

Policies, Rights, and Institutions for Sustainable Management of Land and Water Resources¹

SOLAW Background Thematic Report - TR09

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List of Abbreviations

CIS	Commonwealth of Independent States
FAO	Food and Agriculture Organization of the United Nations
FPIC	Free, prior and informed consent
HID	Hangjin Irrigation District
ICT	Information and Communication Technology
IPM	Integrated pest management
IWRM	Integrated water resources management
IWSR	Irrigation Water Supply Reliability Index
PES	Payment for environmental services
PIM	Participatory irrigation management
SLWM	Sustainable Land and Water Management
WB	World Bank

Main messages

1. Land and water management (L&W) practices operate over wide areas, long time horizons or involve multiple farmers and other land and water users. Policies, property rights and institutions, which are capable of coping with the rapidly increasing demand for land and water resources, are critical for successful adoption of efficient, equitable and sustainable resource use. Such policies, rights and institutions require varying combinations of state, collective action and individual rights/ownership.
2. Both land and water markets could be helpful instruments for managing competition and scarcity. Land rental could improve the efficiency and equity of land allocation. Long- and short-term fixed rental and share cropping could be fostered by abolishing prohibition or regulation of rentals and share cropping as well as other laws that undermine security of tenure and, therefore, rental markets. Marketable rights to water induce users to consider the full opportunity cost of water, including its value for alternative uses, thus providing incentives to economize on the use of water.
3. In many countries history and local conditions have left behind inefficient and inequitable allocations of land and water, depriving local populations, indigenous groups, women and youth of access and secure rights. They may not allocate secure property rights, undermine investment incentives, increase the potential for conflict, and reinforce existing inequities. These historical legacies and deficiencies define the reform agendas that therefore vary enormously from country-to-country.
4. There is no one-size-fits-all solution to reform of policies, rights and institutions. Reform is a long-haul process spanning not just years but decades, involving repetitive dialogue, policy and institutional experiments. Therefore, reform should focus on important principles, policies and institutions that could improve the efficiency of resource use reduce ongoing degradation or depletion and address inefficiencies and inequities in the allocation of land and water.
5. Reform processes are more likely to succeed if they allow for public consultations and consensus building, which are informed by technical knowledge and judgment and:
 - actively involve those affected in the decision-making process;
 - secure property rights for both land and water;
 - provide options for the definition of rights and the corresponding administration systems;
 - consider the feasibility of direct command and control versus indirect incentives approaches;
 - implement appropriate land and water management information systems, conflict resolution mechanisms, management systems; and
 - generate political will in order to push through policies, legal reforms and associated regulations; provide for the necessary financial allocations for the institutions in charge of implementation; implement the registration and updating of rights; and transparently and equitably enforce the rights created, formalized or reallocated.

Executive summary

A critical challenge for agriculture over the next half century is to increase food production within the constraints of scarce land and water resources. Declines in soil fertility already mean that larger productivity gains will be needed for food production in the future than in the past. In most developing countries, land and water policies and institutions are inadequate to address growing land and water challenges. As a consequence, in many parts of the developing world, resources are degrading. Appropriate policies and institutions can provide incentives to users to regulate uses and invest in improving land and water resources. In most cases they do this by eliminating open access. There are usually sharp sectoral boundaries between land and water policies, rights and institutions. Separate systems for administering land and water are often a barrier to efficient, equitable and sustainable use.

The many competing demands for land and water resources are generally handled best by a holistic approach to water and land management policies and institutions, that is, by an approach that jointly considers land and water. Holistic management is still a rare exception, rather than the rule. New approaches to joint land and water management for watersheds and pasture lands are attempting to overcome these sectoral barriers.

Importantly, institutions, policies, administration systems, and approaches to reform need to be adapted to the degree of scarcity of resources, population density, historical legacies as represented in the current distribution of resources, countries' legal systems, and current inequities and inefficiencies of use. While there is no one-size-fits-all solution, lessons can be drawn from both successes and failures in different systems and societies.

The focus of this report is on rights, policies and institutions that directly impact land and water outcomes. There are many other policies and institutions in the agricultural and non-agricultural sectors that may have large positive and negative impacts on land and water resources. An assessment of the full set of global, regional and national policies that can affect land and water outcomes is, however, outside the scope of this report.

The origins of existing legal systems and institutions: In the face of rising scarcity and competition, most often driven by population growth and market access, institutions can arise spontaneously in communities, or through the actions of powerful individuals or groups, or through deliberate state actions. In industrialized countries the emergence of individual property rights systems has been a slow process over time, with frequent twists and turns. In most of the developing world the colonial powers implemented such systems to serve their own needs, often long before the demand for them was strong among the indigenous population. Communal and formal individual property rights systems therefore have coexisted for a long time. Unfortunately, communal rights were often not recognized by the legal system, subjecting the right holders to great uncertainties and risk of dispossession.

The path by which institutions arise leave deep historic legacies, both positive and negative, such as secure and equitable access rights to land and water; or highly inequitable and inefficient land and water distributions. Where the historical legacies have resulted in negative legacies, overcoming them defines much of the agenda for reforming land and water rights.

Views have evolved dramatically concerning the nature of appropriate policies and institutions. Across the world, efficient, equitable, and sustainable systems and institutions require varying combinations of state, collective action and individual rights/ownership. This is contrary to polarized past viewpoints that either only private property could achieve efficiency, equity and sustainability, or that the only the central government could exert appropriate control over land and water resources. The precise combination of state, collective action, and individual rights will depend on the historic legacy encountered as embedded in constitutions, laws and customs, level of scarcity, state of economic development, technology options and stakeholders' capacities. State action may be very difficult to implement where resource users are atomistic. In such cases indirect methods of influencing the allocation and use of water, for example, through incentives and information for self-regulation, or through prices, may be more effective than directly.

Many natural resources are common-pool resources characterized by subtractability, but face high costs of exclusion. In such cases, common property systems with collective rights, combined with informal or formal rules for access and use, are often more effective than individual private property or public property with state management. Ostrom's (1990) work has identified eight design principles for successful management of collective resources. These are clearly defined boundaries (often an attribute of the resource itself), proportionality between benefits and costs, collective choice arrangements, which allow users to make rules to govern the resource, monitoring, graduated sanctions, conflict resolution mechanisms, minimal state recognition of resource users' rights to organize, and nested enterprises (local groups are nested within larger organizations to manage large-scale resources).

Across the developing world, communal land management systems have provided high levels of tenure security by providing individual and inheritable use rights. These have often adapted to rising scarcity by allowing the emergence of rental markets for land and sales within the communities. However, they inevitably prohibit sales to outsiders or make them subject to community approval. As a result, communal rights can almost never be used as collateral for loans. Communal rights systems are usually able to manage internal conflicts. Many such systems are still functioning, and have often provided a safety net for community members. Functioning communal property rights systems are also a cost-effective way of administering property rights.

Communal rights systems, however, can come under threat or disintegrate because of rising land scarcity and land values; increased internal conflicts; encroachment by outsiders; conflict with neighbouring communities; state disrespect for communal rights; or large-scale conflict and war. The first way to address such problems is to strengthen the communal rights systems, help them adapt to a new situation, as done for example in South Africa, Tanzania, Ghana, India and Brazil. Common measures include the full recognition of the traditional rights of communities and/or indigenous groups, demarcation of community territories, clarifying internal decision-making processes, and capacity development for community-driven systems of land registration and administration. The alternative is for individual plots inside communities, or for communities as a whole to convert to individual formal property rights, which opens up free sales to outsiders and the use of the resources as collateral for credit. Such a conversion is most appropriate for peri-urban areas, regions of intensive farming, and where demanded by communities themselves.

Except in matrilineal social systems, the slow process of allocating land and the ensuing informal or formal rights systems has completely ignored women, whose access to land was mediated by their husbands or the husbands' relatives. In industrial countries these inequities began to be eliminated in the nineteenth century. In developing countries, women's rights are now often recognized in the law, but acceptance and implementation of these laws is lagging in many countries. This is even though women play a major role in agriculture, especially in the context of rising rural-urban and international migration.

The above sequence of endogenous development of property rights has rarely occurred undisturbed. Many studies across the world have shown that small-scale family farmers often use land more efficiently than large-scale farmers in terms of output per hectare of owned land or in terms of total factor productivity. In spite of the greater efficiency of family farmers, over the course of history, powerful groups have allocated land to themselves as overlords or as owners all over the world. The challenge of finding workers for these farms was overcome by force or distortions. Populations were bonded into slavery of servitude, labour levies, or slaves were imported. Distortions to get people to work on the large farms included head or hut taxes, and prohibiting communal farmers from producing and marketing cash crops so that the indigenous populations could only earn the cash needed for the taxes by presenting themselves to the colonizers' farms. In addition, colonizing powers concentrated subsidies and technical support on the large-scale farms. In South Africa and Zimbabwe these systems survived until 1980 and 1992, respectively. All over the world these systems have left a terrible legacy of unequal landownership and inefficient production that was either resolved by revolts and revolution or by land reform. Where the inequities and inefficiencies persist, further land reform will be required.

In the case of water rights, the Public Trust Doctrine, dating back at least to Roman times, specifies that the state holds water rights in trust for its citizens, as an aspect of sovereignty. State control over water rights has also been justified based on the strategic importance of the resource, scale of systems required to manage it that lead to natural monopolies, and positive and negative externalities for its use. Rights have traditionally been allocated for water resources to landowners as riparian rights or as the rights to extract groundwater found under the land; rights to canal water are invariably allocated during canal construction. Under modern water legislation, concessions are given for the withdrawal of specific amounts of water from a specific water resource, and there may be allocations for environmental uses. Water rights and land rights are thereby separated.

Institutions for allocating and managing rights: When resources are scarce, the need for strong and impartial land and water administration and information systems is imperative. The central state generally lacks the capacity to ensure effective and impartial land and water administration, especially at the local level. State action may be especially difficult to implement where resource users are atomistic. In such cases indirect methods of regulation, for example through taxation, may be more effective than directly.

In industrialized countries strong and impartial systems for allocating and managing land and water rights have evolved over many decades, or even centuries. Yet efficient resource use often remains elusive as a result of subsidies and policy distortions. In the developing world, these systems are often under-developed, under-financed, lacking capacity or corrupt. Innovative systems have been developed for both land and water that combine de-concentration or decentralization of administrative government systems with local land and water management by communities or user associations.

