels increased from 14 million to 33 million ha, representing about 2 percent of the global cropland (Bertzky et al., 2011). The agrofuel land area is expected to quadruple by 2030 (World Bank, 2010b). Agrofuels compete with food crops for land as well as for water (de Fraiture and Wichelns, 2010).

2.6. Land and water management deficiencies

Poor management of land and of water has significantly contributed to, and amplified, the scarcity and level of degradation of these two resources. In the agricultural sector – which, as previously mentioned, is the largest share of freshwater withdrawn by all sectors – inefficient and wasteful water use practices are rampant (FAO, 2013). Water losses due to leakages and evaporation in canals and in fields and poor drainage systems result in much more water than needed being withdrawn for irrigation. The same applies to agricultural land. Unsustainable land use practices have contributed to decreased soil fertility. The loss of soil fertility leads to expansion of the agricultural land frontier to maintain agricultural production.

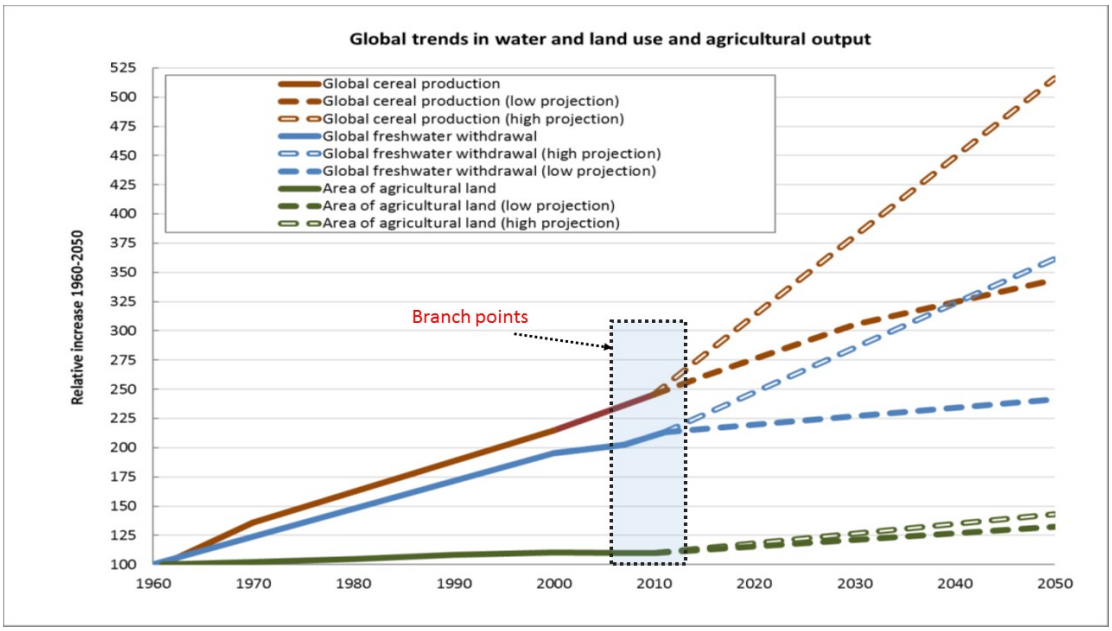

Figure 2. Trends in food demand and related land and water requirements. Source: GWP (2014).

To sum up, humanity finds itself today at a branch point which comprises an unabated rapid growth in global food demand and many possible future trajectories with regard to management of freshwater and farmland, the two

key basic resources upon which food production is dependent (Fig. 2). In prevailing practices, land and water are planned and managed in isolation from each other. These business-as-usual approaches are unsustainable, and ingenuity is needed to meet projected food demand in the next 30–40 years. Therefore, alternative approaches to land and water are called for.

Possible pathways to managing land and water to meet projected food needs are many. One is to step up investments in technical solutions to improving land and water productivity, while continuing to deal with the two sectors separately. This option is being pursued with progress noted here and there, but nothing comparable to the spectacular gains of the Green Revolution. Another option is to strengthen the governance (i.e. the policy and institutional frameworks) dimension of land and water development and management. Such an option responds to the current context of resources scarcity, and intensified competition and disputes over land and water with risks of amplified inequities and exclusion. As discussed below, there is a revival of land governance reforms at the national and international levels. Similarly, as water governance continues to gain currency, more and more countries engage in the formulation of new water policies and water laws to complement technocratic approaches to water management.

3 REVIVAL OF LAND AND WATER REFORM POLICIES

The challenge facing the world is to substantially increase food production and agricultural performance in general in a context in which there is little room for expanding the two key resources upon which agricultural production is dependent: land and water. Any solution to this equation therefore involves a significant increase in productivity of these two resources – that is to augment crop output per unit of land area and per drop of water.

In addition to resource efficiency and productivity concerns, the context of scarcity intensifies competition and conflicts around the access, use, and control over fertile land and freshwater.

Prevailing water development and management approaches show their limitations if we need to simultaneously address water- and land-related efficiency and conflict management challenges, while paying due attention to the sustainability dimension. Knowledge of water management techniques and tools, and availability of inputs such as fertilisers and improved seeds, are all important but fail to create the necessary enabling environment to substantially improve water efficiency and water productivity. Farm labourers with precarious land tenure rights are typically missed by agricultural extension services, which primarily target land owners. Even where they are reached by advisory services, farmers with weak tenure rights tend to lack incentives to adopt and apply suggested techniques and approaches to improve productivity.

In the context of land and water resources scarcity, competition escalates at local, national, and international level. As mentioned concerning the Japan Syndrome, the farmland area shrinks as more agricultural land is lost to benefit urban, industrial, and infrastructure development. As soil fertility declines, more forest and pastoral areas are converted into agricultural land. More dams, big reservoirs, and channels are built to store and divert surface waters, and wells multiply and go deeper to abstract water from aquifers. The rush for land and water amplifies, leading to what is known as 'land grabbing' which, we now know, is also about 'water grabbing'. Water disputes and violent conflicts are today of higher frequency and intensity. Countries whose water and land policy and legal frameworks are typically formulated in contexts of abundance find themselves ill-equipped to respond to the

challenge of managing their land and water resources in times of scarcity and intensified competition and conflicts.

States understand therefore that the world has entered a new context that requires urgent and sometimes radical adjustment of the policy, legal, and institutional framework for managing their land and water resources. A new wave of land and water reform processes is consequently observed in all continents, especially in developing countries and emerging economies.

3.1. Renewed interest in land reforms

Land reform since the end of World War II has evolved in processes as well as content. Land and agrarian reform processes in the early and mid-twentieth century were closely linked to efforts to tackle social and economic inequalities, either by challenging the prevailing social order (as for the revolutionary movements in Russia and later China), or by trying to anticipate and prevent social unrest and political instability (as for Japan, South Korea, and Taiwan after World War II).

Later in the century, land reform processes were part of decolonisation agendas and efforts to rebuild nation-states. Land reform hence featured prominently in the priority demands of liberation movements in Latin America, Africa, and Asia. Redistributive land reforms – state-led reform processes involving compulsory expropriation of land from landlords and other landed classes – and market-oriented reforms helped millions of landless farmers and urban dwellers gain access to secure collective or individual land ownership or tenancy rights.

These reform agendas differed in substance depending on the nature and level of pre-existing inequalities. In contexts where the land was largely under the control of a traditional aristocracy (Japan and Korea) and in settler colonies (in Southern Africa), land reform processes were generally aimed at correcting or attenuating inequalities in land access. In most of sub-Saharan Africa, the land has remained in the hands of traditional owners – generally lineage, village, or tribal groups. The focus in such contexts was and still is to formalise or 'regularise' customary rights – that is to reconcile traditional and modern, statutory tenure regimes.

Between the end of World War II and the late 1970s, most countries in Eastern Europe, Asia, Latin America, and Africa engaged in some form of land reform – some more radical and comprehensive than others.

Although some of these were primarily politically motivated (affirmation and consolidating national sovereignty, and moving from capitalist to socialist regimes), others pursued social justice (equity and justice) or economic goals (economic growth and poverty reduction). From an economic point of view, it is assumed that with secure land title, producers have easier access to credit (by using their land titles as collateral) and are more motivated to invest in long-term improvement of productivity of their land (e.g. through water control infrastructure, soils management, agro-forestry, and agricultural equipment). From a social-justice point of view, land reform is an opportunity to reverse high levels of land concentration in the hands of a minority (in many cases absentee landowners) and allocate it to those who farm the land – 'land-to-the-tiller'. The assumed causal chains from land tenure security, improved productivity, and economic growth are illustrated in Fig. 3.

