Global Water Partnership

Coordinating land and water governance

- An essential part of achieving food security

Feeding the world's growing population and finding the land and water to grow enough food continues to be a basic and sizeable challenge. It is an enormous task because the increase in food production required to meet future needs may have to be achieved with fewer land and water resources. Yet water resources and land use planning and management are mostly disconnected. With this paper we wish to initiate the debate to coordinate land and water governance for the sake of global food security. We argue that the new geopolitics of land and water calls for a more strategic, governance-level response in which land and water are reconnected and the political dimension of the modalities of their allocation and use are fully recognised.

This Perspectives Paper is intended to galvanise discussion within the GWP network and the larger water, land, and development community. This paper has been written by GWP Technical Committee Member Madiodio Niasse and International Land Coalition expert Jan Cherlet. Feedback will contribute to future GWP Technical Committee publications on related issues.

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About Global Water Partnership

The Global Water Partnership (GWP) vision is for a water secure world.

Our mission is to advance governance and management of water resources for sustainable and equitable development.

GWP is an international network that was created in 1996 to foster the application of integrated water resources management: the coordinated development and management of water, land, and related resources in order to maximise economic and social welfare without compromising the sustainability of ecosystems and the environment.

The Network is open to all organisations which recognise the principles of integrated water resources management endorsed by the Network. It includes states, government institutions (national, regional, and local), intergovernmental organisations, international and national non-governmental organisations, academic and research institutions, private sector companies, and service providers in the public sector.

The Network has 13 Regional Water Partnerships, 84 Country Water Partnerships, and 3,000 Partners located in 172 countries.

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Coordinating land and water governance – An essential part of achieving food security (2014)

Cover photo: DFID/Flickr

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Chair, GWP Technical Committee

1 Why does coordinating land and water matter to food security?

Food price increases and market volatility add to the growing uncertainty about whether and how the world will be able to feed itself in the future. Food production principally depends on the availability of fresh water and arable land, yet both these resources are becoming increasingly scarce in many parts of the world and may jeopardise food security. Carrington (2011) calls this one of humanity's major challenges for the 21st century. Beddington (2009) describes the growing international competition to control fertile, agricultural land and freshwater water resources as one of the dimensions of the 'perfect storm' that is brewing towards 2030 when the crises of food, water, and energy come together to create serious shortages. The global rush to acquire land and also fresh water that has taken place since 2007 is just one of the manifestations of this intense competition for land and water.

The inseparable and symbiotic nature of land and water resources for producing food has long been recognised. Land tenure and use practices can significantly influence water availability and quality and, in turn, water availability and quality affect how we use land to produce food. But in spite of this recognition, water resources and land use planning and management remain mostly disconnected and are often dealt with by quite separate and disparate institutions. The international discourse on water resources management over the past 25 years has also largely ignored land issues. Today, in the water sector, the idea of taking a 'silo' or fragmented approach to managing limited and scarce water resources would seem archaic. Integrated water resources management (IWRM) is now well accepted in principle and many countries are now moving towards better coordination and information sharing among multiple sectors and different layers of authority. Land, as an integral part of water management, is embedded in the principle of IWRM, but this has yet to be seriously operationalised.

In this paper we argue that in order to meet the challenges of achieving food security in the future in a sustainable manner, the 'silo' approach to managing land and water is equally archaic and that immense benefits can come from better coordinating the way we think, plan, govern, and manage these two strategic resources. The experiences of adopting an integrated approach to water resources management could provide the catalyst for better coordinating land and water governance. We use examples at all levels to illustrate the potential benefits of this.

2 How do land and water influence food security?

Is the global anxiety about food security justified when history shows that between 1960 and 2000 global agricultural production increased 2.5-fold (FAO, 2011a), and food commodity prices continued to fall (Baffes and Dennis, 2013)?

This success in agricultural production came not so much from expanding the cultivated area – this only increased 9–16 percent (Godfray et al., 2010; FAO, 2011a) – but from significantly increasing 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) – some 20 percent of the total arable land of 1,400 million ha[1]. This has doubled freshwater withdrawals in the past 50 years (MEA, 2005).