Communal property rights and participatory irrigation management (PIM) are good examples of combining decentralization of the functions of the state or the water authority with community management of distribution systems. Conditions for the success of PIM include effective financial control, capacity, clear

specification of rights and responsibilities and sufficient autonomy to charge user fees and control their use. However, these conditions often do not exist and therefore PIM has not been adopted on a large scale.

Both land and water markets can be helpful instruments for managing competing uses and growing scarcity. These markets require well developed property rights, regulations, information systems, infrastructure and supporting technologies. Water markets have been shown to be effective means of allocating water according to its scarcity value where appropriate infrastructure and institutional arrangements exist. Land sales markets alone have rarely led to efficient and equitable allocation, but instead to the excessive concentration of land. On the other hand, land rental markets have repeatedly been shown to lead to efficiency and equity-enhancing outcomes. Unfortunately, many countries still undermine rental markets through excessive control and regulations.

Constraints to the efficient and equitable workings of rights and institutions: A number of natural resources boundaries are not well defined, as for example groundwater in alluvial plains, where the basin stretches far and wide. Community management of groundwater resources, forests, or pastures is most feasible where the resource is confined by geological or other natural conditions. Large numbers of competing resource users also increase the complexity of common property management or state control. Constraints also include historical legacies of power relationships and distortions that created the inefficient and inequitable land allocations, which still prevail in many countries; and inequitable access to resources by women, the poor, tribal groups, herders and other marginalized minorities. Unequal access to land and water rights increases poverty not only directly by excluding the access of poor people, but also indirectly by reducing the efficiency of resource allocation and economic growth.

In many countries, misallocation of land and water resources, inequities and lack of sustainability are aggravated by distortions in taxation, pricing, and institutional mechanisms that reinforce inefficient, environmentally damaging and inequitable outcomes. Such subsidies and distortions have increased as a response to the 2007/2008 food price crisis, in a number of cases reinstating food self-sufficiency objectives. Policy and institutional distortions often reflect a rent-seeking equilibrium that is fiercely defended by those who benefit from it. The distortions and the actions of their beneficiaries foster weak institutions, corruption and conflict. The privileges associated with the distortions are fiercely defended by their beneficiaries and make reform a very challenging task.

Specific improvements of land and water policies, rights and institutions: Improvement of land includes dealing with situations of threats to and breakdowns in communal rights systems arising from land scarcity, internal conflict or external pressure and interference. This can be done by either assisting communal land tenure systems to adapt and improve, or by enabling them to transit to formal individual property rights. In either case, systems of land rights administration should be improved, in particular, by eliminating incentives and regulations that favour corruption, by capacity development and by the provision of adequate fiscal resource. Land rental markets have been shown to significantly enhance efficiency and equity of land allocation, but are often hampered by insecurity of land ownership or prohibitions and constraints to land rental and sharecropping. Reforms are needed in both areas if rental markets are to reach their full potential. Land sales markets can be distorted by subsidies, inadequate access to credit, and speculative behaviour, and therefore there is less potential of transferring land to the most efficient agricultural producers.

Governments find that state land is hard to manage, as it is often subject to invasion, settlement, historic ownership claims and opaque and corrupt allocation through rental and sales. Often governments do not even know how much land they own or where and, if they do, are reluctant to dispose of it.

Land redistribution has occurred worldwide, including in the industrialized countries, to overcome the inequitable and inefficient land allocations left by feudal and colonial regimes. Redistribution has often been carried out in the wake of political crises, revolution and defeat after a war. Land restitution and redistribution became necessary because of the need to dissolve inefficient collectives left behind by socialist regimes and land reforms in market economies. In many countries there is still the need for further redistribution. However, the experience related to recent land reforms is mixed. To improve poorly designed or implemented land reform programmes will require that attention is given to the provision of capital and credit for non-land investments and inputs, beneficiary empowerment for planning and implementation; training and capacity development.

Allocation of water by state institutions can be improved if agency budgets are linked to user fees, if staff are provided incentives to allocate and deliver water to as many of the authorized users as possible, thereby improving efficiency and equity. Allocation can be improved if responsibility for allocation and fee recollection is transferred to water users, at least at the lowest (tertiary) level. However, state capacity remains vital or should be increased for issues such as intersectoral water allocation, water quality regulation and seasonal forecasting. Farmer-managed systems can function well, but require formal or customary water rights and the effective collective action of institutions having the authority to make decisions on these rights. Without strong local institutions, it is less likely that water will be used efficiently or equitably.

The importance of state sanction of locally-accorded rights increases where there are farmer-managed systems, growing population pressures, market penetration and increased government presence. Finally, over the last two decades, private (groundwater) irrigation, already well developed in parts of the United States, has taken off in parts of Asia in response to declining investments in and reliability of surface systems and availability of affordable pumps. Similar to community-based systems, private investments benefit from state regulation to avoid adverse impacts on third parties, including the environment.

Both informal and formal water markets have developed for surface and groundwater as a result of increasing water scarcity. At one end of the spectrum – for formal markets – an original allocation of water rights needs to be well defined, which requires an institutional and legal framework for trade, and the basic necessary infrastructure needs to exist that will allow water transfers to be made. On the other hand, informal groundwater markets can increase the efficiency of water use with minimal infrastructure or governance. Formalization and recording of water rights is not as advanced as for land rights because there not many water markets worldwide and individual water rights systems (separate from land).

The removal of distortions, subsidies and corruption of water systems, combined with implementation of economic incentives, are key to improved water management. Economic incentives need to be adjusted to the state of economic development of users and the water sector, and should be implemented in such a way that they do not harm poor or marginalized water users. For many developing countries that are facing increased water scarcity and rapid urban development or economic growth, paying farmers to use less water can be an attractive option that supports increased water-use efficiency, while providing compensation to water users.

Joint land and water management has been attempted in pastoral systems and in watershed management, but implementation is generally over a long period with few successful cases. In a few countries, such as Switzerland, equilibrium pastoral systems have been developed. These are territory-based systems of herder organization and pasture management; Mongolia is currently developing such a system. In disequilibrium systems, however, where climate rather than number of cattle determines forage production and herders

tend to travel long distances, customary use and grazing rights prevail and growing population, market and farming pressures have severely limited the sustainability of such systems and herders' livelihoods. Progress has been slow in providing legal grazing and water rights to nomadic herders.

The objective of watershed management is to address land and water degradation in a catchment or river basin. This is generally achieved by improving the quality of the upstream water source through reforestation and improved grazing and crop management practices. Watershed management interventions have been implemented in many parts of the world, particularly in Central and Latin America, South Asia and parts of Southeast Asia. Payments for Environmental Services (PES), a mechanism that typically connects upstream land users with downstream water users, can help fund watershed improvements. Similar to other land and water improvements, formal or informal land and water property rights need to be established and recognized. PES functions better in small watersheds with few service providers and beneficiaries.

Reforming policies, rights and institutions: Where history has resulted in adverse legacies, where existing rights systems and the institutions that manage them are weak or corrupt, and where recent policies have created inefficient and unsustainable pricing, subsidies, and other privileges, massive reforms in land and water rights, policies and institutions are needed. New demands for land and water from urban populations and from the environment add to the urgency of reforms. Both the rewards and the difficulties of such reforms are therefore enormous. Reforms may require great effort but yield little impact, or even backfire, increasing insecurity and conflict over access. Reform efforts should begin with the recognition that there is no one-size-fits-all solution to policies, rights and institutions, and there is no ideal solution that can be applied everywhere. Reforms should be adapted to the specific situation existing in a country or region.

Specific solutions have not, therefore, been listed; the focus has been placed on the principles and the processes of reform. In each context, a careful assessment is required of the existing situation with respect to the: (i) role of land and water in the national development framework; (ii) constitutional and legal status of these resources; (iii) systems of rights and the distribution of such rights; (iv) systems for the administrations of rights and transfers of land and water; (v) land- and water-use management; (iv) and implementation of regional and international land and water policy commitments.

Reform is a long-haul process. Many years of discussions and debate usually precede the formulation of land and water policies and the drafting and passing of legislation. Reforms are often opposed by existing right holders if they do not recognize their pre-existing rights. Beneficiaries of distortions, subsidies, and other privileges, will also staunchly defend them. It is therefore important to choose the objectives and sequencing of reforms, as well as their specific policy, rights and institutional changes so that they can be adopted within the existing historical and political context and implemented.

Important process elements for reforms include:

- Sequencing of reform allowing for public consultations and consensus-building processes that are informed by technical knowledge and judgment.
- Actively involving those affected or legitimate representatives in the decision-making process regarding land and water (re)allocation processes as well as investments.
- Secure property rights for both land and water.

- Providing different options for the definition of such rights and the corresponding administration systems to accommodate different situations encountered in the same country.
- Consideration of the feasibility of direct command and control versus indirect incentives approaches.
- Appropriate land and water management information systems, conflict resolution mechanisms and management systems.
- Political will generated by dialogue and debate, and by organization of the groups that stand to gain from the reforms to:
 - push through the policies, legal reforms and issue the associated regulations;
 - provide for the necessary financial allocations for the institutions in charge of implementation, and for their institutional capacity development;
 - implement the allocation, registration, and updating of the rights that are being created, redistributed or formalized; and
 - enforce the rights created, formalized or reallocated transparently and equitably.
- Continued development of the capacity of the state, communities and user associations to allocate and administer rights systems to avoid and manage conflict, including the information systems and technologies needed to do so.

Introduction

A critical challenge to agriculture over the next half century is to increase food production within the constraints of scarce land and water resources and overused soils. These conditions are becoming increasingly severe in many parts of the world. Declines in soil fertility already mean that food productivity gains will need to be greater in the future than in the past. A series of both existing and new challenges will need to be addressed for agricultural land and water management (Bruinsma, 2009; Msangi and Rosegrant, 2009).

Old, but nevertheless crucial challenges include the continued need to increase food supplies – for a population estimated at nine billion by 2050, up from six billion in 2000. Growth of incomes and urbanization will lead to a shift in consumer demand for more water-intensive food products. On the supply side, investments in land and water are expected to increase slowly and at growing cost, leading to continued degradation of the land and water base. In some areas, macroeconomic and trade policies will continue to favour food production and natural resource extraction without comparative advantage. In many countries, agricultural input and output price subsidies and other distorted incentives will further degrade land and water resources. The dependence on groundwater resources has become unsustainable in many arid and semi-arid regions and overgrazing of fragile pastures and grasslands is common in many parts of the world.