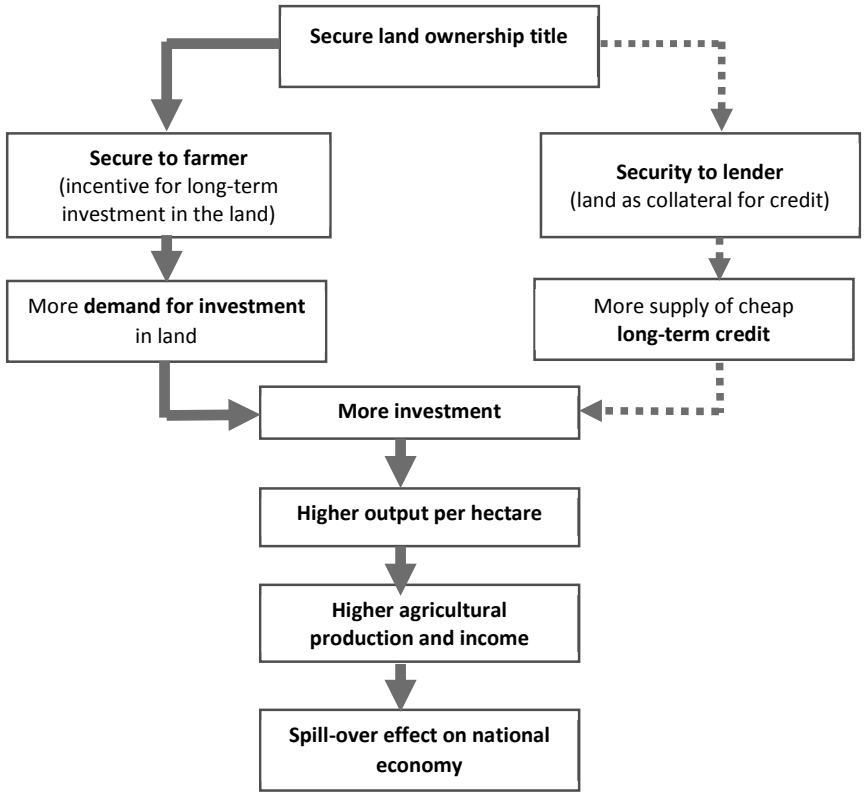

Figure 3. Productivity-enhancing role of land tenure security. Bold plain lines are strong correlations and dotted lines are moderate to weak correlations. Source: adapted from Feder and Nishio (1999).

Evidence from around the world confirms the powerful productivity-enhancing roles of improved broad-based access to secure tenure rights. In Taiwan, 6 percent of households owned more than 50 percent of the country's farmland in the early 1950s, a period during which more than 40 percent of farmers were tenant labourers (i.e. were farming rented land). The land-to-the-tiller redistributive reform process during 1948–1956 reduced the proportion of tenant farmers to 17 percent in 1955. As a result, agricultural production jumped by 60 percent in the short-term (Chen, 1961; Quizon, 2014), and increased by 3.6 percent per year during 1952–1980, with the Total Factor Productivity[4] contributing more than 60 percent to this growth (Chen, 2013). In South Korea, 2.9 percent of farmers owned 64 percent of land when the redistribution of land reform started after the end of World War II. At the end of the reform, in the mid-1950s, two-thirds of the country's farmland was in the hands of 51 percent of farmers, and the number of tenant farmers dropped to less than 10 percent, from 45–50 percent before the reform (Chen, 2013; Park, 2013). Agricultural output increased by 3.19 percent per year during 1954–1973, and simultaneously land productivity (output per unit of land) increased by 2.85 percent per year (Chen, 2013; Park, 2013). The direct and massive impact of land reform on agricultural production in South Korea is shown in Fig. 4. Land reform is among the key factors explaining the spectacular economic take-off of South Korea – from a GDP per capita of US$1,500 in the early 1970s – only double the average GDP per capita for the then newly-independent sub-Saharan African countries – to US$3,200 in 1980 (six times that of sub-Saharan Africa in that year). Many other examples show the positive impacts of post-World War II land reform on agricultural productivity and total outputs as well as economic growth, including China, Thailand, and to a lesser extent in sub-Saharan Africa (Feder and Nishio, 1999).

[4] The Total Factor Productivity measures the efficiency of all inputs to a production process. More simply it is the ratio between the total output (here agricultural production) and total input (e.g. seeds, land, water, physical capital, fertilisers, and pesticides).

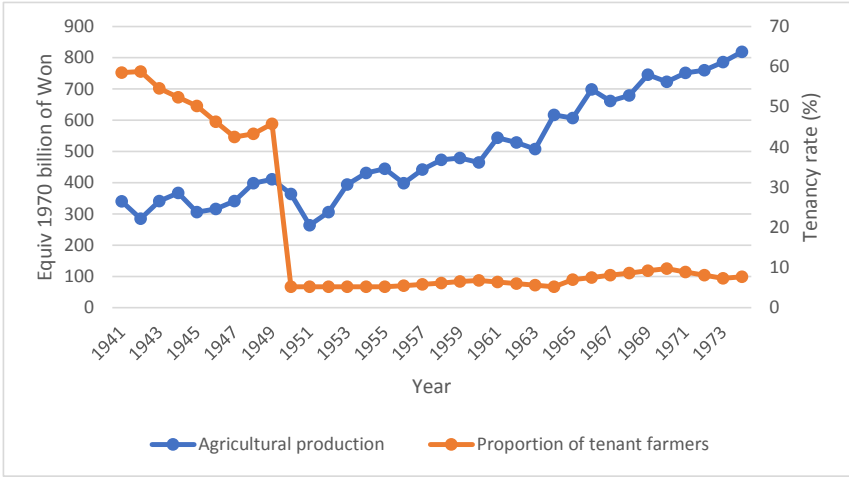

Figure 4. Impacts of Land tenure reform on agricultural output (based on data from Table 1 in Rudolf, 2012).
Note: Time series data for Tenancy rates are incomplete. Missing values for 1948, 1950 to 1954) were filled using linear extrapolation from known values.

Despite these successful examples, land reform fell off the global development agenda in the late 1970s and the 1980s. During this period, investments in water control infrastructures (dams, irrigation schemes, and wells) coupled with Green Revolution solutions led to sustained increases in crop yields. As mentioned earlier, crop production more than doubled during 1960–2000 while arable land only expanded by 10–15 percent. As the possibility of agricultural intensification was perceived to be limitless, access to the means of increasing crop yields – mastery of water for irrigation and access to improved seeds, fertilisers, and agricultural equipment – became more important than taking control of and expanding the land area. Moreover, productivity gains worldwide resulted in falling food prices in international markets. In this context, competition for land decreased and interest waned for land reform (that is in setting rules and conditions for land access and use). Land reform processes stalled in many countries, and where land policy or framework laws were already enacted, the development of the bylaws and establishment of institutions necessary for their implementation were postponed if not shelved and forgotten, which was the case in many sub-Saharan African countries.

The global context started to change from the late 1990s and early 2000s, with increasing numbers of reports pointing to unsustainable use of freshwater resources – one of the key pillars of agricultural production (Cosgrove and Rijsberman, 2000; UNESCO, 2003). Agricultural intensification started to run out of steam, with crop yields plateauing while

options for expanding the agricultural land area remained limited (Ray et al., 2013). All these constraints surfaced during the food–energy–water crises of 2007–2008, which led to intensified competition for land and for water.

The renewed interest in land reform that is occurring today is linked to this context of scarcity, which reveals the central roles of land and water in solving the food security challenge of coming decades. According to Wily (2011), no less than half of the nations in the world (about 100 countries) are today engaged in some form of land reform – in Africa, more than 30 of the 54 countries started land reform processes since the 1990s. The priority given to land reform in Africa is illustrated by the pan-African initiative to promote improve land governance in Africa. As part of this initiative, the Framework and Guidelines on Land Governance in Africa were formulated in 2009, under the auspices of the African Union. To guide the global land governance reform efforts, the Voluntary Guidelines on the Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security were adopted in 2012 by the United Nations Committee on Food Security (CFS) (FAO, 2012).

3.2. Greater interest in improving the legal and institutional frameworks for water management

With regard to the legal and institutional framework for water management, three stages can be broadly distinguished in the last 4–5 decades.

From the 1950/60s to the 1980s

After World War II and until the 1980s, water policy and water law reforms were largely carried out as part of nation-state building and the need for accelerated economic development. Countries recovering their independence after colonial occupation had to formally repossess and restore their sovereignty over their territory and natural resource base, including water resources. In Africa, for example, many of the land policies and laws were formulated immediately after independence; the water codes and laws, and in some cases the constitution, nationalised water resources (surface and groundwater) considering them as a public good, held in trust by the government on behalf of the nation.

During this period, water was still largely considered an abundant and almost inexhaustible resource. Given the fugitive and unpredictable nature of water, the priority was to tame the resource through structural solutions. Therefore, modalities of harnessing water with infrastructure development

(dams, wells and boreholes, and irrigation schemes) featured prominently in water policies. In the 1980s, many of the water policies and water framework and implementation laws tended to incorporate provisions for state disengagement from some key aspects of water development and management (such as water service delivery for domestic use) and for greater roles of the private sector, in line with structural adjustment recipes of Bretton Woods institutions.

From the 1990s to the mid-2000s

From the 1990s, pressures on water intensified as a result of population growth, economic development, and spectacular expansion of irrigated areas. In some regions of the world, water scarcity manifest itself in the form of severe reduction of river flows, sometimes to an extent where traditionally water-abundant and open river basins became closed water bodies. As rightly observed by Chartres and Varma (2011), when a basin closes, "further development of water resources shifts from the physical debate about how to make water available to a political debate about who should get how much water". Long-standing modalities of access to water (riparian rights to surface water bodies, open access to certain water points, and other informal and customary collective or family rights) tend to be challenged and perverted to benefit more powerful actors (USAID, 2013). Hence, water scarcity creates an imperative to move from water management centred on technical, hydraulic engineering solutions to broader water governance responses.

In response to the water scarcity context, a new wave of water policy and water law reforms emerged. A large majority of the 134 countries covered by the survey performed within a UN-Water global study reported to have initiated or made changes in their water policies (79 percent) or their water laws (82 percent) during 1992–2012 (UN-Water, 2012). This generation of water policies and laws were inspired by the 1992 Dublin principles on water and sustainable development, and in particular the four IWRM principles: sustainable management, participatory planning, gender aspects, and economic value of water. They also embody many of the normative provisions in the 1997 UN Convention on non-navigational uses of transboundary water courses.

Currently it is still the era of 'end-of-abundance' of water (Zetland, 2011), and water scarcity concerns are even more pressing. Competition for declining surface and groundwater resources has intensified, new policies at national level and river basin conventions include provisions for regulating

modalities of water allocation while defining priority uses (such as water for basic human needs and water for nature). They also offer incentives for improving water use efficiency and addressing water-related conflict prevention and management.