Concerns about the future stem from worries that increasing food production will not keep pace with the additional demands from demographic growth and changing patterns of food consumption. Estimates suggest that food production will need to

[1] 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; *agricultural land* as the sum of cultivated land and the area of permanent meadows and pastures. On this basis, according to FAOSTAT data for 2010, there are 4,894 million ha of agricultural land; 1,541 million ha of **cultivated** land; and 1,388 million ha of **arable** land.

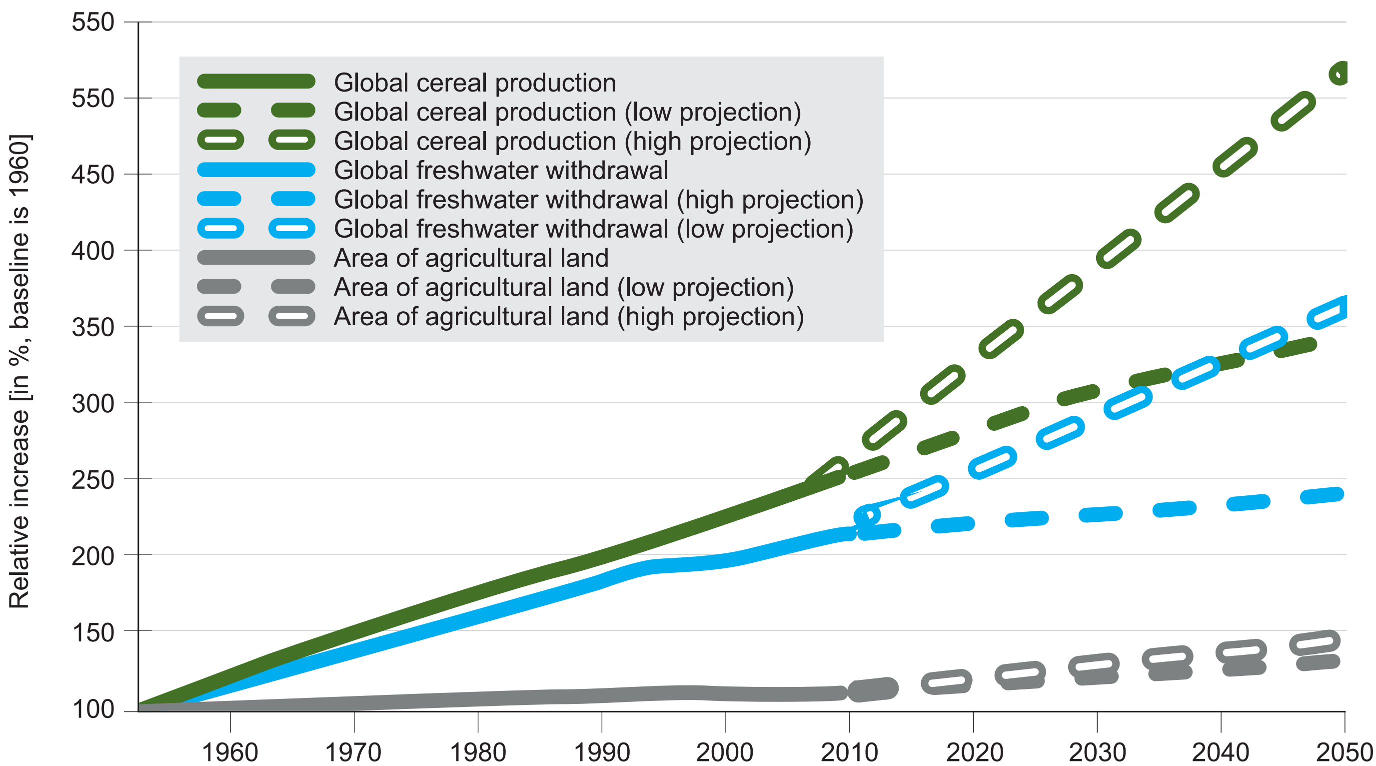
increase between 60 percent and 110 percent above current levels in the next 40 years (FAO, 2011a; Tilman et al., 2011; Alexandratos and Bruinsma, 2012; ICID, 2014).

Past successes also came at a high cost to the natural resource base. Traditional high-performing agricultural regions are facing dwindling groundwater resources and closing river basins, and productivity levels are plateauing. There are now growing doubts about whether 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 the average annual yield increase for key crops, such as maize, rice, wheat, and soybean, is only 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 (Molden, 2007; de Fraiture and Wichelns, 2010). This increase in demand is likely to cross the planetary boundary of sustainable water resources use (Rockström et al., 2009).