New challenges facing land and water resources include increasing demand for non-food products, particularly from industries, for household use, the environment and fisheries; new competition from biofuel production, for example, from sugar cane or corn; higher energy prices that increase the costs of intensive agricultural production; and the increasing impact of climate variability and climate change. After decades of being ignored by policymakers and investors, the food price crisis of 2005–2008 brought the need for investments in sustainable land and water resources to the fore; although the subsequent financial crisis and ensuing drop in food prices has already dampened renewed interest.

Efficient use of land and water resources will be key to meeting effective food demand and other claims on land and water. High levels of resource use efficiency have been achieved, in many industrialized countries and parts of the developing world, such as China. Elsewhere both water and land are either wasted and over-used, or under-used, as for example for rainfed arable land in Africa and Latin America.

The improvement of resource use efficiency is partly a technical problem, but more the challenge is to create better policies, rights and institutions. Key ingredients to sustainable land and water management (SLWM) are the appropriate policies, rights and institutions that can provide incentives to users to regulate uses and invest in improved land and water resources. This is achieved by allocating secure rights of ownership or use to individuals or households or, in the case of common property resources, by eliminating or regulating open access. However, given the rapid pace of change in most developing countries, land and water policies and institutions are generally inadequate to address growing land and water challenges. As a consequence, in many parts of the developing world, resources are degrading for want of better institutions.

Esther Boserup (1965) taught us that growing population densities, scarcity of land and access to markets will lead to the intensification of land use, higher labour demand, investments in land resources, irrigation and drainage, and the gradual emergence of individual property rights for land. Vernon Ruttan (1978, 2001) showed that not only technical change, but also institutional change is induced by changing factor scarcities and other economic factors. Thus, induced institutional change can help identify solutions to the many challenges

discussed above. Finally, Elinor Ostrom (1990) convinced us that under the right conditions, communities are able to endogenously develop the institutions and rules to control access to common property resources. All three authors view institutions as adaptations to material, economic and social challenges that differ across space and time. There are therefore few policies, rights and institutions that are appropriate everywhere; instead they need to be adapted to local conditions at a given time.

In industrialized countries, historical processes, lasting for decades or centuries, have led to many policies, rights, and institutional regimes that ensure SLWM. Even in these cases, however, there are still cases of unsustainable land and water use. For example, groundwater depletion continues in the United States, nitrate runoff from agriculture generated the largest hypoxic zone in coastal waters of the Western Hemisphere, irrigation diversions for sugarcane production in Florida has contributed to the destruction of the important Everglades ecosystem, and distorted output prices in the European Union support irrigation and high fertilizer applications for basic staple crops. In the developing world historical processes related to the development of water rights systems and policies are lagging farther behind. Progress may be constrained by a variety of material, historic, and political factors that will be discussed in this report. In many cases options to policies, rights and institutions that would provide incentives for SLWM are well known, but economic and political constraints prevent their implementation at the stage of legislation and regulation and, more often, at the stage of implementation.

Furthermore, water and land tend to be separate domains of policy, law, rights and institutions. The increasing scarcity of both resources, and their interrelationships, suggest instead a holistic approach in which the two sectors are dealt within a common conceptual framework; but this has been seldom implemented. Separate systems for administering land and water are often a barrier to efficient, equitable, and sustainable use. New approaches to joint land and water management in watersheds and pasture lands are attempting to overcome some of these sectoral barriers; but successes appear to be limited to date. A common policy and legal framework would describe appropriate policies, institutions, and incentives. A lack of appropriate policy framework, on the other hand, tends to exacerbate resource scarcity as a result of rampant, growing inequality, and sometimes anarchy (an example is the 'anarchy' of groundwater extraction in parts of South Asia (Shah, 2009)).

Importantly, institutions, policies, administration systems, and approaches to reform should be adapted to the degree of scarcity of the resources, the population density, the historical legacies as represented in the current distribution of resources, and the countries' legal systems, and to current inequities and inefficiencies of use. While there are no one-size-fits-all solutions, lessons can be drawn from both successes and failures in different systems and societies.

In this report both the options for policies, rights and institutions will be reviewed that could be used for SLWM, as well as the material, historic and political factors that may hinder their application. The process of institutional change is perceived as being driven by growing resource scarcity, market access, and the desire to manage resources sustainably, but it is also recognized that change is difficult, just as it has been in industrialized countries. In Section 2 current and emerging trends are reviewed for land and water resources and their impacts on SLWM. In Section 3 the basic elements needed for improving land and water management are analysed, as well as common constraints to such improvements. Sections 4 and 5 are specific to land and water resources, respectively, and look at approaches to improving their management, and reforming inequitable allocations of rights. In Section 6 two areas are looked at in which progress is being attempted through the joint management of soil and water resources. These are integrated river basin or watershed management and pasture management. Finally, in Section 7 an observation is made of the important elements required for successful reform.

1. Current and emerging trends and impacts on SLWM

1.1 Degradation of resources and infrastructure

Land and water resources are degrading in many parts of the World, but there are also many cases of system resilience and gradual improvement (Mortimore, 2009). Where land and water degradation is occurring the processes include the: degradation of water and soil in irrigated areas; depletion of groundwater; degradation of water-related ecosystems; increasing water pollution; desertification processes; overgrazing of pasture lands, and the depletion of agricultural soil fertility in rainfed and dryland areas, especially in Africa where there is a common lack of resources to enhance soil fertility. In addition, there is continuous degradation of irrigation infrastructure investments, which is increasing the need for modernization and rehabilitation. Similarly, agrochemical pollution, overgrazing, soil nutrient depletion, and degraded soils require significant investments to ensure sustainable soil and land management.

Poor irrigation practices accompanied by inadequate drainage damaged soils as a result of over-saturation and salt build-up. A notable example is the Aral Sea Basin in Central Asia, which shrank drastically as a result of excessive withdrawals for irrigation. It is estimated that on a global scale there are about 20-30 million ha of irrigated land is severely affected by salinity. An additional 60-80 million ha are affected by water logging and salinity (FAO, 1996).

Water pricing for irrigation systems rarely covers the cost of operation and maintenance. As a result, degrading infrastructure reduces the efficiency, equity and sustainability of water use. After rehabilitation, water charges are not often reformed, and the cycle of degradation and rehabilitation is repeated (Shah, 2009).

In arid and semi-arid areas, the unsustainable pumping of groundwater has contributed to significant lowering of groundwater tables, particularly in South Asia and in parts of China; and to saltwater intrusion in some coastal areas. Globally, about 15-35 percent of irrigation withdrawals are estimated to be unsustainable; many of these withdrawals are from groundwater sources, which are nonrenewable or exploited beyond recharge rates (Vorosmarty *et al.*, 2005). On 25 percent of agricultural land in Central America, 16 percent of land in Africa, and 15 percent of land in Asia, the productivity of the land resource base on which the poor depend has declined substantially (Scherr, 1999 citing Oldeman *et al.*, 1991). There is growing concern that degradation of agricultural soils is already seriously limiting production in the affected areas (Lal, 1990; UNEP, 1982; UNCED, 1992). Soil degradation also leads to off-site problems, such as sedimentation of reservoirs, reduced functioning of watershed systems and carbon emissions (Scherr, 1999).

Land degradation both reduces land productivity and reduces water use efficiency. De Vries *et al.* (2008) state that a 13 percent yield loss, as a result of severe degradation on 40 percent of agricultural land and moderate degradation on a further 9 percent of agricultural land, is equivalent to a decline in water use efficiency of at least 13 percent. A global agricultural model suggests a slight increase in degradation relative to baseline trends could result in 17-30 percent higher world prices for key food commodities in 2020, and increased child malnutrition (Agcaoili *et al.*, 1995).

Agrochemical pollution resulting from poor nutrient management practices is a growing concern in much of East and Southeast Asia, parts of the Former Soviet Union, and some plantations in Central and Latin America. Subsidies for agrochemicals, poor extension services, and lack of water quality monitoring and enforcement of existing standards are the cause for much of today's agrochemical pollution. China clearly leads in this type of pollution, consuming more than 30 percent of the world's nitrogen fertilizer, which is applied to only 7 percent of the world's land area.

Increasing water pollution is a further constraint to sustainable land and water management. Poor water quality increasingly constrains agricultural and economic development in regions that experience water scarcity and are plagued by poor wastewater treatment, particularly in densely populated Asia. Water pollution reduces agricultural production, threatens fish and other aquatic life and human health. Salinity is a significant water quality problem facing the agricultural sector. Freshwater biodiversity and associated fisheries are declining in almost all developing countries, which is negatively affecting protein availability for the poor. Rapid economic growth in Asia is increasing political pressures to remedy these pollution efforts, and the induced policy and institutional changes may lead to reductions in pollution, as they have in most industrialized countries (Lomborg, 2007).

1.2 Competing demand and increasing scarcity

Land and water trends within agriculture

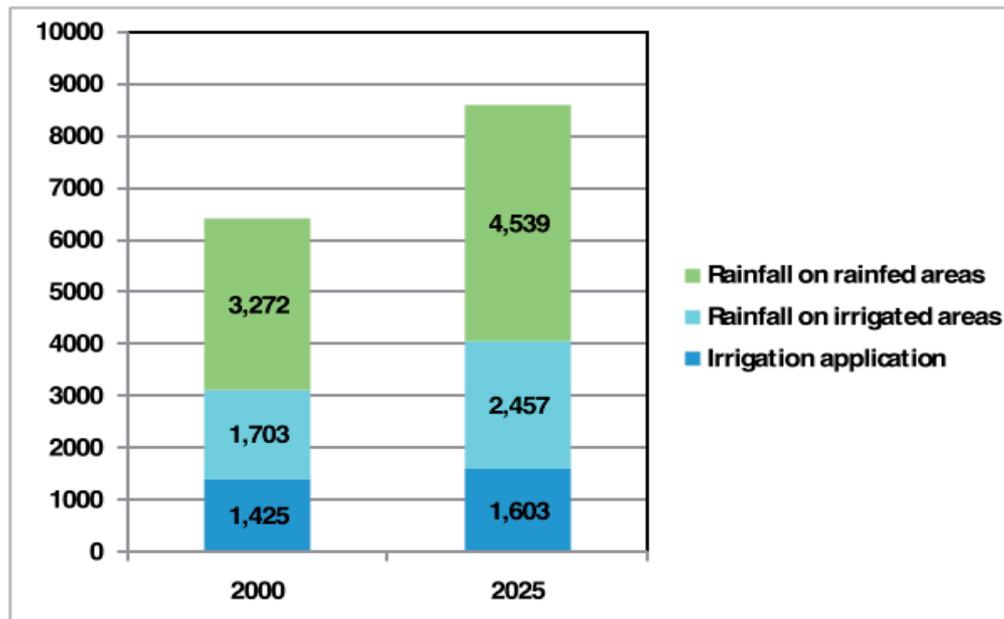
In 2005, agricultural land (including permanent pastures, permanent crops, and arable lands) covered around 5 billion ha, about 38 percent of global land area. According to FAOSTAT (2010), almost 70 percent of the agricultural area is used for permanent pastures and the remainder used for annual and permanent crops. Most of this area is located in developing countries; moreover, the share of area irrigated in developing countries is more than double the share of industrialized countries, given specific climatic and crop preferences in these countries. In 2000, agricultural water use consumed about 16 percent of total freshwater resources; this share is expected to increase to 21 percent by 2025 (Sulser *et al.*, 2009) (Figure 1).