Water law reforms in countries such as Chile, Australia, the USA (Western USA), and Mexico define water rights that are tradable, with the aim of responding to water scarcity by optimising water use efficiency (Hertel and Liu, 2016).

The extent to which the above water law and policy reforms have contributed to improve water use efficiency seems to vary depending on context. Allocation of water rights (through licenses, permits, and authorisation) and the emergence of water markets contributed to improving water efficiency – allocating the water to sectors and users that optimise value per drop of water – in country contexts such as Chile, Australia, and the Western USA (Debaere et al., 2014; Fargher, undated; Hertel and Liu, 2016). Due to weak institutional frameworks and law enforcement capacity, the impact of water pricing and that of the issuance of permits and authorisations is elusive in developing countries (Pegasys Institute and IWMI, 2017; World Bank, 2007). Formal water rights (permits and authorisation) can even be used by powerful actors to dispossess informal and customary rights holders from accessing and using freshwater resources to which they are traditionally entitled, as seen in some developing countries (Pegasys Institute and IWMI, 2017; Ravnborg, 2016) and in developed countries like Australia with growing concern about emergence of 'water barons' (Fargher, undated). Other risks associated with water productivity gains through tradable water rights are that control and access to available water tend to move from basic food grains (e.g. rice, wheat, and maize) to high-value crops, and even from the agricultural sector to industry and from rural to urban use (Debaere et al., 2014). In other words, water productivity gains can easily translate into widening inequities in water access.

Since the mid-2000s

In recent years, especially since 2007–2008, there has been a new dimension in water scarcity. Water for productive use (especially agricultural production) is increasingly disputed, not only at national level, but also regionally (in transboundary river basins and aquifers) and internationally, as seen as part of transnational large-scale land deals, which are also about water. Effective legal and institutional water management responses to

these new challenges are still to be devised. Although there is a sense that a bold governance response is needed in the water sector, similar to what is being done for land (UN CFS, 2015), there is a long way to go before such a normative framework for water governance is agreed at the international level.

3.3. Recognising and addressing the limitations of parallel approaches to land and water management

Land and water management reforms, especially those related to legal and institutional aspects, in response to resource scarcity have indeed contributed to addressing the challenge of improving land and water productivity. Where tenure security was given to land-insecure and landless farmers, the output per unit of land area improved – provided that accompanying measures were in place, such as extension services and access to inputs and markets. As shown in the case of South Korea, land reform has significantly contributed to the spectacular increase in agricultural output, especially food production globally, but the arable area has remained unchanged and in some cases has shrunk. Similarly, where secure water rights were granted to water users, for example through tradable water permits, water productivity and water use efficiency improved, especially in contexts where the hydraulic infrastructure and the overall institutional environment were strong enough to allow effective functioning of water markets. Although it is necessary to continue to invest in productivity-enhancing management reforms for land and water, the magnitude of the challenges justifies seeking to get much more from the available agricultural land and freshwater resources.

Although many experiences around the world illustrate the resource productivity-enhancing role of water and land tenure security, these tenure reforms have their own drawbacks. One of these relates to the fact that formalised land titles and water rights – one of the most common ways of securing resource rights – tend to dispossess traditional, customary rights holders (farmers, herders, and fisher people) who are the majority of the population in most developing countries (MAEDI and AFD, 2015; UN CFS, 2015).

A second limitation relates to the weak implementation capacity of the resource governance laws. This applies to both land and water, but is more glaring for the latter. For example, allocating water rights, recovering related costs, and establishing a well-functioning water market is often far beyond

the reach of developing countries. Hence the most successful water markets are in the USA and Australia.

Third, one of the most striking features of land and water reform processes in recent decades is that they have typically been done in parallel, although in a real-life context these two resources are inextricably interlinked and even congruent. At national level, land reform and water policy reform agendas are distinct and disconnected. Moreover, in the case of water market experiences discussed above (i.e. Australia and the Western USA) land ownership was deliberately delinked from water rights to make the latter tradable.

This parallel approach to land and water management is a paradox. Land and water are so interlinked that "a land-use decision is also a water-use decision" (Gowing, 2003). Along the same line, Hodgson (2016) stresses the need for change "in the way in which water is governed and used if transient or long-term crises are to be averted", but reminding us that "using the land often requires water, and land use and land management influence where water will be available and for how long". The High Level Panel of Experts of the UN CFS also points out that "When land and water governance are not adequately linked, changes in land ownership and tenure at one location can have impacts on water access rights elsewhere, with impacts on agriculture and FSN [food security and nutrition]. Conversely, loss of access to water can impede the proper use of land" (UN CFS, 2015). Given that this simple reality has been ignored in practice, we can imagine that land reform experiences discussed earlier have had significant implications on water use and management, and vice versa, although such implications are typically overlooked.

Land reform processes have changed the status of large areas of land and allocated land or dispossessed hundreds of millions of rural and urban households. Michael Lipton estimates that, during 1955–2005, land reform processes benefitted over one billion people and changed the legal status of more than 1 billion ha of agricultural and residential land (Lipton, 2009). These reforms have radically modified the legal and regulatory framework under which farming activities are done, and therefore have far-reaching but unaccounted-for repercussions on the governance of water resources that are underneath, on the surface, or that flow through land areas whose legal status has changed.

Similarly, although we know that water rights and governance reforms significantly affect land value and land tenure security, the specific modalities and magnitudes of these impacts are typically ignored. Against this backdrop, this paper explores the question as to whether (re-) connecting land and water resources management can improve the results achieved through parallel approaches to land and water, and therefore contribute to the challenge of feeding the world in the coming decades.

4 VALUE PROPOSITION AND ANALYTICAL FRAMEWORK

This section elaborates on the value proposition of this paper. Section 2 defined the nature of the problem to be solved. Section 3 explained how far land reform and water rights reform carried out independently from each other contribute to addressing the food security challenge. A coordinated approach to land and water governance is here proposed as an untapped opportunity for improving agricultural productivity, for achieving greater equity – especially gender equity – and sustainable resource use, three requirements for attaining food security for all. The current debates on 'virtual water' and 'land grabbing' are used to illustrate why the integrated nature of land and water needs to be recognised for a better understanding of the emerging challenges facing each of these resources.

4.1. Value proposition

Humanity is faced with the major challenge of feeding the world in the coming decades, considering that the global population will continue to grow exponentially, reaching 9 billion people in 2050, and be wealthier. On this basis, it is estimated that food production needs to increase at least by 60 percent in the next three decades (and doubling in countries of the Global South). One reason for this concern is that the approaches currently used to increase food production, mainly Green Revolution solutions, are not resulting in productivity improvements that are on track to meeting the 2050 food output targets. The second reason for concern is that the two pillars upon which agricultural production depends – farmland and freshwater resources – are either shrinking or degrading and increasingly solicited by non-agricultural sectors.

The world is searching for solutions to the food security challenge – food considered as "humanity's ultimate security need" (Carrington, 2011). Given the complexity of this problem and the magnitude of associated challenges, it is unlikely that there will be a single or simple solution. A combination of responses, some more effective than others, will probably be needed to meet the challenge.

Reforming the legal and regulatory environment of land use and that for water-resource management and use has been and can continue to be among the many responses to the need to increase food production through improved crop yield per unit of land and water productivity.

The value proposition and unique contribution of this paper is to show that linking the governance of land and that of water is an untapped opportunity in efforts to contribute to addressing the food security equation. The objective of the paper is to demonstrate that the interactions between land and water are such that any major change in the governance of one of these two will have significant repercussions on the other. These repercussions can be negative, especially if they are not taken into account upfront. However, the paper makes the case that a coordinated approach to governance of land and water not only helps to minimise potential negative interactions but even to create conditions with mutual benefits and cross-fertilisation between the two resources.

4.2. Analytical framework

As illustrated by the simplified analytical framework chart below (Fig. 5), the world faces a major food security challenge. Although water and land are congruent resources, in practice they are governed in isolation from each other. In the frame of this silo approach to land and water governance, there have been significant achievements in the agriculture sector in recent decades, in terms of improvement of land productivity (outputs per unit of land), and of water productivity and efficiency (more crop per drop). The challenges ahead call for a coordinated approach to the management and governance of land and water. This alternative approach capitalises on and amplifies the positive interactions between the two resources, and will help achieve higher land and water productivity gains, compared with the silo approach.

A coordinated approach has additional advantages, including that it (a) helps attenuate inequities in water and land access, especially gender inequities, and (b) promotes sustainable tools and practices for land and water. This paper uses case examples from around the world to illustrate the advantages of a coordinated approach to land and water as well as the disadvantages of a silo approach.