Expanding the area of agricultural land is an option, but this comes with risks of 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 (Tilman et al, 2011; de Fraiture and Wichelns, 2010). But globally only 445 million ha are available for expanding potential cropland, while minimising ecological costs of land conversion (World Bank, 2010). Moreover, most of this land is concentrated in a few countries – 10 countries in sub-Saharan Africa share more than half the potential land area (World Bank, 2010) – which leaves little for the rest of the world. Foresight (2011:171) advises that it is wise to assume that there is little new land available for agriculture.

Figure 1 Global trends in water and land use and agricultural output



Source: developed by the authors based on data from MEA (2005) for past freshwater withdrawals 1960–2000 and for future withdrawals 2007–2050 both low and high projections; FAOSTAT (consulted 2014) for cereal production and area of agricultural land 1961–2010; FAO (2011a) for cereal production 2010–2050 low projection; Tilman et al. (2011) for cereal production 2005–2050 high projection; FAO (2011a) for agricultural land 2010–2050 low projection; Tilman et al. (2011) for agricultural land 2005–2050 high projection.

2.1 Aggravating factors

Pressures for increasing land and water use are not just from agriculture. They come also from people, from industry, and from the environment.

CONVERTING FOOD-CROP LAND TO NON-FOOD USE

Brown (2004) referred to this phenomenon as the 'Japan syndrome' – when densely populated countries are fast-growing and industrialising, they experience a trend towards converting their grain land to urban, commercial, industrial, and infrastructure use. As Japan has industrialised, 30 percent of its arable land has been lost since the 1960s (Shimizu, 2011). A similar pattern emerged in South Korea, which has lost 25 percent of its agricultural land in the past 40 years (Yoon et al., 2013). In the past 10 years China's fast-growing economy has meant a loss of 7–8 percent of its arable land (8.2 million ha), resulting in a sharp decrease in grain production (Hofman and Ho, 2011). This trend, if not addressed, poses serious challenges not only to Chinese national food security, but also to the world food system in general.

EXPANDING AGROFUELS

The pressure on land and water from agrofuels is difficult to predict given that it is strongly dependent on political decisions, such as the targets set for agrofuel consumption in the EU and USA. Agrofuels currently only occupy 2 percent of arable land, but a fourfold increase is expected by 2030, with most growth taking place in North Africa and Europe (World Bank, 2010). Associated with this is the consequent impact on freshwater withdrawals (de Fraiture and Wichelns, 2010). Demand is expected to be lower in Africa and Asia with agrofuels occupying only about 0.4 percent of the land area by 2030 (World Bank, 2010).

CLIMATE CHANGE

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) and for biodiversity conservation purposes.

Climate change is likely to adversely affect agriculture in most regions, particularly the developing and tropical countries. Declining and unpredictable rainfall is expected with more extreme floods and droughts. Rising temperatures may also adversely affect evapotranspiration, soil moisture, and crop yields. In sub-Saharan Africa, estimates indicate that by 2080 land areas experiencing severe climate or soil constraints will increase from 35 million ha to 61 million ha (9–20 percent of the region's arable land) (Fischer et al, 2005; World Bank, 2010).

LAND DEGRADATION

About 20 percent (12–20 million ha) of the world's crop land has degraded over a 25-year period to the point where crop production becomes uneconomic (Bai et al., 2008). If current trends persist, 320 million ha – more than the combined arable land of India and China – will be lost by 2050.

2.2 In summary

If the world continues to use land and water resources in a 'business as usual' approach then anxiety over food security is well justified. Land and water resources are unlikely to meet the growing demand – fertile land and fresh water are unevenly distributed, surface and groundwater resources are being depleted, and agricultural land is being lost to production.

3 Changing course is imperative

Alternative and innovative approaches are needed to make better use of existing resources and to 'navigate the storm' (Beddington, 2009). They do exist, but it will require "a revolution in the social and natural sciences concerned with food production" (Godfray et al., 2010). A key option must be an integrated approach to land and water governance and management to enable more effective use of the limited resources in the face of increasing competition and potential for conflict. However, there are barriers to be overcome.