Competition with non-agricultural uses

While irrigation water supply is expected to increase slowly, non-irrigation demands are expected to double by 2050, putting pressure on supplies available for irrigation, particularly in the group of developing countries where changes in population, economic growth and urbanization are fastest. Some non-irrigation and non-agricultural land-use demands will come at a direct cost to agriculture, particularly in countries with high economic growth coupled with limited natural resources, such as China; and countries with extreme water scarcity, such as the Near East and North Africa (IFPRI IMPACT Simulations, 2008).

Irrigated harvested area – taking into account multiple cropping and estimates of informal irrigation – are expected to increase from 421 million ha in 2000 to 473 million ha by 2050 at 0.23 percent per year. Water scarcity alone has already reduced cereal production by 5 percent in 1995, and is projected to reduce cereal production potential by 11 percent by 2020 and 14 percent by 2050, without taking into account adverse impacts from climate change and further land degradation (Rosegrant *et al.*, 2002 and IFPRI IMPACT Simulations, 2008). Moreover, as a result of growing water shortages, the irrigation water supply reliability index (IWSR), which measures the availability of water relative to full water demand for irrigation, declines from 0.71 globally in 2000 to 0.66 by 2050 (IFPRI IMPACT Simulations, 2008); the decline will be steeper in water-scarce basins. Irrigators are hurt not only on average, but because water availability becomes more susceptible

FIGURE 1: WATER CONSUMPTION FOR CROP PRODUCTION, 2000 AND PROJECTED 2025



Source: Based on Sulser et al. (2009).

to downside risk in low rainfall years. In much of the world, owing to climate change, the problem will be compounded by increasing intra-annual variability in rainfall and significant increases in the number and severity of droughts (Meehl *et al.*, 2007).

Agricultural harvested area is estimated to increase by only 0.39 percent annually from 2000–2025 and 0.07 percent per year during 2025–2050; increased productivity for much of current rainfed agriculture could be significantly higher if the challenges of turning low-potential areas into high-potential areas could be overcome in much of sub-Saharan Africa, parts of Latin America and parts of the former Soviet Union. These challenges include poor infrastructure, poor access to markets, and lack of incentives for small farmers and investors alike. Of course, such conversion will need to take into account high valued environmental and carbon sequestration needs and opportunities. The opportunities and constraints to arable agriculture in the Guinea Savannahs of Africa are reviewed in Box 1.

Thus, growing scarcities of water and land are projected to increasingly constrain food production growth, causing adverse impacts on food security and human well-being goals and have been an underlying factor of the food price spikes during 2005–2007. Moreover, the food price spike has prompted some food-importing countries to seek to acquire farm land overseas, rather than depending on world markets. This is increasing competition for land in land-abundant areas of Africa, Latin America and the former Soviet Union (Cotula *et al.*, 2009).

The role of biofuels

The production of biofuels affects land and water resources both directly, through land reallocation from food to non-food crops and water withdrawals for irrigation and the industrial processes of feedstock conversion, and indirectly through increasing water loss resulting from evapotranspiration that would otherwise be available as runoff and groundwater recharge (Berndes *et al.*, 2003). Biofuel production can also affect water quality

by increasing nutrient loads in rivers and lakes. Even though the amount of water withdrawn globally for the production of biofuels is modest, local water scarcity problems may worsen owing to irrigation of feedstocks (Rosegrant *et al.*, 2008). In countries with little land and water available for biofuel expansion, the use of water for biofuel production is likely to affect existing water allocations both across sectors as well as within agriculture and can involve serious trade-offs between energy, environment, food security, and livelihood protection (McCornick *et al.*, 2008; Muller *et al.*, 2008).

De Fraiture *et al.* (2008) also find that, while biofuels are of lesser concern at the global level, local and regional impacts could be substantial. The strain on land and water resources in China and India means that these countries are not aggressively pursuing current biofuel options based on traditional field crops. Careful land and water-use planning focusing on rainfed and marginal land and water-using feedstocks, such as sweet sorghum and jatropha, could mitigate some adverse impacts (McCornick *et al.*, 2008). However, second-generation biofuels will require water and land resources and, importantly, access to rural infrastructure that are generally poorly developed in countries having the potential for area expansion. To ensure sustainable development of biofuels without undue impact on land and water resources will require sound water and land policy and systems that reveal the full set of costs and benefits of biofuel development. These are described in detail in the following sections.

BOX 1: AWAKENING THE SLEEPING GIANT

The Guinea Savannas cover some 600 million ha of which about 400 million ha can be used for agriculture. Less than 10 percent of this area is currently cropped, making it one of the largest underused agricultural land reserves in the world. During the past four decades, two similar, landlocked and largely rainfed agricultural regions developed rapidly and became international agricultural powerhouses: the *Cerrado* of Brazil and northeast Thailand. The difficult agro-ecological conditions, remoteness, and poverty levels of the two regions were successfully overcome, and the same could happen for the Guinea Savannas.

A recent World Bank study (World Bank, 2009) found that farm level production costs in representative countries in the Guinea Savannas are competitive with the two comparator countries, with family farmers generally having lower costs than commercial farmers. African farmers are also generally competitive in domestic and regional markets, but not competitive in international markets. Logistical costs are much higher than in Brazil and Thailand because of inadequate transport, processing and marketing infrastructure; lack of competition in vehicle import and trucking industries; cumbersome transport regulations; and the need to pay bribes at border crossings and police checkpoints. Besides resolving these problems, awakening of this Sleeping Giant requires better agricultural incentives, greater state leadership, greater focus of development expenditures on services for family farmers, and greater involvement of the private sector.

After the recent price spike, international agricultural prices have settled at higher levels than before, providing better incentives for developing the Guinea Savannas and other areas with land reserves. Growing incomes in most African country and urbanization mean that domestic and regional African markets will provide many opportunities in staple foods and livestock products. Much of the technology that family farmers will need is already on the shelf, such as improved seeds, mechanization through animal draft or tractors, low on no till technology, fertilizers and pesticides. They require local adaptation, dissemination and marketing support.

Despite recent efforts, mainly by foreign investors, to launch large-scale agribusinesses in Africa, the study found no evidence that the large-scale farming model is either necessary or even particularly promising for Africa. The apparently successful settler farms of eastern and southern Africa were nurtured by streams of preferential policies, subsidies, and supporting investments. Nevertheless, large-scale farming may be appropriate where land must be developed in areas with few people, such as in many parts of the Guinea Savannas. In that case, however, three solutions are possible: Immigration, as in the Guinea Savannas of West Africa, machine hire from private

(Continued)

and lower latitude regions (Bates *et al.*, 2008). Furthermore, rising temperatures will increase the rate of snow cap and glacier melt affecting agricultural production in river basins fed by mountain ranges. Of key concern are the Himalayas feeding Asia's bread bowls in China, India and Pakistan. Sea-level rise resulting from the thermal expansion of seawater and the melting of continental glaciers will lead to inundation of low-lying coastal areas, with significant adverse effects, including salinization of coastal agricultural lands, damage to infrastructure, and tidal incursions into coastal rivers and aquifers. Here Bangladesh and Vietnam's rice bowls are threatened (Kundzewicz *et al.*, 2007).

Analyses of multiple climate change scenarios indicates that climate change will likely have a slight to moderately negative affect upon crop yields (Parry *et al.*, 2004; Cline, 2007), but crop irrigation requirements would increase (Frederick and Major, 1997; Döll 2002; Fischer *et al.*, 2006), as would overall water stress in many areas dependent on irrigation (Arnell 1999; Fischer *et al.*, 2006).

Similar to global trade regimes, foreign direct investment, and international cooperation on land and water, climate change causes the challenge for sound land and water rights, policies, and institutions to be raised to the international level. Poor land and water rights and policies combined with high vulnerability to climate change – a situation present in many developing countries – will worsen adverse impacts of and increase the costs of adaptation to climate change. At the same time, climate change also presents an opportunity for the international community and national governments to refocus resources on enhanced investments, institutions and policies for sustainable land and water management.

2. Property rights and collective action for land and water management

Views have evolved dramatically concerning the nature of appropriate policies and institutions. This is contrary to past polarized views that private property alone could achieve efficiency, equity and sustainability, or that only the central government could exert appropriate control over land and water resources. Across the world, efficient, equitable, and sustainable systems and institutions require varying combinations of state, collective action and individual rights or ownership.

Property rights play a fundamental role in allocating both rights and responsibilities for resource management. They can be variously defined, e.g. "the capacity to call upon the collective to stand behind one's claim to a benefit stream" (Bromley, 1991:15) or "an enforceable authority to undertake particular actions in a specific domain" (Commons, 1968). Rights to land and water may derive from the state, but they can also derive from a range of customary law, religious laws, and project regulations – a situation referred to as legal pluralism.

Property rights include particular 'bundles of rights' or 'web of interests', not just full ownership. Rights of use (access and withdrawal), and control (management, exclusion, and alienation) may be held by different claimants, even on the same land or water resource, such as when herders have rights to graze on fallow agricultural land, or fishers, domestic water users and irrigators all draw from the same water source. Thus, systems of property rights need to accommodate multiple uses and users. These overlapping uses can be a source of competition and conflict, but can also facilitate increased livelihood opportunities and environmen-

tal benefits for a broad range of people, especially the poor, than assigning simple 'ownership' to a single right-holder.