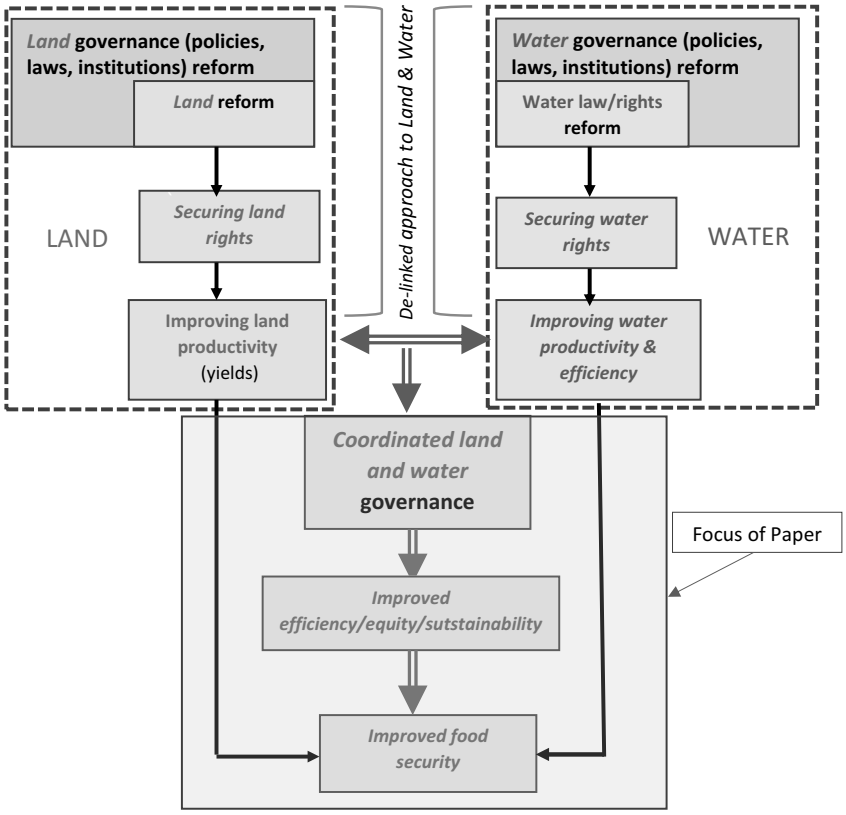

Figure 5. Analytical framework for coordinated land and water governance for good security.

4.3. The case against a silo mind-set to understanding and addressing emerging water- and land-related challenges

The debates on 'virtual water' and 'land grabbing' are succinctly discussed here to show the importance of factoring in the land dimension to fully comprehend water challenges, and vice versa.

The parallel narratives on virtual water vs virtual land

In the context of globalisation marked by intensified international exchanges and interdependency, countries compensate their unequal endowment in natural resources, know-how, and wealth through international trade. Defined as "water embedded in key water-intensive commodities", the concept of 'virtual water' was coined in the late 1990s to account for and understand the significance of water in the global trading system (Allan, 1997). The concept has improved the understanding of water issues in the current context and has opened new perspectives on the geopolitical dimensions of water and food. It has deservedly been the subject of abundant literature. Typically, the virtual water trade flow is understood to be from water-rich countries (that produce

and export water-intensive food crops and meat) to water-poor countries (Hoekstra and Hung, 2005).

However, Kumar and Singh, in a review of the flow of water-intensive agricultural commodities between more than 131 countries, found that the most important determinant of virtual water exports was the availability of arable land (expressed in gross cropped area per capita) and not always water abundance (Kumar and Singh, 2005). In this context, they observed that water-rich but land-poor countries such as Japan and Indonesia are among the major net importers of virtual water, but other countries that are water-scarce but rich in agricultural land such as Australia are among the world major net virtual water exporters. On this basis, the concept of 'virtual land' was defined to refer to the land resources embodied in international trade (Kumar and Singh, 2005; Lugschitz et al., 2011; Qiang et al., 2012).

The observed reality is that water and land must be jointly considered for a fuller understanding of the trade flows of agricultural commodities between nations. By focusing on either of these two resources an important dimension of the reality would be lost. Kumar (2012) rightly pointed out that "assessing the future food security challenges posed to nations purely from a water-resource perspective provides a distorted view of the food-security scenario". What he did not mention is that the same observation can be made for approaches using an exclusive land-resource perspective.

Surge in transnational land deals: land grabbing vs water grabbing?

GRAIN, a Spain-based NGO, published in 2008 the first comprehensive report of the then newly-observed surge in the acquisitions through leases and purchases of large tracts of agricultural land, essentially in developing countries (GRAIN, 2008). Since then, this phenomenon has grabbed media headlines globally and been the subject of numerous academic publications, regional gatherings, and declarations. A number of ad hoc and longer-term monitoring initiatives have been launched in order to provide a better understanding of the nature and magnitude of the phenomenon. As a result of these, various estimates of the quantity of deals and the land areas concerned were released, with figures varying from 25 million ha (von Braun and Meinzen-Dick, 2009), 56 million ha (Deininger and Byerlee, 2011), to over 200 million ha (Oxfam, 2011). After substantial improvements to its global land transactions database, the database of the Land Matrix Initiative now includes data of 1,204 concluded transactions covering 42.2 million ha (Nolte et al., 2016). Although the real magnitude of the phenomenon will probably remain unknown given the secrecy surrounding these transactions, it is commonly agreed that this is a new phenomenon,

in terms of intensity (number of deals per year), size of the land concerned (surface area covered by the aggregate deals), and the pattern of land acquisition processes.

Even though the land deals, when closely examined, are also about water, the phenomenon remained alien to the water community until 2011–2012, when a number of reports and publications started to refer to it as acts of 'water grabbing' (Skinner and Cotula, 2011; Woodhouse and Ganho, 2011). When the water community engaged in the debates, they tended not only to recognise the importance of water in the global land deals, but even to downplay the role of land as a driver. This is illustrated by the session of the 2012 World Water Week entitled: "Inward Investment in Water – Misleadingly Called 'Land Grabbing'"[5].

Today it is clear that rather than being about land grabbing or water grabbing, the phenomenon of large-scale transnational deals is equally about both resources (Allan et al., 2012; Rulli et al., 2013; Woodhouse and Ganho, 2011). Focusing on either of two resources, while ignoring the other, loses sight of important dimensions of this complex phenomenon which, if current trends continue, will lead to a radical redistribution of water and land assets. This will challenge national sovereignties and the prominence of the state in the management of land and water resources located within the boundaries of their national territories.

The above two examples show the increasing integration and congruence between land and water. This is at odds with the prevailing mind-set of operating from a narrow sectoral perspective when dealing with land and with water. A one-sided approach to any of these resources translates into erroneous conclusions, leading to ill-advised policy decisions. This is particularly true for water- or land-based approaches to addressing the food security challenge, where purely sectoral-focused decisions are at best sub-optimal responses to the problem at hand. The section below illustrates some potential benefits of adopting a coordinated approach to land and water.

[5] Event organized by King's College London and the Stockholm Environment Institute

5 A GENDER PERSPECTIVE TO COORDINATING LAND AND WATER GOVERNANCE AND MANAGEMENT

This section analyses the gender perspective on land and water governance from various angles. First, available evidence regarding gender disparities in access to and control over land and water resources is briefly reviewed, with emphasis on productive use, especially in the agricultural sector. Second, the implications of women's limited access to secure tenure rights over land and water are discussed. Third, the section elaborates on the rationale for why closing the gender gap in access to secure land rights makes sense from an economic efficiency point of view as well as from a social-justice and women's agency perspective. Finally, some tested mechanisms through which women's access to and control over land and water resources can be improved are discussed.

5.1. Women's limited access to land and water use in agriculture

Although women provide a significant share of agricultural labour worldwide – 40 to more than 60 percent depending on sources (FAO, 2011c; Foresight, 2011; Niasse, 2013) – they only have limited access to secure rights on the land they use. There are no verified aggregated figures on the level of gender inequalities in access to and ownership of land at the global level; however, available data show significant gaps in diverse parts of the world. Figures of the share of women's land ownership vary from 5 percent of registered land titles in Kenya to 14 percent in Nepal and 36 percent in Ghana (UN-Women, 2014). Similarly, the FAO Gender and Land Rights Database shows that in Africa, as well as other developing countries and emerging economies in Asia and Latin America, the proportion of women among operators of agricultural land holdings is consistently very low: less than 5 percent in countries like Bangladesh, Egypt, Mali, and Morocco ; 5–10 percent in Burkina Faso, Guatemala, Nigeria, and Senegal; and slighter better but still low in Brazil, Ethiopia, India, and Madagascar with 13–19 percent (Fig. 6). Moreover, where women enjoy secure tenure rights, farm sizes tend to be much smaller than for men (UN-Women, 2014).

Because women are marginalised in access to secure tenure rights to agricultural land, they also have limited access to water for productive use – the latter being intrinsically linked to access to land (Wahaj and Hartl, 2007). Improving gender equity in water use in agriculture remains an unachievable goal, unless related inequalities in land access are addressed.

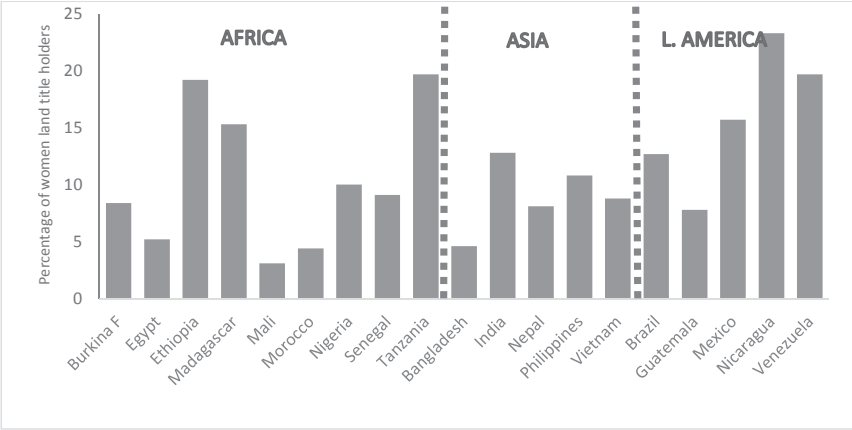

Figure 6. Proportion of women among the total number of land title holders in selected countries. Source: adapted from FAO Gender and Land Rights Database, accessed 25 June 2017; and De Schutter (2010).