The first barrier is the current approach to land and water governance and management. Land, and especially water, management practices still give priority to technical solutions, such as increased yields, water productivity, and a focus on single use 'sectors'. Indeed, water has long been considered a resource to be developed that emphasises supply-side approaches and technical solutions to challenges, 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 for crops. Progress made in increasing yields has under-rated the value of other yield enhancing factors, such as land holding size. These technical approaches also tend to ignore the unequal power relations surrounding land and water resources at the local and international levels, which result from the uneven distribution of these resources and competition for them.

The second barrier is the 'silo' approach to governing, planning, and managing land and water resources. In spite of significant advances in integrating water resources management, land and water are typically managed in isolation. This is not necessarily a problem when resources are abundant, but it can become a serious obstacle when they are scarce. The availability and quality of farmland and water are interconnected – the way land is managed affects water use and quality and vice versa.

The third barrier exists because land and water governance rarely goes beyond the confines of nation-states. This approach ignores the increasingly international and global nature of land and water politics and markets as evidenced by the current intensification of transnational land deals, which are equally about water. The current status and trends in water demand and availability and the demand for land (especially arable land), give rise to a new geopolitics of land and water. They are becoming increasingly strategic resources.

Overcoming these barriers requires more strategic and inclusive governance that reconnects land and water and recognises the political dimension of allocating and using land. Globally, but especially in developing countries, the governance of land and water has not evolved to adapt to this new geopolitical reality – to the increasingly global nature of the pressures on these resources, and to anticipating future challenges (FAO, 2011b).

4 The case for a coordinated approach

Here are examples that illustrate how a 'one-sided' approach to governing and managing land and water resources can lead to ill-conceived conclusions and decision-making, and reduce the effectiveness of limited and valuable resources.

4.1 Virtual water or virtual land?

Countries compensate for their unequal endowment in natural resources, know-how, and wealth through international trade. To help understand and account for the significance of water in global trading, the concept of 'virtual water' was coined (Allan, 1997). This is the "water embedded in key water-intensive commodities". The concept has improved understanding of water issues and has opened new perspectives on the geopolitical dimensions of water and food.

Virtual water trade has the potential to help improve resource use efficiency. The benefits would come from an open market where water-intensive products are primarily produced where water is abundant, cheap, and has few adverse impacts on other water users or on key eco-system services (Hoekstra, 2003). Water-scarce countries could compete with water-rich countries, but they would need to achieve high water productivity at the lowest cost. Nevertheless, each country could specialise in producing commodities for which it has a comparative advantage, based on water endowment and/or unique water management know-how. Water-poor countries would rely on imports and so avoid having to exploit limited freshwater resources that could be used more profitably.

Although this makes sense, and it is the perceived wisdom that virtual water trade flows from water-rich countries to water-poor countries (Hoekstra and Hung, 2005), it is not what is happening in practice. In more than 131 countries, virtual water exports are not always the result of abundant water resources, rather they are the result of abundant arable land[2] (Kumar and Singh 2005; Kumar 2014). Water-rich, but land-poor, countries, such as Japan and Indonesia, are among the major net importers of virtual water, while other countries that are water-scarce, but rich in agricultural land, such as Australia, are among the major net virtual water exporters. It was on this basis that the concept of 'virtual land' was defined to reflect the land resources embodied in international trade (Kumar and Singh, 2005; Lugschitz et al, 2011; Qianga, 2012).

Kumar (2012) argues that, "assessing future food security challenges posed to nations purely from a water resource perspective provides a distorted view of the food-security scenario". However, what he did not mention was that the same observation could be made for approaches using an exclusive land-resource perspective. The reality is that water and land have to be jointly considered for a fuller understanding of the trade flows of agricultural commodities between nations.

4.2 Land acquisition or water acquisition?

The recent surge in purchasing and leasing large tracts of land, mostly in developing countries, is causing concern as some countries and organisations seek to secure land as part of their food security strategy. This was first reported by GRAIN (2008) – a non-governmental organisation based in Spain. It has since attracted headlines in the media with concerns about 'land grabbing' by rich nations and it is the subject of academic publications, regional gatherings, and declarations.