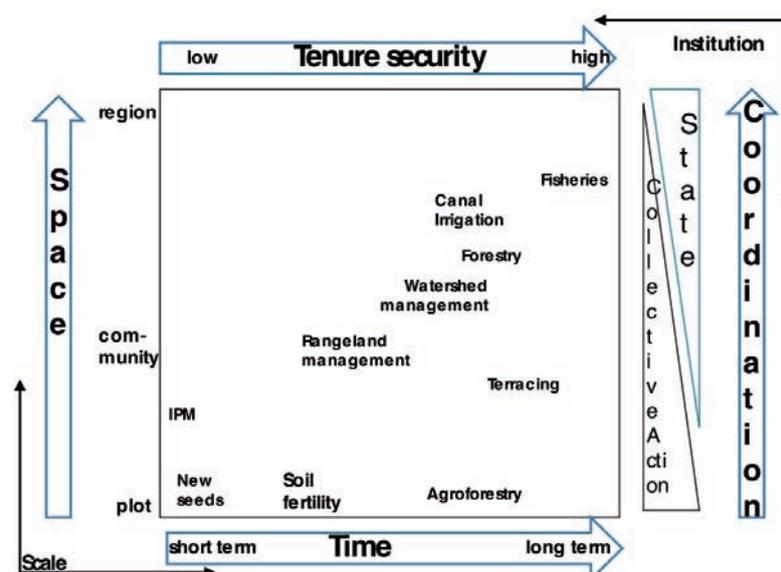
Where property rights are difficult to define or enforce, as for example for common pool resources, collective action is needed to achieve SLWM (Ostrom, 1990). While scarcity itself and access to markets may drive the emergence of collective action and/or property rights, the law and a set of institutions is needed to enable and administer property rights and to underpin collective action. "In many jurisdictions, water rights have for a long time been considered as a subsidiary component of land tenure rights, a right to use water often being dependent on the existence of land tenure right. In contrast to land tenure rights, however, debate over water rights and their reform has tended to be less concerned with ideology than with hydrology, with hydraulic engineering than with social reform" (Hodgson, 2004, p. 2).

Nevertheless, rights and institutions related to land and water are usually separate, and integrated treatments of these processes and institutions hardly exist (Hodgson, 2004). In this section property rights and collective action are addressed for both land and water in an integrated way. However, Sections 4 and 5 focus on these issues as they arise separately for land and for water. In Section 6 pastoral issues and watershed management are dealt with, which are the areas where innovative approaches have been introduced, with mixed success, to jointly manage land and water rights.

2.1 Need for both collective action and property rights

Many SLWM technologies and management practices are not adopted because of numerous potential constraints. These include suitability to particular local contexts, farmers' knowledge of the practices, and costs relative to the returns to the farmers. Beside these factors, collective action is critical to the adoption of SLWM practices involving multiple farmers, and property rights and institutions are critical to ensure the adoption of SLWM technologies having long time horizons. As illustrated in Figure 2, new varieties of annual

FIGURE 2: ROLE OF COLLECTIVE ACTION AND PROPERTY RIGHTS IN NATURAL RESOURCE MANAGEMENT



Source: Adapted from Knox et al., 2002.

Note: Location of technologies will vary depending on farm and community sizes and specific technology characteristics

crops can be adopted on a single plot that provides returns within a season. The technology can be adopted by a single farmer or a tenant because of the short time horizon. These technologies are the simplest from an institutional standpoint.

A single farmer can plant trees, without having to join others in the investment. Because of the long time horizon for trees, however, farmers without secure tenure may not have the incentive – or even the authority – to make such investments. This can constrain the adoption of tree planting or soil fertility management, by tenants or other households having insecure tenure and by women, who may not have recognized rights to the land, as a result of widowhood or divorce.

Integrated pest management (IPM) has relatively short payoff periods, but because the practices operate at a larger spatial scale, some form of coordination is required. Most natural resource management approaches (e.g. irrigation, watershed development, rangelands, or forestry) have both large spatial scale and long time horizons. This means that both secure tenure and coordination institutions are required to apply the investments.

Viewing technologies in this framework allows for a precise identification of whether property rights or (lack of) collective action are likely to be constraining or enabling factors in investments and technology choices. It can also provide guidance to the development and dissemination of technologies that are appropriate for the institutional context. For example, technologies that operate on a landscape scale (such as watershed management) may be more appropriate where traditions of cooperation are strong. Those technologies that require an extended duration to produce benefits may realize greater success where tenures are long-term and reasonably secure, at least for those resources linked to the technology being applied.

Conversely, where many farmers have insecure tenure, technologies are required that offer significant short-term returns. For example, to slow runoff and stop soil erosion in a watershed, stone bunds have a long payoff period, so are less likely to be adopted where farmers have insecure tenure, whereas vegetative strips on the contours may be more readily adopted because of their shorter payoff period. This heuristic device helps identify the institutional implications of various technologies or approaches. Short-term technologies can be adopted in situations of low tenure security; those that are long-term are unlikely to be adopted by people with low tenure security. Technologies that can be adopted on a single plot can be adopted without coordination, but the higher the spatial scale, the greater the need for some form of coordination.

Coordination can be provided by the state, the market, or collective action (including both formal organizations and a range of customary organizations and ad hoc interactions). For example, an irrigation system that serves many farmers can be operated by a government agency, by a farmers' group, or by an individual farmer who sells water to the others. Indeed, many systems combine these. For example, in large-scale canal systems, a state agency often provides the water along the main canals, farmers' groups below the outlet, and individual farmers with tubewells may sell excess water to their neighbours. In general, we would expect that collective action institutions that tap into local knowledge have the greatest advantage at local levels, and state institutions have an advantage at higher levels, but both may be present and active at any given point.

Market institutions are most likely to operate when there is greater possibility of exclusion (as, for example, in dealing with the transfer of land through rental and sales, or from sales of water through pipes from tubewells, as opposed to open canals); where a level of technical skill is required; or where it is more difficult to monitor the level of effort or quality of contributions. The latter two factors are related to why the coordina-

tion of pumping equipment that serves more than one user is more likely to be under market arrangements (whereby one person owns them, and sells water to others) instead of collective action, whereby all users are directly involved in the management of the shared resource/equipment. In contrast, activities that take large amounts of undifferentiated contributions (either cash or unskilled labour) are easier to organize through collective action.

Another well-known approach to identifying the likely roles of the state, markets, and collective action is to consider the degree of excludability and rivalry of a good or service. Those with high excludability and high rivalry of consumption (also referred to as subtractability, whereby use by one person reduces availability to others) are generally private goods and allocated by markets. At the other extreme, those with low excludability and low rivalry (e.g. civil defence) are generally public goods, provided by the state. Those with high excludability but low rivalry are toll goods, and the market may play a key role, along with state authorization. The most complex cases to manage are those with low excludability and high rivalry – the common pool resources. Because of the high costs of exclusion, it is difficult for individuals, but rivalry for consumption implies that the resource will be depleted unless there is careful management. Many natural resources fall into this case. It is in these areas that collective action is often called upon to play a major role.

Ostrom's (1990) work has identified eight design principles for successful management of collective resources: clearly defined boundaries (often an attribute of the resource itself), proportionality between benefits and costs, collective choice arrangements that allow users to make rules to govern the resource, monitoring, graduated sanctions, conflict resolution mechanisms, minimal state recognition of resource users' rights to organize, and nested enterprises (local groups are nested within larger organizations to manage large-scale resources). While these principles are useful guidance, they should not be taken as blueprints: Ostrom (2007) herself cautions against seeking 'panaceas', and argues instead for crafting 'polycentric' governance that involves the state, communities, and private institutions at different levels (Anderson and Ostrom, 2008).

2.2 Emergence of property rights

This section explores three ways property rights can emerge: as an evolution of communal rights under increasing scarcity, by the state, and by force, power, or distortions.

Population density, access to markets and resource scarcity

Property rights for water, such as the right to withdraw water from the ground or from an adjacent water course, have been associated with land rights, and were rarely articulated separately (Hodgson, 2004). Therefore these land and water rights initially evolved in similar ways.

When population densities are low and markets are absent, resources are abundant. Shifting cultivation is the farming system operated under these conditions and access to land and water is open to all members of the community that occupy a given territory. Boserup (1965) described the sequence of development that follow upon population growth and/or infrastructure development and market access. The time land is left fallow is shortened, leading initially to a decline in soil fertility. As land becomes scarcer, the point is eventually reached where the system moves to permanent agriculture, with animal draft and the plough replacing the hand hoe. When payoffs are high enough, intensification of the farming system leads to higher application of organic manure and fertilizers, to investments in soil conservation, drainage of waterlogged areas, and eventually irrigation and double cropping.

Farmers require incentives to invest in land improvements, drainage and irrigation, which are provided by increasingly secure ownership rights. To provide these rights and incentives, communal right systems allocate inheritable usufruct rights, first to homesteads and nearby fields, then to the right to resume fallowed land, and any areas into which farmers have invested by planting trees, or investing in soil conservation, drainage and irrigation. Intensifying farming systems that provide secure rights are characterized by rising labour inputs per hectare and rising productivity, and reverses the initial degradation associated with shorter fallow periods.

As land becomes scarce, people start to trade their inheritable usufruct rights, first through temporary rentals, then sales. The hallmark of communal rights systems is that they restrict sales to outsiders of the community, or subject them to community approval. Eventually these constraints break down, and the stage is set for shifting to full and individual property rights. Communal property rights over pastures, forests and wastelands may continue for a long time. Studies in Africa have shown that customary systems can provide sufficient tenure security for investment (Bruce and Migot-Adholla, 1994). Communal property rights systems and the security they provide may become threatened by internal conflicts, outside claimants, or by neglect or interference by the state.

In industrialized countries the emergence of individual property rights systems followed the same sequence in a slow historic process, with frequent aberrations, twists and turns. In most of the developing world the colonial powers implemented such systems to serve their own interests, often long before they were strongly demanded by the indigenous population. Customary (or communal) and individual property right systems, therefore, have coexisted for a long time. Unfortunately, customary rights were often unrecognized by the legal system, subjecting the right holders to great uncertainties and risk of dispossession. Nor were the processes defined by which such communal rights could be transferred to individual property rights. Many developing countries, including Mexico, Tanzania, Mali Mozambique and South Africa, to name a few, have fully defined both traditional communal rights as well as individual property rights in their reformed land policies and land laws. They have also developed processes of transition from one to the other, either by individual or community decision. Such reforms have been especially well implemented in Mexico and have led to major benefits (Deininger *et al.*, 2007, and Box 2)

Thus, in the absence of intervention by the state and/or ruling classes, where a resource is characterized by rivalry and excludability, communal rights over land and water have been gradually replaced by more individual rights within the communal rights structure, and ultimately to individual private rights. For common pool resources, where excludability is difficult, there is a need for collective action to better manage access to the resources as common property and prevent a situation of open access that would dissipate the resource rents. Where collective management of the resource is inadequate, or rights of common property are not recognized by the state and outsiders, open access and deterioration of the resource is likely to result. Customary right systems are often able to eliminate open access and provide security of tenure, but when such systems break down (through erosion of the customary institutions or pressure from powerful outsiders), customary rights systems must be assisted to adapt and reinforced or statutory individual rights must replace customary rights.