5.2. Implications of women's poor access to secure rights to land and water

Women's poor access to secure land and water rights has far-reaching implications. Despite the increasing feminisation of agricultural labour – as a result of male outmigration, HIV, and other factors – men continue to predominantly exercise control over farmland. This means that women are largely excluded from decision-making processes regarding management of the farm and agricultural production activities (Wahaj and Hartl, 2007). Because of the prevailing assumption that farmers and rural workers are essentially men, agricultural policies and programmes as well as extension services tend to be designed to ignore and bypass women (World Bank, 2007). This negatively affects the rate of adoption of promoted agricultural innovation and sustainable land and water management (IDLO, 2016). It also contributes to the low agricultural performance by women with insecure tenure rights, as illustrated by a case in Burkina Faso in which the productivity of plots managed by women was 30 percent lower than that of men (Foresight, 2011). Similarly, the 2012 World Development Report observed that in many sub-Saharan countries, farms held by women had an average yield much lower (20–30 percent) than men's farms (World Bank, 2011). This is explained by women having plots that are too small, tenure insecurity, and difficulty accessing credit and therefore agricultural inputs and equipment (World Bank, 2011). In agrarian economies, as is the case of many countries in the developing world, women who are denied access to ownership and/or secure rights to agricultural land and water for production are likely to be socially and politically marginalised.

5.3. Rationale for closing the gender gap in access to and control over land and water for productive use

Experience shows that addressing the equity and gender gap in access to, and tenure security over, farmland contributes significantly to improving the total output of the agricultural sector (Foresight, 2011). Given that women are just as efficient as men and would achieve the same yields if they had equal access to productive resources and services, FAO (2011c) estimates that closing the gender gap in agriculture implies higher levels of input use, resulting in an increase of up to 20–30 percent in the average crop yields in women's land. This means an increase of 2.5–4.0 percent in domestic food production in developing countries, and a 10–20 percent decrease in the world's undernourished population (FAO, 2011c). These positive impacts on food security of gender equality in land access are also verified at the household level. It is demonstrated that when women have more influence over economic decisions – which happens when they enjoy greater land tenure security – their families allocate more income to food, health, education, children's clothing, and children's nutrition (Niasse, 2013). The World Bank 2012 World Development Report quotes evidence from Ghana showing that the share of land and assets owned by women is positively correlated with higher food expenditure by households (World Bank, 2011). Therefore, from a resource-productivity and economic efficiency point of view, as well as from a food security standpoint, it makes good sense to address gender disparities in access to and control over land and water.

Beyond this efficiency perspective, which some refer to as an instrumentalist perspective, closing the gender gap in access to secure land and water rights are justified from social-justice and human-rights perspectives (GLTN, 2008; IDLO, 2016; Sida, 2010). Article 16 of the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) calls for equal rights of both spouses in terms of the ownership, acquisition, management, administration, enjoyment, and disposition of household property (Niasse, 2013). Because secure land rights opens access to other key resources (such as water, as shown earlier), IDLO considers it as the "single most important condition for women's empowerment" (IDLO, 2016).

Human-rights concerns as well as the positive economic and social spill-over effects of gender balance in access to productive resources (especially land) amply justify the fact that this question features prominently on the international development agenda. The UN Sustainable Development Goal 5 (SDG-5) aims at achieving gender equality and empowering all women and girls, and target 5.4. is to "undertake reforms to give women equal rights to

economic resources, as well as ownership and control over land and other forms of property…". Unsurprisingly, women's role is central to achieving all other SDGs, including SDG-1 on ending poverty, SDG-2 on achieving food security and promoting sustainable agriculture, and SDG-6 on availability and sustainable management of water (UN-Women, 2016).

Although the case for gender equality in ownership and control of land and water is compelling, the real challenge is at the implementation level. What exactly can be done to address current gender disparities? These inequalities not only have often deep historical and cultural roots, but are also reinforced by power imbalances that typically favour men. Some of the approaches tried in different locations to tackle gender disparities in access to land and water are discussed below.

5.4. Approaches to addressing gender disparities in access to and control over land and water

Concerns for equity and gender issues in irrigation are typically addressed through farmers' and community participation in decision-making processes, for example through the transfer of water management responsibilities to communities and especially to water user associations. The extent of gender equity would then be assessed through the level of involvement of women in decentralised water governance structures. It would hence be assumed that meaningful involvement of women in these decentralised water management structures would ensure that women's interests and perspectives are duly considered and that gender equity would be improved. Quotas of women participants in meetings, and the percentage of women in leadership positions in water user associations would then serve as measures of gender equity in water governance (Harris and Gantt, 2007). It is true that women's access to decision-making powers in local and decentralised institutions has in some cases helped achieve better outcomes in water management. In India, it was noted for example that villages with greater representation of women in leadership positions – i.e. villages complying with the constitutional requirement to have at least 30 percent of leaders and members of village councils be women – had 60 percent more drinking water facilities than villages with weaker representation (Zetland, 2011).

Efforts to understand gender impacts of water management are also often centred on the assessment and analysis of time spent, distance covered, and level of effort by women to fetch freshwater from wells and surface water bodies for domestic use (Chartres and Varma, 2011). Concerns over women's access to water for domestic use and women's participation in water-related

decision-making processes are all legitimate. However, addressing such concerns will not have a significant effect in attenuating the currently very high gender disparities in access to and control over water resources for domestic and productive use. More importantly, it is obvious that efforts to improve women's access to and control of water for productive use – in particular water for agriculture, which accounts for 70 percent of freshwater withdrawals – cannot succeed without tackling gender disparities in ownership of agricultural land.

From this angle, there are clear limitations in the GWP Gender Strategy (GWP, 2014) with its objective being to bring gender into the mainstream of GWP work. Three approaches are defined: (a) gender mainstreaming of policies and practices, (b) creating an enabling environment for women's meaningful participation in all aspects of water management for sustainable and equitable development, and (c) gender equality in the workplace. The strategy hence assumes that women's meaningful participation will have a positive influence on gender inclusion in water-related policy and practice, which would then treat women in a fairer manner. As shown previously, access to and control over freshwater used in agriculture is conditional to access to land. The GWP Gender Strategy, however, only mentions in passing the importance of land tenure. It is therefore important to discuss approaches that can be used or have been successfully tested to improve women's access to secure land rights. Several are mentioned below.

Constitutional and legal provisions for addressing gender disparities in land access

Of the many countries that have statements and specific provisions in their constitutions or selected national laws to improve women's access to land rights, some have been more successful than others in enforcing such provisions. In Colombia, the proportion of women beneficiaries of the agrarian reform increased from 11 to 45 percent as a result of mandatory joint-titling (in the name of both the husband and wife) of couples' land ownership (Giovarelli et al., 2013). Other joint-titling experiences (including Ethiopia, Kenya, Nepal, Rwanda, and Vietnam) have contributed to improving the proportion of women having access to secure land rights (Ali et al., 2014; Holden and Ghebru, 2016; IFAD, 2016).

Reclamation of degraded land

Each year, hundreds of thousands of hectares of agricultural land are lost due to land degradation, itself caused by a combination of factors, including climate variability and change and unsustainable farming practices.

Traditionally fertile soils or land ideally located (next to villages or to roads) are the most vulnerable to land degradation because of their intensive exploitation. Usually land ownership claims erode as the land degrades and the value of the land declines. The case examples of Section 6 show that in Niger (bio-reclamation of the land) and Jharkhand State in India (small-scale water management to recover degraded land), interventions aimed at restoring the productivity of these types of soils offer the opportunity for fairer land allocation to women.

Built-in project design principles or project conditionalities

Donor-supported project interventions can also be successfully used – through conditionalities or built-in design principles – to promote equitable access to the land benefitting from project support. An International Fund for Agricultural Development (IFAD)-supported project to improve floodplain agriculture in Maghama (Mauritania) offered the possibility of secure tenure rights to land for traditionally landless groups (Section 6). Another example is IFAD's Lowlands Agricultural Development Project implemented during 1997–2005. The project promoted the concept of 'land-against-labour' which allowed more than 22,000 landless women to become landowners (Wahaj and Hartl, 2007).

Irrigation schemes

State-funded and -managed irrigation schemes are also important opportunities to set in place mechanisms of land allocation that are fairer than customary practices. The fact that public resources are mobilised to develop the land is a solid argument for treating all citizens equally, regardless of the traditional condition of landed or landless farmers. Land allocation processes in state-sponsored large irrigation schemes – such as in Senegal (left bank of the Senegal River) and Mali (Selingue and Inner Delta of the Niger) – can employ an open democracy principle by which all households in targeted villages are allocated the same plot size (or according to household size), while the exact plot location within the scheme is randomly determined. For this reason, in a study carried out the late 1980s in the Senegal River Valley, Boutillier (1989) likened a village irrigation scheme to a 'lieu d'émancipation' (place of emancipation) for marginalised, landless families, compared to rain-fed and recession agricultural land where customary land governance practices prevailed.

A common feature of all of the above approaches is the high level of interconnectedness between land and water. They show that searching for a solution to gender inequities in access to water is an impossible task if

inequities to land access are not addressed. It is noteworthy also that where land tenure right is undefined and precarious, evidence of access to water is used as a means of securing land rights. That is the case in the Selingue irrigation scheme in Mali where the only document that farmers can show as evidence of land having been allocated to them is their receipts for payment of water charges (Adamczewski-Herzog, 2016).

6 BENEFITS AND COSTS OF A COORDINATED APPROACH TO LAND AND WATER: ILLUSTRATIVE EXAMPLES

6.1. Gains from a coordinated approach to land and water

Case 1. Securing land rights for sustainable increase in Total Factor Productivity (East Asia and Africa)

Insecure land tenure systems, with loosely defined rights, act as disincentives for making substantial investments aimed at improving land productivity in a sustainable way. This was noted in the contexts of countries (such as Eastern Europe, former USSR, China, and Vietnam) that nationalised and/or transferred land to newly created collectives – a process known as collectivisation – as part of the implementation of their revolutionary, socialist agenda. The same phenomenon was and is generally noted in many sub-Saharan Africa countries where a conjunction of factors (including pre-colonial and colonial land tenure legacies and modern reform) has resulted in the majority of the population, especially in rural areas, holding informal and precarious tenure rights.