The Land Matrix Global Observatory has recorded 1026 concluded transactions involving 39 million ha (Land Matrix, 2014). This is thought to be an underestimate given the secrecy surrounding this activity. Concerns are now growing about the increasing number of acquisitions each year, the extent of the land areas involved, and the pattern of acquisitions.
What has only recently been reported is that these land deals inevitably impact water resources. More recent reports are now highlighting the fact that 'land grabbing' may also mean 'water grabbing', whether or not this was intentional in the acquisition process (Skinner and Cotula, 2011; Woodhouse and Ganho, 2011).

In the rush to sell or lease land to a prospective investor, some government officials may not be aware they are also providing water entitlements as well. In many cases, where access to water is not clear, this can be a potential source of national or even inter-state conflict and can impact on local water abstraction by smallholders, downstream users, biodiversity, and groundwater recharge. This is illustrated in many land concessions made in Mali (Skinner and Cotula, 2011). In Tanzania, land allocated to a biofuels company caused heated debate and controversy over the impact of water abstractions and on the environment of rivers in Bagamoyo (Havnevik et al., 2011).

Transactions which implicitly allocate undefined quantities of freshwater run the risk of inefficient water use, reduced flow for downstream users, and less water for the ecosystems that depend on the river flow. In both cases, the need for good water accounting when transacting land deals was clearly essential.

In sum, large-scale transnational land acquisitions are equally about land and water (Woodhouse and Ganho, 2011; Allan et al, 2012; Rulli et al., 2013). If one or other is ignored this can lead to the unexpected and radical redistribution of water and land assets to an extent that may even challenge national sovereignties and the prominence of the State in managing land and water resources located within national boundaries.

4.3 Securing land titles can secure investment in water

Improving water use efficiency in irrigation schemes usually requires investment in water control infrastructure, soils and water conservation management practices, and input services, such as seed, fertiliser, and

[2] Expressed in gross cropped area per capita

access to markets. If farmers are expected to make some or all of these investments they will need security of land tenure both for their own future livelihood and as collateral for credit. China's oft-praised food production miracle observed from the late 1970s to the early 2000s – when farm outputs tripled without expanding the area of arable land – is, to a large extent, a result of the decision taken in 1978 to grant farmers more secure individual land titles, through the Household Responsibility System. Crop production subsequently grew by 42 percent between 1978 and 1984 (Bruce and Li, 2009). There are similar examples in Africa and elsewhere, where securing land rights by proving land titles has helped to increase investment and improve productivity (World Bank, 2007: 138–140; Kirk and Nguyen, 2009).

4.4 Securing land rights can ensure access to water

Access to water rights in many settings is mediated by access to land rights. Although water is a mobile and fugitive resource (Meinzen-Dick and Nkonya, 2007), it can in principle be 'controlled', i.e. stored, transported, diverted, allocated, and apportioned. However, its mastery requires power, technical knowledge, and infrastructure (such as dams, canals, and wells).

When water is abundant, open access tends to be the rule, and "people often do not even know or care who else may be sharing the same river, lake, or aquifer" (Meinzen-Dick and Nkonya, 2005). This changes when water becomes scarce. Water access is then dependent on access to land, as water rights are typically embedded and considered as an integral part of the land and, therefore, subsidiary to land rights (Hodgson, 2004; Cotula, 2006). Thus control of the land provides the power to grant or deny access to water resources that are located on or underneath the land.

In Mauritania, the Project for Improving Flood Recession Farming in Maghama, required land access modalities to be renegotiated in order to ensure more equitable access to water (IFAD, 2010). The project brokered an agreement with landed families that gave traditional landless households access to flood recession agriculture in the lowlands of the river floodplain. Through this agreement – referred to as *Entente foncière* or land tenure agreement – both landed and landless families were equally allocated long-term use rights.

4.5 Securing land rights can secure women's access to water

Women's limited access to secure land rights is the main obstacle to their securing access to water. Despite the increasing feminisation of farm labour in the developing world, it is estimated that less than 5 percent of women have access to secure land rights (Niasse, 2013). In the few cases where women enjoy secure tenure rights, farm sizes tend to be much smaller than those farmed by men. Closing the gender gap in agriculture could result in a substantial increase in crop yield in land owned by women, translating into to a 2.5–4 percent increase in domestic food production, and a 10–20 percent decrease in the number of undernourished people worldwide. This would benefit 100–150 million of the 950 million undernourished people (FAO, 2011c; Niasse, 2013).