BOX 2: TRANSFORMING COMMUNAL LAND RIGHTS OF LAND REFORM BENEFICIARIES IN MEXICO

The 1992 Ejido reform in Mexico illustrates that group rights can be perfectly consistent with secure land tenure by individuals and, if adopted with a view to making institutions more accountable, they can significantly affect governance. It also illustrates that even without full ownership rights, efforts to improve the functioning of markets can significantly increase land market activity.

First, the legal status of the *ejido* [the community of land reform beneficiaries] was enhanced by recognizing the legal personality of *ejidos* and vesting the general assembly of all members with the ability to regulate internal matters, including regularizing land ownership within the *ejido*. To ensure that these sensitive questions could be tackled without political interference, a procedural framework was established, including rules for decision making. A second element was the liberalization of land markets. Land rental transactions were completely freed, while land sales were allowed within the *ejido*. Finally, and most important, *ejidos* could undergo a voluntary programme of land regularization that, in a participatory process, helped establish and demarcate the boundaries of community land. With a 75 percent majority the *ejido* assembly could decide which of the community lands should be parcelled out to individuals and which should be held in common property, or whether landowners in the *ejido* should be allowed to make the transition toward a private property regime. In all cases households receive certificates that document their share of the land. This increased transparency led to increases in rental market activity and household welfare and to improved governance without the sell-off that many of the programme's initial critics had feared.

Source: Slightly adapted from World Bank, 2003, p 121.

State allocation

The above sequence of development of property rights has rarely occurred undisturbed. Rights may instead emerge by way of state allocation of land and water resources. The state may allocate the ultimate ownership of land and water to itself. This is particularly true of water rights, because the Public Trust Doctrine, dating back to Roman times, specifies that the state holds water rights in trust for its citizens, as an aspect of sovereignty.

In pre-modern times and during the colonial era, allocation of rights to land and territories by monarchs or the state or to specific tracts of land to the elite or colonial settlers was common worldwide, usually without the recognition of pre-existing customary rights. In these cases expropriation of land also expropriated water. Recognition of the customary land rights of local populations, indigenous tribal groups, and herders has only recently become more common across the world, while it is still uncommon for water.

Today, allocation of rights to state land occurs when land owned by the state is leased, sold, or redistributed. For water resources, rights have traditionally been allocated to landowners as riparian rights or as the rights to extract groundwater found under the land; rights to canal water are invariably allocated during the process of canal construction. Under modern water legislation, concessions are given for the withdrawal of specific amounts of water from a specific water resource, and these may be allocated for environmental uses.

Heavy state involvement in water allocation has been justified based on the strategic importance of the resource, scale of systems required for its management, and positive and negative externalities of its use. Because, in a very real sense water is life, most governments are reluctant to turn over its allocation to commercial interests. The large-scale systems used to deliver much of the water for irrigation and municipal needs lend themselves to natural monopolies, and would be beyond the capacity of most communities or private firms to organize and fund. The positive externalities of irrigation systems for improving national

and regional food security, or of domestic water supply systems for improving public health, have also been used to justify state involvement in such systems. The high individual costs of internalizing negative externalities such as deterioration of water quality caused by agricultural runoff, sewage, and industrial effluent, or deterioration of groundwater levels, provide further arguments for a strong state role.

However, public allocation often does not provide an incentive structure for using water most efficiently. The dominant incentive under public management seems to be coercion; setting regulations and using sanctions against those that break them. This only works if the state is effective in detecting infractions and imposing penalties. In many cases the state lacks the local information and ability to penalize, for example, the breaking of water delivery structures, or for excessive water withdrawals. It is relatively more effective where there are fewer points to monitor; for example, the main canals of large irrigation systems rather than tertiary delivery structures or small-scale irrigation, or withdrawal and discharge points where there are a few large factories rather than for many small business enterprises.

2.3 Constraints to the efficient workings of rights and institutions

Constraints to the efficient and equitable working of rights and institutions derived from historical legacies are reviewed in this section. The areas addressed include the poor's, women's and marginalized groups' inequitable access to resources, the nature of the resources themselves, policy distortions and subsidies, poorly developed rights and enforcement mechanisms and corruption and conflict.

The focus is on constraints that directly affect land and water resources. However, many other policies and institutions affect land and water outcomes indirectly.¹ Generally, policies and institutions that support agricultural productivity growth can help conserve land and water resources, if implemented in cost-efficient, pro-poor and environmentally sustainable ways. Their further treatment is beyond the scope of this paper.

Power and distortions

Many studies worldwide have shown that small family farmers often use land more efficiently than large scale farmers. Yet in spite of this, large scale farming emerged over the course of history and continues to this day. The efficiency of the family farm derives from the high incentives of family members to work hard and reinvest their income into the farm, and from their lower costs of supervising hired labour. These advantages are counterbalanced by advantages of scale of information, input and output markets, and access to credit. Usually these advantages of scale are outweighed by the incentives and supervision cost advantages of family farmers (Binswanger and Rosenzweig, 1986, Rosenzweig and Binswanger, 1993; Lipton, 2009). Exceptions occur for plantation crops where outputs are highly perishable and need to be processed or marketed very quickly, leading to a coordination problem between the farm and the processing facility that is often associated with large economies of scale. The coordination problem can be resolved within a single plantation, or through contract farming with smallholders.

Over the course of history, powerful groups have allocated land to themselves as overlords or as owners. When such land was not scarce, the challenge to owners of large land areas was to find workers for their farms, as potential workers could establish their own farms instead of working for the overlords or owners

¹ Policies with indirect impacts may focus directly on the macro economy, investment and trade; genetic resources, research and the associated intellectual property rights; Information and Communication Technologies (ICTs); climate change or energy (see, for example Rosegrant *et al.*, 2009 and Ringler *et al.*, 2010).

(Binswanger *et al.*, 1995). This challenge was overcome by force and/or distortions. Populations were bonded into slavery of servitude, or slaves were imported. Where colonial powers allocated the most fertile land to their own citizens as overlords or settlers, communities were often moved to less fertile or infertile land. Means to get people to work on the large farms included labour levies and head or hut taxes. These systems were often reinforced by prohibiting communal farmers from producing and marketing cash crops so that the local populations could only earn the cash needed for the taxes by presenting themselves to the colonizers'. Colonizing powers also concentrated subsidies and technical support on the large-scale farms. In South Africa and Zimbabwe these systems survived until 1980 and 1992, respectively. Currently there is the concern that the wave of foreign investment in land over the past few years could lead to similar problems in parts of Africa and Asia (Cotula *et al.*, 2009).

The legacy of power and distortions survives as both inefficiencies and inequities. An example is Colombia (and several other countries in Central and South America) where much of the high-quality arable land is occupied by large estates belonging to people of Hispanic origin. The indigenous and mixed populations tend to live on the hillsides and in mountain areas. The estates are largely under pastures, while crop farming is predominant in the hillsides. Over the course of the last century, sharecropping and other forms of land tenancy became grounds for the expropriation of estates for land reform, and tenant evictions followed, aggravating the misallocation of resources. Progress with land reform has been very slow (Heath and Binswanger, 1996).

Similarly, in Zimbabwe and South Africa the large estates of white settlers occupied the best land, while overcrowded communal areas were established on much poorer land. Until the fast track land reform in Zimbabwe, the large-scale commercial farms utilized only a small fraction of the land for crops, using the remainder for livestock grazing. The allocation of land was inequitable, inefficient and led to land degradation. Eventually this led to the fast track land reform whose consequences are still unfolding (World Bank, 2006).

All over the world systems of large-scale estates or farms created by power and distortion has left a legacy of unequal landownership and inefficient production, which was resolved by revolts and revolution or by land reform (Binswanger *et al.*, 1995, Lipton, 2009). In Europe these reforms [were at their height from the eighteenth to the twentieth centuries, however, the scale and speed of the land reforms in Central and Eastern Europe and the Former Soviet Union, with the transfer of lands from collective and state into private tenures during the 1990s is probably unprecedented globally]². When and how land reform was resolved elsewhere is further discussed in Section 3.5.

Inequitable access to resources by poor, marginalized groups and women

Unequal and inequitable resource allocations have been shown by a growing literature to not only reduce equity, but also to reduce the efficiency of resource allocation and growth (World Bank, 2007). The negative farm-size productivity relationship discussed earlier, found in most empirical studies, and is a case in point. Inequities also affect women and other marginalized groups directly, with consequent equity and efficiency losses.

Women and poor and marginalized groups are often denied access to resources. This is because of the failure of customary or formal rights to recognize the rights of women; or because poor people did not inherit such rights, or historically were considered migrants, were enslaved or as a result of other forms of discrimination, and therefore were unable to obtain rights allocated by the community or markets. Tribal groups lost access to resources owing to encroachment onto their resources and eviction onto low-quality resource

² Note. [...] this phrase has been added by the editors.

areas such as mountainous, dry, or remote forested areas. Nomadic herders' traditional right to pasture and water resources is threatened by agricultural intensification or by state neglect or interference. Many farmer groups, herders, and indigenous populations having customary rights that date back centuries do not have recognized land rights and can be evicted by the state, either when outsiders wish to acquire land for agriculture or forest concessions, or when the state declares 'protected areas' such as national parks. The resulting insecurity of indigenous communities has prompted considerable attention, such as from the United Nations Permanent Forum on Indigenous Issues (2004), which calls for recognition of their land rights and free, prior, and informed consent (FPIC) for any use of their land. India's Tribal Land Act is a move toward formal recognition of such land rights.

Except in matrilineal systems, women may only have access to land through a husband, father, or son. Depending on male relatives for land is only as secure as their relationship with that man. This is a source of tenure insecurity particularly for married women when they become widowed or divorced, or when a widow fears her sons may displace her. This, for example, constrains farm production and investment, as women cannot obtain credit, or may not be allowed to plant trees. Fragmentation of landholdings and associated water rights adds to the pressure. Rental and sales markets offer women and other marginal groups' important opportunities for access, but they are themselves limited by poverty and marginality or inadequate supply of water or land, respectively. Rental markets may not provide security for long-term investments.