When reforms to improve land tenure security for individual farmers or communities have been successfully implemented, beneficiaries of such reforms have generally had an incentive to increase labour and capital investment (including in water management) in their land, which led to increased yields and hence crop production. Where land tenure security has benefitted many farmers, it has contributed to national food security. China is the most compelling example of large-scale productivity-enhancing role of securing land rights and of improved land governance. Indeed, China's oft-praised food production miracle observed from the late 1970s to the early 2000s – when farm outputs tripled without expanding arable land – resulted to a large extent from the decision taken in 1978 to grant farmers more secure individual land titles, contributing to crop production growing by 42 percent during 1978–1984 (Bruce and Li, 2009). The example of South Korea cited earlier is another compelling case. There are similar examples in Africa and elsewhere where securing land rights, for example by providing land titles, has helped to increase investment and improve productivity (Deininger and Byerlee, 2011; Kirk and Tuan, 2009; World Bank, 2007).

Case 2. Community-level land tenure agreements (conventions foncières locales) as a means of achieving both higher efficiency and greater equity in access to flood recession agriculture in the Senegal (Maghama, Mauritania)

During its peak flow period in the rainy season, the Senegal River inundates a series of low-lying areas in the floodplain of its middle and lower reaches. Before the multipurpose Manantali Dam was built upstream in 1988, the annual flood could inundate up to 500,000 ha in the wettest years, of which up to 100,000–150,000 ha was inundated long enough to be cultivated after the water receded (i.e. recession agriculture). Since the dam became operational, inundation of the floodplain requires artificial flood releases from the upstream Manantali Dam. There are many competing demands on the Senegal River's water – each year, about 20 billion m^3 of water pass through the Bakel station after the various tributaries converge. Thus a compromise was agreed by member states of the Senegal River Development Authority (OMVS) such that when needed, and if annual hydrological conditions permit, artificial flood releases will be implemented by the Manantali Dam to allow at least 50,000 ha of recession agriculture. This target area of recession agriculture requires huge volumes of water from the Manantali Dam: a total volume of water of 4.5 billion m3 for two months (August and September) or 22.5 percent of the total annual river discharge (Niasse, 2017; TRACTEBEL et al., 2013). When implemented, these flood releases translate into reduced hydropower production and less water available for dry season irrigation. Although there are critical ecosystem services attached to the annual flood such as groundwater recharge, survival of *Acacia nilotica* forests, and fish reproduction (Niasse and Cherlet, 2015), it is also important that the flood waters be optimally used by other beneficiary activities including fisheries, livestock rearing, and recession agriculture. The latter used to play a key role in the food security of the population of the middle valley of the river. However, recession agriculture suffers from chronically very low yields (500–800 kg/ha of sorghum) and a quasi-feudal tenure system that prevents innovation.

IFAD, through the Project for Improving Flood Recession Farming in Maghama, targeted one of the cuvettes *(walo)* of the floodplain in Mauritania (the *walo* of Maghama) with the objectives of improving the efficiency the inundation of the cuvette and of supporting farmers to improve productivity of recession agriculture. One condition of the project for supporting the development of the Maghama *walo* was to ensure greater equity in access to land and hence to flood waters of the targeted *walo* (IFAD, 2010). The project brokered an agreement (referred to as *Entente foncière* in French)

with landed families which gave secure access for flood recession agriculture to traditionally landless and land-poor households in the lowlands of the river floodplain. As a result, productivity per unit of land improved and the flooded area increased substantially from 2,000–3,000 to 9,000 ha benefitting hundreds of families from 28 neighbouring villages (Baro, 2016; Jonkheere and Liversage, 2017). This project hence achieved a triple objective of improving equity in land access, increasing productivity, and expanding the cultivated floodplain area. Moreover, this project contributed to more efficient and equitable use of the river's floodwaters.

Case 3. Improving the land governance framework to increase water use efficiency in agriculture at basin scale: the Charter for the Irrigable Domain (left bank of the Senegal River Basin, Senegal)

With reservoirs built upstream and downstream, the Senegal River allows in theory the irrigation of a total of 375,000 ha of land in the entire basin, including about 240,000 ha in Senegal and 120,000 ha in Mauritania and 15,000 ha in Mali. Of this potential, about 200,000 ha have been developed, with 130,000–150,000 ha that is exploitable. A large proportion of the developed land is lost due to factors such as soil salinisation, itself a result of poor drainage systems. For example, it is estimated that no less than 15,000 ha of land developed for irrigation has been abandoned in recent years on the Senegalese part (left bank) of the lower river basin (Gning, 2015). The Senegal River basin therefore faces two major challenges: ensuring that a substantial share of water stored in the reservoir is used to develop the available irrigation potential; and to avoid loss of irrigation land resulting from poor drainage and inappropriate land use practices.

To respond to these challenges, a *Charte du Domaine Irrigué* (CDI: Charter for the Irrigation Domain) was adopted in 2007 under the auspices of SAED[6], the parastatal body established to oversee the development of the left bank of the Senegal River basin. This charter defines the conditions and norms to be complied with by beneficiaries of irrigation land allocations in the basin. These include the need to effectively develop the acquired land in a reasonable timeframe, have appropriate drainage systems, contribute to maintenance of irrigation channels, and commit to wise and efficient use of irrigation water (SAED, 2007). In theory, the CDI helps prevent the speculative land hoarding practices which have occurred more frequently in recent years ('land grabbing'). Failure to comply with the principles

[6] SAED: Société Nationale d'Exploitation des Terres du Delta du Fleuve Sénégal et des Vallées du Fleuve Sénégal et de la Falémé

of the CDI normally leads to expropriation of the allocated irrigation land. Land tenure is therefore conditional on efficient and sustainable water management. That said, given that the CDI has not yet been fully implemented, it is premature to assess its impacts.

Case 4. Addressing land governance to cope with severe and unanticipated water scarcity in the Quibor Valley, Venezuela

The Quibor Valley is an agricultural zone with a potential of 21,500 ha of irrigated land, of which only 3,000 ha is being used. The region only receives about 400–500 mm of annual rainfall. Irrigated agriculture has therefore essentially relied on groundwater. Due to excessive abstraction of aquifers, the water table has dropped by more than 100 m in the last four decades. In response to this chronic water scarcity, the government launched a major hydraulic project in the 1970s to transfer water from the neighbouring Yacambu catchment – an area that receives more 2,000 mm of annual rainfall – to the Quibor Valley through a 23-km-long tunnel to be excavated through the mountains separating the two regions. The tunnel (of diameter 4 m) would annually transfer 330 million m^3 of water from the planned Yacambu Reservoir to the Quibor Valley (Garduño and Marcella, 2003; Hoek and Guevara, 2009). More than 40 years later, the project is still not completed but has absorbed US$800 million, and according to some estimates even more than US$1.2 billion, against an initial cost estimate of US$150 million (Boscán, 2016). One of the key challenges posed by this megaproject is an equity issue – there are high inequities in land access in the Quibor Valley. Less than 50 producers (with more than 200 ha each) control 47 percent the agricultural land area and are responsible for most of the groundwater abstraction. Small farmers with less than 5 ha each represent 51 percent of the farming population, but only 4 percent of the irrigated land. More than 3,000 people (45 percent of the economically active population) are agricultural labourers in the large and medium size farms (Jégat and Mora, 2015). This means that unless land is allocated more equitably and/or an appropriate water pricing system is set in place, the enormous public resources invested in this water transfer scheme will disproportionately benefit a minority. For now, the promises of this gigantic white elephant are delayed and are more uncertain than ever, and farmers in the Quibor Valley had to find ways of coping with an increasingly acute water scarcity challenge. In order to regulate and control groundwater abstraction as well as promote conjunctive use of surface and groundwater, the depression has been divided into zones depending on soil quality and aquifer status, and less water-intensive crops have been promoted (Jégat and Mora, 2015).

Case 5. Provision of water harvesting infrastructure to prevent distress land sales during drought in the north of the Province of Córdoba, Argentina

Many regions of Argentina face water scarcity and this is also the case for the Administrative Department of Tulumba in the Province of Córdoba in northern Argentina[7]. During 2007–2013, this region suffered an extended period of drought. It is estimated that rural inhabitants lost 70 percent of their livestock and the average outputs of farms and orchards dropped by 80 percent. Many families decided to sell their land to wealthy actors and move to urban areas. Women were among the hardest hit by the severe drought as they had to devote more time and cover longer distances to fetch water for the household.

It is in this context that the Plurales Foundation decided, from 2012, to launch the project *Unidos por Agua* (United for Water), focusing in the northern part of Tulumba. A pilot phase targeted a community of 2,000 people, helping build 100 water harvesting cisterns (of 16 m^3 each) while providing technical training in water management and gardening and horticulture. As a result of the project intervention, the livestock numbers started to recover in size a year later and the number of vegetable gardens increased by 45 percent. Access to water for domestic use improved substantially, with a positive impact on women's workload. The wave of outmigration stopped as did the distress sales of land.

This experience is highly relevant in the current context of climate change in which extreme events (droughts and floods) are expected to be of higher frequency and magnitude. Drought- or flood-induced landlessness is hence expected to increase, unless the economically vulnerable households are provided with emergency support, like that offered by United for Water. In Tulumba, the provision of small infrastructure for water harvesting and storage served as protection for families who opted not to emigrate during the drought episode, and helped them safeguard their land rights

[7] This case is a summary of a case example submitted by Plurales Foundation in Argentina (Avellaneda et al., 2016). Plurales Foundation was the only organisation that responded positively to the open invitation for submission of case stories that ILC and GWP jointly circulated in mid-2016 among their respective networks as part of the preparation for this Background Paper. The International Land Coalition has recently published a case study on the submission received from Plurales Foundation (Fundación Plurales, 2017).