4.6 Reclaiming land requires water

Reversing land degradation and increasing productivity requires a combination of land and water management, especially in poor communities where there is little access to capital-intensive methods. In the Sahel region, modest investment in small-scale land and water management techniques (water harvesting, improved planting pits, contour stones, and half-moon shaped bunds) has helped to restore the productivity of thousands of hectares of barren and degraded land and improve groundwater recharge (Reij and Smaling, 2008). Applying such techniques in just 25 percent of sub-Sahara's cropland area could help to increase crop yields by up to 50 percent, resulting in an extra annual output of 22 million tonnes of food (Winterbottom et al., 2013).

4.7 Bringing national land tenure and use plans into water development strategies

An integrated approach to water management is now becoming well established in many countries as they develop their IWRM plans. According to UN-Water (UN-Water, 2012), over 80 percent of countries worldwide now have IWRM principles in their water laws and two thirds have developed a national IWRM plan. But such plans (in UN-Water, 2008) make little mention of land issues being addressed as an integral part of this process. A notable exception is Kazakhstan, where a legal framework was established to implement the national IWRM plan, which included a Land Code and a Forest Code as well as a Water Code (UN-Water, 2008).

4.8 Raising the profile of land in river basin management

Although river basin conventions cover the whole area drained by the river system, the way the land is developed and used generally has low priority in the agenda of river basin organisations and of riparian states.

In the Niger basin, the riparian states devoted substantial resources to the assessment of the possible impacts of a series of dam projects on water availability for downstream countries. Yet Mali has conceded 100,000 ha in the Inner Delta to Malibya, a Libyan Sovereign Fund, which was not on the Niger Basin Authority's agenda in spite of the huge water commitments associated with this land deal. Estimates suggest that the 40 km long canal built as part of this project has an annual total irrigation capacity of 4 billion m^3 (Oakland Institute, 2011). This has created protracted tension among riparian countries as it represents one third of the combined capacity of three of the storage dams (Fomi, Taoussa, and Kandadji).

In Australia, water reform in the Murray-Darling basin was to a large extent motivated by the need to address land issues. The reform was initiated as an answer to the high salinity of the soils and the severe droughts that the region occasionally suffers. The reform cherishes the principle that 30 percent of the freshwater resources in the basin have to be returned to the environment. The allocation of water is entirely regulated on the basis of this minimum environmental flow (Murray-Darling Basin Authority, 2010).

5 What level of coordination is needed?

Coordinating land and water governance should aim to optimise the productivity of both land and water in a sustainable manner while addressing concerns of equity and social justice at all scales, from local to national and international. Two key words are 'coordination' and 'governance'.

THE NOTION OF "COORDINATION"

Coordination reflects the idea that some form of interrelationship needs to be established. The desirable level of interaction depends on the context, scale, and nature of the challenges being addressed. Coordination can be limited to **concerted governance**, which enables information flows between the two sectors for the benefit of both resources. It could be **interlinked governance**, which goes beyond information sharing to include identifying interactions and factoring these into resource management. A third, approach is **integrated governance**, which implies a combined approach so that the two resources are part of one single system (Figure 2).

Figure 2 Three dimensions of coordinated approach to water and land for food security

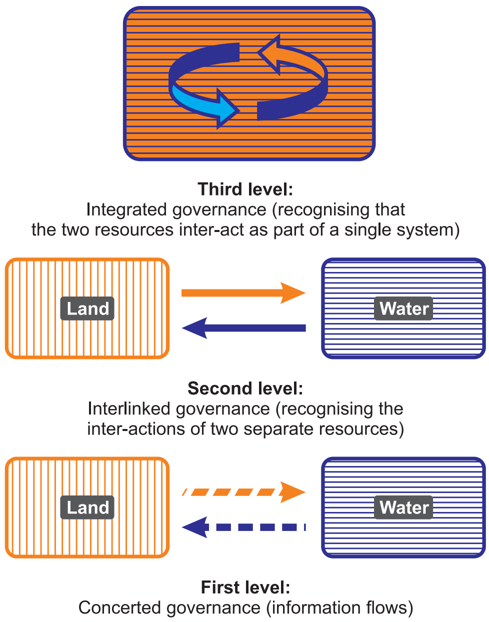


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Table 1 Spatial scales for addressing land and water governance for food security