The nature of the resource and the number of its users

Common property resource management is easier when resource boundaries are well defined, and the number of users is limited and well known. As for example in the Swiss Alps where communal rights over the alpine pastures have combined for centuries with allocation of stocking rates to village populations resident at lower altitudes, where individual ownership of land and forest prevails. There are similar conditions in the high mountains of Mongolia and the forest steppe, where seasonal migrations are relatively short, and the potential for collective action to slow the pace of pasture degradation is significant (Usukh *et al.*, 2009). On the other hand, in most arid areas of Africa, or in the desert steppe and desert zone of Mongolia, the territory is flat, and herds move over large distances to wherever rainfall has caused the pasture to grow. In such areas pasture degradation is usually determined by climatic conditions and climate change, rather than animal pressures, and management of common property resources is challenging (*ibid.*).

In the Saurashtra region of Gujarat, where groundwater basins are confined by a pan, water users can understand the interconnectedness of their water-management decisions. This case therefore satisfies the first condition for successful collective action set out by Ostrom (1990) of clearly defined boundaries of the resource. Soil and geological conditions are also suitable for groundwater recharge. Therefore a powerful groundwater recharge movement has emerged, initially without state support (Shah, 2009). In arid and semi-arid alluvial areas of the Indo Gangetic plain, however, the groundwater resources are interconnected over very large areas, and it is difficult to ascertain the impacts of individual or community behaviour on the groundwater table.

Common resource management, therefore, has not emerged in any form and the groundwater table continues to decline. Following a history of large-scale subsidies for groundwater pumping, the state has lost control over the digging and deepening of wells by tens or hundreds of thousands of individual farmers. As a result groundwater anarchy prevails. In hard rock areas of peninsular India, where groundwater storage capacity is limited, it has been difficult to convince communities to collectively manage their groundwater resources, in part because it is difficult to monitor and sanction excessive withdrawals, and

because the wealthier well owners can 'opt out' of customary collective management institutions that once operated for surface irrigation.

Poorly developed rights and enforcement mechanisms

Property rights are only as strong as the institution that stands behind them. The capacity of the central state to allocate rights, enforce them, resolve conflicts, and manage the land or water records is generally weak, especially at the local level. These factors tend to increase insecurity, open opportunities for denial of rights, abuse and corruption, and tend to lead to conflicts that the system is poorly able to resolve. Where powerful outsiders develop an interest in land or water, customary rights may not be enough to protect existing users. However, many attempts to change property rights through external intervention have led to increased uncertainty for local resource users (Spiertz and Wiber, 1996). Most initiatives for change in water rights, assessed in a book on water rights reform by Bruns *et al.* (2005), were triggered primarily by influences outside the water sector, and were then shaped by elite perceptions and politics within the sector. Developing effective land or water rights reforms therefore needs to take account of the interplay between systems of rights, and the ways these are used by various state and non-state actors.

Policy distortions and subsidies

In many countries, poorly developed rights and institutions are aggravated by tax distortions, pricing, security of tenure and other institutional mechanisms. Fertilizer application rates tend to be beyond recommended levels and balanced in favour of the subsidized ingredients in those countries that subsidize fertilizer use (for example, Bangladesh and China). According to Huang *et al.* (2010), Chinese farmers received US\$34.4 per acre (2.47 acres = 1 ha) in 2008, comparable to the per acre subsidy level in the United States. Bangladesh in 2008/2009 spent US\$41 million on agricultural research and development, but US\$758 million on urea support with resulting adverse impacts on (ground) water quality. In Brazil, up to the economic crisis of the early 1990s, credit subsidies, and tax exemptions favoured the clearing of land in the Amazon region for often unsustainable livestock grazing. The virtual exemption of agriculture from income taxation through excessive depreciation allowances also favoured such investments. In the face of such distortions it becomes much harder to enforce zoning regulations that protect forests and biodiversity (Binswanger, 1991).

In India electricity for irrigation is provided at highly subsidized prices or free of charge precisely in the areas that suffer from the greatest threat of groundwater depletion, aggravating an already unsustainable situation. These subsidies undermine the viability of state electricity boards, and come at an enormous fiscal cost estimated at US\$5.2 billion in 2001/2002 alone (Navroz Dubash, personal communication). Attempts to restore power tariffs have repeatedly led to the political ruin of the leaders that attempted them (Shah, 2009). Fertilizer subsidies aggravate ground and surface water pollution, at great cost.

Distortions do not only occur within the agriculture sector, but also between agriculture and other sectors. According to Schiff and Valdes (1992) distortions to agricultural incentives are more negative the lower a country's per capita income, taking into account not only direct distortions to agricultural prices, but also indirect ones that attract resources away from agriculture, such as manufacturing protection and overvalued exchange rates. Rural areas tend to receive little public investment in infrastructure and extension compared to urban areas and farmers tend in many countries are still required to sell food at fixed prices to support urban consumers (Byerlee and Sain, 1986; Pinstrup-Andersen, 1988).

The impact of population growth and poverty on natural resource management is heavily influenced by the presence or absence of such distortions. Tiffen *et al.* (1994) showed that in Machakos district, Kenya, from 1932

to 1995, the population increased six-fold while agricultural output increased tenfold. The normal Boserup intensification sequence followed and today the area has wide coverage of erosion-control measures, and significant increase in tree coverage. The conditions that favoured these developments were relatively favourable price policies, access to international markets for export crops, the development of infrastructure, the proximity to the market in Nairobi, the remittances sent by temporary migrants, secure, individual rights to land, initially through communal tenure and later land titles, and a fair supply of soil conservation services.

In Ethiopia, during the time of Haile Selassie and the Derg, farmers were heavily taxed under a variety of methods. Infrastructure and market development was minimal, and agricultural services deteriorated. Access to domestic and international markets was often disrupted. Employment opportunities in the rural non-farm sector and the urban economy were limited. Land rights were highly insecure because farmers either were tenants at will, and under the Derg their land had been redistributed or collectivized, and many were forcibly resettled from dispersed homesteads into villages, or to low population density areas. Grepperud (1994) reports widespread deterioration of land resources, which was most likely the result of the long period of insecure rights; of poor infrastructure, market access, and incentives; and of policy distortions (Heath and Binswanger, 1996).

Corruption

Robert Wade (1975, 1982) created a storm when he showed that the irrigation department in Andhra Pradesh was riddled with systematic administrative and political corruption. Since then it has become apparent that irrigation departments in many other countries are equally affected. Bribes are paid for allocation of water, for ignoring the breaching of canal banks to scavenge water, and for the award of construction, rehabilitation and maintenance contracts for irrigation, drainage and flood control. The posts that enable the office holder to collect large amounts of bribes are highly coveted, and often allocated by payment of more bribes to superiors, sometimes to the point that the price for getting a specific post is common knowledge. Shah (2009) shows that the growth of pump irrigation in the command areas of irrigation schemes in India has made farmers more independent of the irrigation department and the posts in water management are no longer coveted, and only those in the construction department command high premiums.

Where land agencies are still able to allocate land rights, such as in parts of Africa and Latin America, or where they are in charge of converting communal rights to private property rights, risk of corruption (World Bank, 2003a) is also high. The land and water institutions are often weak and corrupt because of poorly developed and/or conflicting rights, and because the policy distortions favour groups in the economy that benefit from this situation and oppose the strengthening of the systems. The weakness of the institutions may therefore be the consequence of a rent-seeking equilibrium that allows powerful groups and/or administrators to extract rents for themselves.

Conflict

Scarcity and competition for land and water is an important potential cause of conflict, which can cause violence as well as further degradation of the resources. Although much of the attention has been over 'water wars' and international conflict, more localized conflicts are widespread (UCDP, 2008). Institutions that allocate and enforce rights and adjudicate disputes play an important role in preventing competition from developing into conflict. Customary institutions can play an important role in reducing intra-community conflict over resources, but external institutions are needed to mediate conflicts among communities, or between communities and outsiders. The latter is especially problematic when powerful outsiders seeking land or water have strong ties to government. However, rigid institutions are often not adapted to the dynamic nature of land and

water use. Thus, it is important that management institutions are resilient and adaptable to changing conditions. Lebel *et al.* (2006) propose three positive attributes of resilient resource governance: (a) participation and deliberation in building trust and common understanding about potential courses of collective action; (b) multilayered institutions as enablers of decision-making that adapts to social and ecological change; and (c) accountability of public authorities as a determining factor in arriving at socially equitable outcomes.

3. Improving land policies, rights and institutions

In this section we discuss the challenges to communal right systems and their transition to individual property rights; land rights administration under both of these systems; land markets; state land; and redistributive land reform.

3.1 Dealing with threats and breakdowns of communal rights systems

Section 4.2 discusses the literature that shows that traditional communal property regimes can provide highly secure tenure. From the times of settlement of a territory, the usufruct right to land is an inheritable right of all members; over time, rights to parcels of land are specified, and become tradable in rental markets and by sale to insiders. Thus these systems can provide high investment incentives to the members.

Communal rights systems, however, can come under threat or disintegrate because of land scarcity and rising land values; internal conflicts; encroachment by outsiders; conflict with neighbouring communities; state disrespect for communal rights; or large-scale conflict and war. The first way to address such problems is to strengthen the communal rights systems. This is being done South Africa, Tanzania, Uganda, Mali, Ghana, India, Brazil, and many others through full recognition of the traditional rights of communities' herders, and/or indigenous groups. To be most effective with outsiders, such recognition needs to be followed by the demarcation and titling of the areas under community ownership, a process that lags in many countries. Better defining transparent decision-making processes, as for Mexico (Box 2) is also helpful, as is support to conflict resolution within and across communities.

Assisting communities to recognize and register customary rights as practiced in Mexico, Ethiopia, Mozambique and Madagascar, is helpful in strengthening communal land rights administration and resolving a wide range of conflicts. The reform of the Mexican *Ejido* system is perhaps the most comprehensive approach that combines all these elements. The registration of existing rights was comprehensively accomplished within a few years. Conflicts that could not be resolved within the communities were referred to a specifically created agrarian court system.