6.2. Costs and missed opportunities of ignoring the interactions between land and water governance

Case 6. Tenure insecurity as key constraint to soil and water management practices in Cisadane Hulu sub-basin in West Java, Indonesia

The Cisadane is a small river of about 140 km long, flowing through Bogor, West Java, Indonesia. The basin is in a water-abundant region, as the annual rainfall in the catchment area varies within 3,000–6,000 mm. However, in recent decades, a high level of land use change – with expansion of agricultural land at the expense of forests – has been contributing to decreased soil water retention capacity and hence to higher runoff rates and accelerated soil erosion (Harto and Kondoh, 1998). Widespread land tenure insecurity is one of the underlying causes of this soil degradation trend. An estimated 70 percent of the land in the Cisadane Hulu sub-basin belongs to mining and tourist resort companies (through concessions) and to absentee landlords, while 80 percent of resident farmers are tenants (Tillah, 2015). Land owners typically prevent tenants from adopting agroforestry and/or sustainable land management investments aimed at improving soil water retention capacity and reversing soil erosion. Instead, they allow tenants to grow seasonal crops so that tenants' contracts can be terminated at the end of the harvest if necessary (Tillah, 2015). This unresolved context of land insecurity is one key obstacle to achieving sustainable management of the basin, despite efforts underway to promote micro-scale watershed management and to establish a multi-stakeholder forum at basin and sub-basin level.

Case 7. Climate impacts on water with repercussions on land and territorial disputes – Lake Chad (Nigeria and Cameroon)

The dramatic dwindling of Lake Chad is often used as a textbook example to illustrate the impact of climate change and variability on surface water resources. The maximum flooded area of the lake – here the area flooded for four consecutive months is taken into account – shrank from 25,000 km^2 in the 1960s to 2,500 km^2 in the late 1990s and early 2000s, with slight improvements noted since 2007 (AFROSAI, 2015; Niasse, 2005). Although a long-term trend toward shrinking of the lake was observed in recent decades, it appears that the size of the flooded area does fluctuate annually, depending on rainfall and river flow conditions in the tributaries of the rivers (the Chari–Logone river system and the Komadugu-Yobe River) (Lemoalle and Magrin, 2014). The production systems in riparian villages (composed of herders, farmers, and fisher people) used to adjust to the seasonal and inter-

annual fluctuations of lake levels, for example by moving to keep contact with the lake water.

This pattern of mobility aimed at maintaining use rights to the fugitive water resource began to pose problems as independent riparian states consolidated their national borders. In the 1980s and 1990s, the lake shrank to an extent that it migrated out of Nigerian territory. Nigerian villagers, especially fisher communities, followed the receding lake and entered and settled in Cameroonian territory. In the mid-1990s, more than 30 villages populated by Nigerian immigrants (a total of 70,000 inhabitants) were identified in the Cameroonian part of the Lake Chad Basin (Niasse, 2005). One of these villages, Darak – located in Cameroonian territory, 35 km east of the border with Nigeria– was founded in 1987 by Nigerian fishermen who immigrated to that location in pursuit of Lake Chad in its progressive retreat (Niasse, 2005) (Fig. 7). Tension erupted between Nigeria and Cameroon because Cameroon considered this as a de facto occupation of a portion of its territory by Nigeria. Cameroon accused Nigeria of continuing to provide administrative and social support (education and health facilities) as well police and military protection to its migrating communities, even after they entered Cameroonian territory. After a series of military clashes, the two countries referred the case to the arbitration of the International Court of Justice (ICJ), along with the overall border dispute between the two countries. The ICJ Ruling in October 2002 largely endorsed Cameroon's position, and a Cameroon–Nigeria Mixed Commission was established to oversee border demarcation and compliance with this ruling.

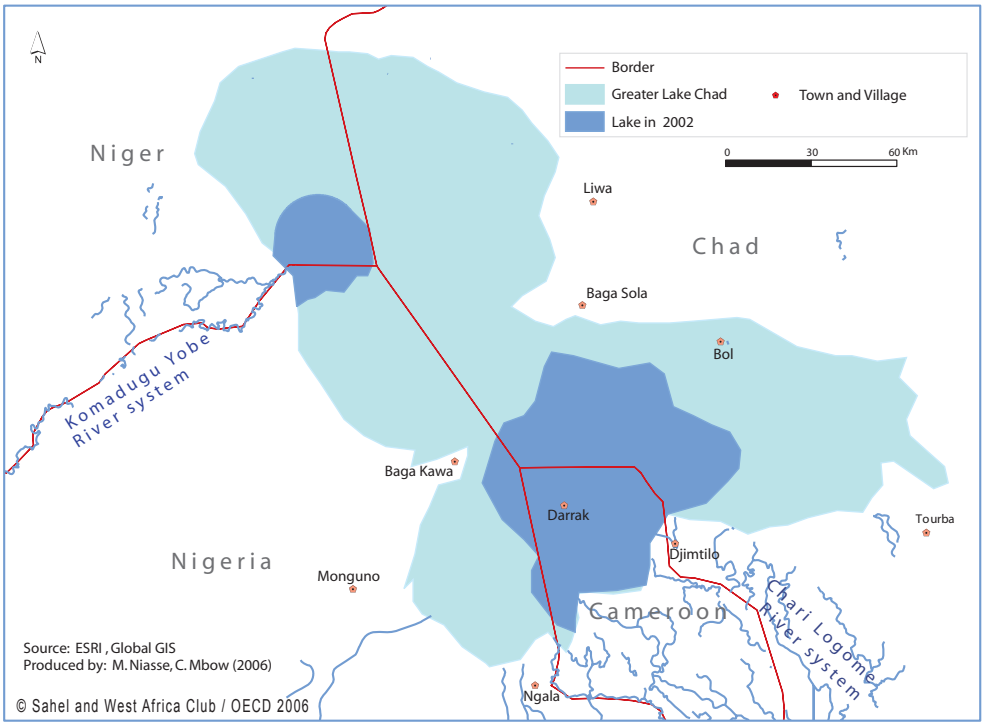

Figure 7. Shrinking Lake Chad: rights to a fugitive resource and territorial disputes
Source: Niasse (2009) and LCBC Remote Sensing Unit (May 2002). Niasse, M. 2009. "Transboundary River Basins" in Regional Atlas on West Africa, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264056763-en

Case 8. The hidden water dimensions of large-scale land grabbing in African river basins. Examples of Nile, Niger, and Senegal transboundary river basins

As discussed earlier, the global rush for agricultural land is also about water. Three examples of African transboundary rivers that are among the key regions targeted in large-scale land acquisitions are briefly analysed to illustrate some challenges posed by this phenomenon. Although massive amounts of freshwater are given away along with the land that is leased out, water is seldom mentioned in the negotiated land deals. River basin authorities whose mission is primarily water management ignore these land concessions which, if developed for irrigation, could in the near future ignite water-sharing tensions among riparian countries.

The Nile River basin is one fiercely disputed target in the global search for agricultural land. The irrigation potential of the entire basin is estimated at a maximum of 8 million ha, of which 5.4 million ha is already developed. GRAIN – a Spain-based NGO – estimates that together Ethiopia, Sudan,

South Sudan, and Egypt (representing 85 percent of the basin surface area) have recently allocated 8.6 million ha to prospective investors. The water requirement of existing and newly allocated farmland clearly far exceeds the river's available water (GRAIN, 2012).

The Niger River basin – shared by nine countries – is another key target of large-scale land acquisitions for agro-investments, especially the fertile land of the inner delta in Mali. In recent years, Mali has allocated hundreds of thousands of hectares of agricultural land to investors. The allocation of a 50-year-lease of 100,000 ha to Libya (a venture called Malibya) attracted international attention in 2008–2009. Along with the land, Malibya was allocated unrestricted access to water, mainly from the Niger River (Skinner and Cotula, 2011). However, water requirements of the scheme amount to an average of 115 m^3/s during the low flow season at a time when the Niger River discharge falls below 50 m^3/s (Adamczewski et al., 2012). The Oakland Institute (2011) estimated that the 40-km canal built as part of this project has a total irrigation capacity of 4 billion m^3 per year. If fully operational, the project – stalled following the Libyan political crisis – will therefore substantially increase the pressure on Niger River water. Paradoxically, the Malibya irrigation project is absent in the Niger Basin Authority deliberations. In the mid-1990s, proposals by Niger and Mali to build the Kandadji Dam (Niger) and Taoussa Dam (Mali) raised serious concerns from downstream Nigeria (Niasse, 2005).

Similar challenges are noted in the Senegal River basin, which is shared by four countries: Guinea, Mali, Mauritania, and Senegal. It is estimated that the upstream (Manantali) and downstream (Diama) reservoirs create a potential for 375,000 ha of irrigated land in the entire basin, of which about 150,000 ha is already developed. In Senegal alone, the Land Matrix project identified 19 international land deals covering a surface area of 270,980 ha, of which 50 percent is in the Senegal River basin (Land Matrix, 2016). Although no reliable figures are available, large tracts of land have also been allocated to investors on the Mauritania side of the basin. Despite the magnitude of large-scale land deals in the basin and their implications for water withdrawals from the river, OMVS, the river basin authority, does not seem to have clear responsibilities in relevant regulation.