Scale	Land and/or water governance issues	Possible benefits of coordinated governance
Local/sub-national	• Inequities in access to land and/or water • Tenure insecurity of land and/or water • Unsustainable levels of abstraction and use of land and/or water resources • Land and water degradation • Land- and/or water-related conflicts • Poor implementation and enforcement of national land and water laws • Inconsistencies in land and water tenure systems	• Securing access to land rights as a means of ensuring greater equity in access to water • Investing in water infrastructure as a means of securing land rights • Securing land rights as an incentive for sustainable water conservation and for improved land productivity • Securing land and water rights for women • Factoring water access rights in to land use plans, as means of preventing or resolving resource use conflicts (e.g. between farmers, pastoralists and fishers) • Coherency in local/community-based land • use and water management plans
Nation/State	• Sub-national inequities in land access and tenure insecurity • Formulation of national land- and/or water-related laws, strategies, action plans (rural development strategies; climate adaptation plans; plans against desertification; poverty reduction strategies and Millennium Development Goal plans) done in parallel • Inconsistencies and incoherencies in approaches to land and agrarian reform • Water policies and water law reforms	• Water policies and laws are informed by challenges and risks to sectors dealing with land reform and land use, and vice versa • Water policies used as enabling environment for land policy objectives and vice versa • Ensure wider citizen input to water and land policy formulation, with the involvement of actors concerned with water and land • A more coherent and inclusive national platform for food security and poverty reduction strategies, especially in agrarian economies
River basins /regional inter-state integration groupings	• Typically undefined responsibilities of river basin organisations for the management/ governance of river basin land (basin cooperation agreements typically deal only with water issues) • National territorial sovereignties clashing with each other and constraining water cooperation for addressing food sovereignty • High occurrence of conflicts in trans-border land and water use (cross-river or upstream downstream water- land- users)	• Basin cooperation more sensitive to and supportive of the agricultural and food security needs of riparian states and communities • Fairer allocation of water across sectors (irrigation and energy) • National decisions on land (e.g. concessions to investments) take into account inter-state commitments on water
Global	• Disconnected land and water discourses, theories and normative policy processes	• Cross-sector, concerted normative response to water and land • Joint collaborative efforts to address land and water challenges • Improved cooperation, experience and perspectives sharing between global alliances of social movements of actors concerned with land and water
Interplay between scales	• Disconnect between scales	• International and inter-state commitments better informed by realities at lower levels • Land and water policy practices at lower levels are inspired by and comply with international and inter-state agreements

Box 1 The concept of 'governance'

Governance refers to the system of actors, rules, mechanisms, and processes through which land and water are accessed, used, controlled, transferred, and related conflicts managed. Defined as such, the notion of governance recognises the critical political dimension of water and land that today are increasingly contested resources.

6 A scale-sensitive framework

The potential issues and benefits of a coordinated approach differ depending on the scale of activity. Four levels are identified: (i) local level (meaning the level of community, village, province, or any other sub-national scale); (ii) national level; (iii) basin level, with the focus on transboundary basins; and (iv) global level. A fifth dimension relates to the interplay between the various levels.

Table 1 lists potential issues that can arise from a 'silo' approach to land and water governance and the benefits of coordinated governance at different scales.

7 Conclusion

There is no clear-cut answer to the question as to whether and how the world will feed itself in the coming decades. Regardless of whether we are optimistic or pessimistic, the various views converge on the need for a paradigm shift in the way we manage the land and water on which food production is dependent. In order to meet the challenges of achieving food security in the future in a sustainable manner, the current 'silo' approach to governing and managing water and land is archaic. Immense benefits can come from coordinating the way we think, plan, govern, and manage these two strategic resources – in other words, taking an integrated approach. Resource scarcity and the rapidly increasing demand for food requires a shift from narrow sectoral approaches to a politically sensitive coordinated governance of land and water. This paper has shown examples that set out the benefits of coordination by illustrating the disadvantages of a 'one-sided' approach that lead to ill-conceived conclusions, poor decision-making, and ineffective use of limited and valuable resources.

Full integration, which combines land and water resources into a single system, is only one option available. It may be appropriate to limit coordination to information sharing (concerted governance) or to identifying interactions between land and water and factoring these into resource management. The desirable level of coordination depends on context, scale, the challenges to be faced, and the objectives being pursued.

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