Overall, the above cases of the Nile, Niger, and Senegal transboundary basins exemplify the danger of not paying due attention to water when decisions are made to allocate the land and when actual development and exploitation of the land takes place. In all cases (especially for the Nile and Senegal basins),

what is being observed is a 'tragedy of the commons' in which each of the basin countries allocate as much land as possible to foreign actors, with the assumption that other riparian states are doing the same. The examples of the Senegal and Niger basins show that river basin organisations – whose role is to regulate water use and management, prevent conflict, and foster cooperation – are ill-prepared to respond to the challenges of large-scale land acquisitions. A central limitation is that these transactions are perceived to be about land and not water, and are therefore under the responsibility of individual member states. To give an idea of the significance of the water footprint of these large-scale ventures, Breu et al. (2016) calculated that if fully implemented, the projects in a sample of 475 large-scale land deals covering 26 million ha would annually consume 92 billion m^3 of freshwater, which is more than the average annual discharge of the Nile at Khartoum. By giving away massive amounts of land for irrigation agriculture, countries commit more than the water available in the shared water course, and therefore create the conditions for future inter-state tensions and water conflicts.

6.3. Promising examples of addressing gender disparities in access to secure land and/or water rights

Case 9. Adapted water management techniques and reclamation of degraded land as opportunities to address gender inequities in access and control of rain-fed agricultural land (Niger)

This report discussed in Section 2 the high level of land degradation, translating into accelerated shrinking of the remaining precious agricultural land and the decline of its fertility. Climate change and variability and inappropriate land use practices are the main drivers of land degradation. Where land degradation takes place – manifesting itself in desertification, salinisation, deforestation, and severe soil erosion – soil fertility declines and the value of farmland decreases. The land can then be under-used or even abandoned, with land rights weakening and claims over the land disappearing. In many cases, degraded lands are strategically located (near villages or roads), which is the very reason why they are degraded.

Reclaiming degraded land, where the extent of degradation has not become irreversible, can contribute to containing the current trends toward the shrinking of arable land. It is also a unique opportunity for addressing inequalities in access to secure land rights – especially the glaring gender gaps.

ICRISAT[8] has been working toward reclaiming and restoring degraded lands in the Sahel region, and especially in Niger where degraded lateritic soils occupy 50 percent of the land area (Fatondji et al., 2013). The approach used, called 'bio-reclamation', consists of combining indigenous water harvesting techniques, locally tested soils and water management practices (such as improved planting pits, contour stones, and half-moon shaped bunds) with planting of high-value drought resistant trees. This approach which uses community mobilisation, especially women, has helped reclaim hundreds of hectares of abandoned land that was subsequently allocated mainly to women. Prior to the reclamation work, it was agreed with the traditional owners that the largest share of land, once reclaimed, would be given to women. Although the experience is at an early stage of scaling up, it has already benefitted more than 15,000 women who gained secure land rights on productive rain-fed agricultural land (Fatondji et al., 2016).

Many similar initiatives are taking place in the Sahel, and these have shown that modest investment in small-scale land and water management techniques can help restore the productivity of thousands of hectares of barren and degraded land and improve groundwater recharge (Reij and Smaling, 2008). Large-scale adoption of such techniques can have very significant impacts. The World Resources Institute estimates that applying similar techniques in just 25 percent of cropland area of sub-Saharan Africa could help to increase crop yields by up to 50 percent (Winterbottom et al., 2013).

Case 10. Small-scale water management interventions as means of recovering abandoned land, improving women's tenure security, and boosting agricultural productivity. An experience from Jharkhand State, India

Jharkhand is a new state of India, formed in the year 2000 to support the rights of the indigenous people to have their own state (Roy Patnaik and Venkataramanan, 2015)[9]. Agriculture is the main economic activity of Jharkhand's rural population, and the sole source of income for the poorest segment of society. Agriculture is predominantly rain-fed, with less than 13 percent of the arable land irrigated (compared to 35 percent for India). Expanding of agricultural land is also constrained by the fact that much of the land is either rocky and uncultivable or composed of reddish soil with low water retention capacity and low fertility. Unsurprisingly, poverty is rampant

[8] International Crops Research Institute for the Semi-Arid Tropics (a CGIAR centre).
[9] The information for this case example is essentially derived from Roy Patnaik and Venkataramanan (2015).

in Jharkhand, one of the poorest states in India, with 54 percent of its 6.9 million households below the poverty line.

Although women provide the largest share of the agricultural labour in Jharkhand – 44.8 percent of agricultural labourers are women compared to 27.8 percent of men[10] – they typically lack access to secure land rights and are seldom recognised as farmers and as relevant targets for agricultural extension efforts.

To address this problem, SWADHINA (a local NGO) set itself the objective of piloting approaches to improve women's access to secure land rights and to expanding irrigation agriculture through small-scale water management techniques and agroforestry practices. Initiated in early 2000, the intervention initially targeted an area of 165 ha of uncultivated and abandoned land. This land was recovered and made arable by helping organised community groups – 600 indigenous families, especially women – to build water harvesting cisterns and to clean and desilt old water tanks. Additional work carried out included digging, levelling, and treating soil by application of green manure. Once the land was reclaimed, plots were allocated to members of women farmers' groups. SWADHINA took the initiative to issue and deliver land 'possession certificates' to beneficiaries of plots distributed by the project. Although not formally recognised by government, these certificates did provide a high level of tenure security to beneficiaries, because they were accepted by local communities. The benefits of this intervention were many: agricultural land area expanded by recovery of abandoned land; water harvesting and rehabilitated tanks helped increase not only productivity per unit land, but also crop diversification and crop intensity (with villagers continuing farming activities beyond the monsoon season); and women gained secure access to land and were hence recognised as farmers in agricultural support interventions. It was also observed that with the possession certificates and related tenure security, many of the beneficiary women felt empowered and visibly improved their civic engagement, including at the level of local government activities.

[10] This means that 27 percent of the labour input could not be disaggregated by gender.

7 CONCLUSION

Land and water are two of pillars of a yet-to-be resolved global food security equation. Achieving sustainable, equitable governance and efficient use of land and water resources is central to humanity's ability to take up the challenge of feeding the world in the coming decades. This explains the current context of fierce competition for fertile land and freshwater resources, at global, national, and local levels.

This paper makes the case that, although managing water and land in separation from each did prevent substantial production improvements in the past, the time has come to reconcile the governance of the two resources. Coordinated management and governance of land and water helps achieve more substantial productivity gains in each of agricultural land and water for productive use by capitalising on the potential for mutually reinforcing interactions between the two resources.

The time is opportune for a coordinated approach to land and water. Worldwide, there is an era of land and water policy and law reforms, triggered by greater awareness of the increasing strategic role of land and water in the emerging geopolitics of food security, but also because of their critical role in boosting economic growth and inclusive development. Unfortunately, the opportunity of reconciling land and water is being missed – land and water reform processes are being carried out independently from each other. If current patterns are maintained there is the risk of further widening the divide between land and water.

Another favourable context is offered by the projected increase in investments aimed at expanding irrigation, in response to climate change (and the need to improve the mastery of water resources) and the renewed ambition to increase agricultural production worldwide to respond to increasing food need. This is a unique opportunity for improving equity in access to irrigation land and hence to water for productive use. As this paper shows, compared to traditional agricultural production systems such as rain-fed or flood recession agriculture, state-sponsored irrigation has a better record of allocating secure land rights to women and other traditionally landless families. However, irrigation can and should do even better, because achieving improved equity in access to secure land rights also boosts Total Factor Productivity. It is also called for from a human-rights perspective.

Although inequities in land and water access are deeply rooted in history and social norms, and are reinforced by existing power imbalances, there are opportunities for attenuating and even correcting the disparities. In addition to state-sponsored irrigation, the rehabilitation of the millions of hectares of land already degraded and the hundreds of thousands more lost each year is a huge opportunity for both responding to the challenge of shrinking farmland and promoting equitable access to land tenure rights. Donor-funded land and water development and management interventions are also opportunities to raise the standards, from an environmental sustainability point of view as well as a social-justice perspective.

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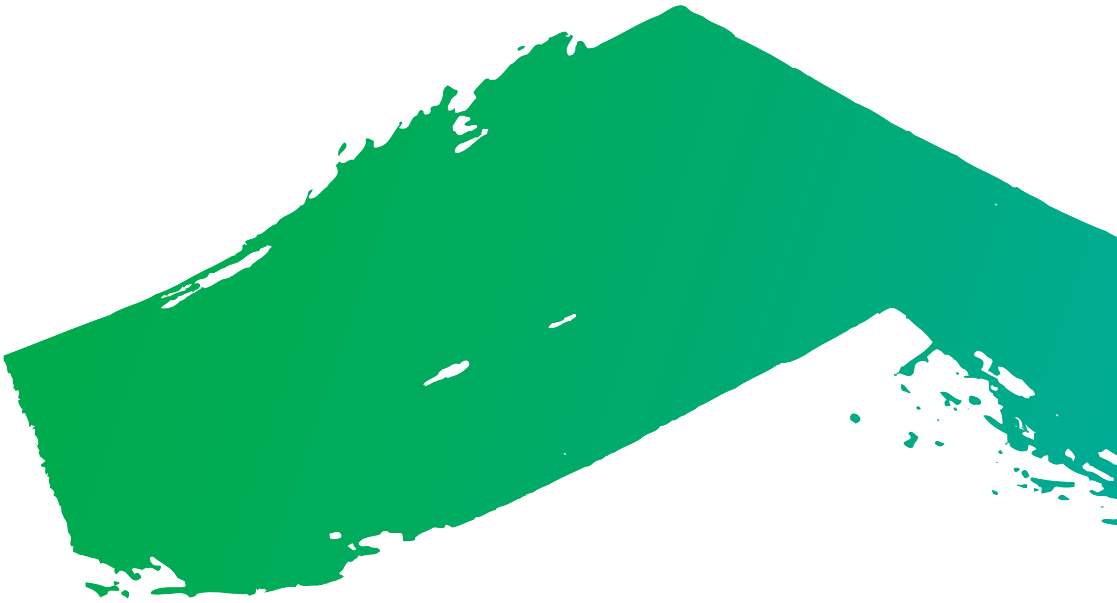

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