The other way to deal with pressures on communal rights systems is to transfer the system or individual plots to individual property rights. The Mexican system regulates the process of system change and subjects it to the decision of a qualified majority of the members of individual communities. The land laws of Tanzania and Mozambique have adopted the same approach. A more state-led, targeted approach would be for the state to select areas where the traditional land right system has come under pressure, such as peri-urban and urban areas, or areas with high-intensity agriculture, and lead or facilitate the process of land titling.

In all cases, strong safeguards are required to avoid elite capture. For example subdivision of Maasai group ranches in Kenya have allocated the largest share of land to elders, while poor herders and widows have received smaller parcels, and married women and youths have been entirely excluded. In addition, access to common resources such as footpaths and water points has been closed off (Mwangi, 2006). Transfer to individual property rights may be inappropriate where these rights would erode common identity and community among landholders that play important roles in preserving environmental functions and protecting the livelihoods of poor households and individuals (Meinzen-Dick and Mwangi, 2008). The benefits of more secure rights within communal or individual property rights systems include the appreciation of land values, an increase in investment incentives, tradability in rental and sales markets, reductions in costs of defending land rights, and increased mobility of labour to non-farm activities and to urban areas. Studies in Thailand and Latin America also show that the benefits of individual land rights accrue primarily from the use of land as collateral to access credit (World Bank, 2003a).

3.2 Land rights administration

In communal rights systems, the decentralized self-governing nature of administration by chiefs and councils of elders, or the community, minimizes costs. Even there, a legal framework and administrative support by the state are required to delimitate the areas owned or claimed by different communities, assisting them in strengthening their own internal land rights administration and conflict resolution, helping them record their rights, and defend their areas against encroachment from outsiders. In South Africa the setting up of the required administrative systems is still awaiting the passage of the Communal Land Rights Act. While Uganda, Tanzania and Mozambique and Madagascar have all put in place the required legislation, the supportive land-rights administration system is weak and unable to manage all these tasks properly. These countries are therefore largely forgoing the land tenure security advantage of their specified land laws. Ethiopia is one of the few countries that have made considerable progress at a low cost (Deininger *et al.*, 2007).

In countries and regions where individual property rights prevail, the land rights administration system is a government function, preferably at the decentralized level with central government oversight. As discussed, unfortunately, in many developing countries these systems are weak, under funded and often corrupt, again undermining the security of tenure and of land transactions provided by the law. Improving these systems and freeing them of corruption remains a huge agenda.

Many land laws (e.g. Mozambique and Tanzania) allow for the orderly transfer of land from communal into individual ownership through a process of negotiation for specific pieces of land with communities, and application for such transfer to the land rights administration authorities. This process has acquired special relevance as a result of foreign and domestic investors' recent rush to invest in large-scale farming. While the laws include all the necessary safeguards, these may or may not be properly applied, raising risks to communities, providing incentives for corruption, and perhaps creating the basis for future conflicts.

The regularization of informal settlements is a major issue in peri-urban and urban areas, offering the possibility of creating the capital basis for the development of poor communities (de Soto, 2000). Such regularization is often required where forest land has long been cleared by cultivating migrants, as for example in Thailand, where a large-scale land titling programme has been in place for over 20 years. In all cases, a systematic approach to regularization is to be preferred where all claims are adjudicated and conflicts are resolved, rather than a piecemeal regularization based on individual demands.

3.3 Land markets

Land markets can reallocate land from less efficient to more efficient uses and producers. However, imperfections in credit and other markets, policy distortions, and speculative behaviour undermine the proper functioning of land sales markets in many countries (Binswanger *et al.*, 1995). Therefore rural land sales markets are rarely able to transfer land from less efficient to more efficient producers, such as from larger-scale owners to smaller family farmers. This situation is aggravated by inadequate land laws or deficient land-rights administration, which reduces the security of ownership of land for both sellers and buyers (World Bank, 2003a).

In contrast, land rental markets are often more active. Temporary land transfers have been shown in studies in and elsewhere to significantly enhance efficiency as well as equity in land access, (Deininger and Jin, 2002; World Bank, 2007). While land rental markets are highly active in industrialized countries, they are constrained by legislation (South Asia) or by insecurity of ownership (Latin America, East and Southern Africa, and countries of the Commonwealth of Independent States (CIS)). Long-term land rental would provide better incentives for land investments than short-term rental, but it is often undermined, or ruled out by insecurity of land ownership (as in Latin America) or by prohibitions on the rental of land (as in most of South Asia).

Fixed short-term rentals are the next best option, but are rare compared to sharecropping. While sharecropping has long been regarded as providing poor work and investment incentives to tenants, there is great flexibility to these contracts and there are many specific contract terms that are widely used to improve on this situation. As a consequence, many studies have shown that the efficiency costs of sharecropping are not large (World Bank, 2007). Clearly long- and short-term fixed rental and sharecropping should be fostered by abolishing prohibition or regulations of rentals and share cropping and other laws that undermine security of tenure and therefore rental markets.

3.4 State land

In some cases the state holds land in trust, for example, in protected areas with key ecological functions. However, states frequently hold large areas of land, which they have great difficulty managing or disposing of. Often, as for South Africa, the national land agency does not even know all the land that is held by the state, as many different agencies hold land rights, such as the military or municipalities. The difficulties include encroachment and asset stripping; conflicting historic claims of communities that may once have occupied this land; and the resulting difficulty of leasing it out or selling it. Leasing and selling often takes place without transparency and corruption is an ever present threat. This leads to under use or misuse of land, to the insecurity of rights of those that have long settled on it, and to their inability to fully value and trade their acquired possession rights. For example, the Thai forestry agency owns large areas of 'forest reserves' that have been settled for ages, but refuses to regularize such ownership through the well-developed land titling programme (Feder, 1988). There are continued problems of state ownership leaving inefficiently managed state farms in Eastern Europe and CIS countries (World Bank, 2003).

Rising land values and interest of domestic and foreign investors in large-scale agricultural investment from domestic and foreign investors make the issue of state land allocation especially problematic. Since 2006, countries that depend on food imports (such as the Gulf countries, Korea, China and India), as well as

Europeans importing biofuels, and those with commercial interests in the United States and other countries have become increasingly interested in foreign agricultural investment (Cotula *et al.*, 2009).

Many of these land deals have been in areas where the state claims ownership rights to the land. In many cases the land is provided to investors for sale or long-term lease; often with very low payments per hectare; although there may be promises of major infrastructure investment, local clinics or schools. In many cases, customary rights holders have not been consulted or compensated. Such practices have prompted calls for a code of conduct, including respect for local peoples' customary land rights, and ensuring their free, prior and informed consent for such investments, as well as more careful environmental and social impact assessments (De Schutter, 2009). Whether these standards will be adopted by investor or host countries to protect the livelihoods and land rights of customary land rights holders, remains to be seen.

3.5 Redistributive land reform

Feudal regimes and colonialism left large, inefficient and inequitable fiefdoms and ownership holdings worldwide. In Western Europe, the reforms and revolutions led to the redistribution of these holdings from the seventeenth century, with the most recent land reform [ongoing in Scotland under the Land Reform (Scotland) Act 2003]³. Land reforms favouring the tillers in the early years of communist revolutions in Russia and China were quickly followed by collectivization, also extended to Eastern Europe under Soviet occupation. Inefficient collective agriculture (Deininger, 1995) has largely disappeared both in the West and in formerly and currently socialist countries.

Inefficient collectivization was undone in China after the household responsibility system was established in 1978, with spectacular results, followed by several legal reforms since then; in Eastern Europe through restitution to former owners; and in the CIS countries by a combination of household plot allocation and privatization of the collectives, often with land ownership shared to the members. Since the Second World War the most successful land reforms have occurred in Japan, Taiwan, Korea, and under the Zamindari Abolition Act in Eastern India.

Redistribution of collectives to families was also extremely successful in China and Vietnam. Elsewhere in Asia, large-scale land redistribution has occurred in Iran and Kerala (India), with redistributive land reform remaining a major need in Pakistan, the Philippines and India. In Latin America, land reform was largely completed in Mexico only, is active in Brazil, and is still an important policy on the agenda in most of Central and South America. In Cuba, the collectives have not yet been reformed.

Finally, in Africa, early land reforms took place in Egypt, followed after decolonization in Kenya, Algeria, and most recently in Zimbabwe. South Africa has well-defined land-reform policies and programmes, combining restitution and redistribution. Progress however has been extremely slow and unsatisfactory. China's 2008 land policy strengthens the 30-year rural land contracting rights, provides farmers with the right to rent out land, and with limited rights to transfer, and has introduced better protection against seizures by local governments of rural land for conversion to commercial use, in effect introducing land rights that look like ownership rights without calling it ownership. The problems addressed by these land reforms have varied widely, as has the means for resolving them. Lipton (2009) discusses all these cases.

³ [] this phrase has been added by the editors.

The case for continued land reform rests on the unresolved inequities of the past, and the attendant inefficiencies and underutilization of land. A number of studies have shown that more uniform land distribution leads to higher agricultural and economic growth (Deininger *et al.*, 2007; World Bank, 2003a; Lipton, 2009). Increasing demand for equitable land rights from women, tribal groups and herders add to the need for continued active land redistribution policies worldwide.

Many land reforms were the result of massive political upheavals, revolution, and defeat, as after the Second World War. Since then, reforms have been dominated by land reform agencies in most of Latin America, South Africa, and the Philippines, and by various processes of decollectivization. Since the 1990s market-assisted or community-driven land reforms, whereby communities or individuals are given grants and loans to purchase land for farms, have been added in Brazil, Central America, Malawi, South Africa, India, and the Philippines.

Performance of recent land reform programmes has been mixed. In many cases land reform focuses almost exclusively on the provision of land, without providing the needed capital and access to credit to equip and run a farm. Often beneficiaries are poorly equipped to participate in decision-making related to land acquisitions and farm and enterprise planning, or the choice of collective versus individual farming. Capacity development and training of beneficiaries may be inadequate. Often bureaucratic inertia, blockages, and ineptitude slow the process of land acquisition and settlement (Binswanger *et al.*, 2009; World Bank, 2003).

The progress of land reform is undermined by the policy-makers doubts about the benefits, and by disagreements among the advocates of land reform about methods of implementation. While theoretical and empirical literature leaves little doubt about the efficiency of smaller family farms, and the growth benefits of greater equality of land distribution, the findings on the high efficiency of smallholders in terms of yield or total factor productivity, or the security benefits of communal land rights are counter-intuitive, and therefore difficult to convey to policy-makers.

The damaging discord between advocates of redistribution over methods is centered on the role of expropriation (with compensation) versus the market in land transfer, and how to choose the beneficiaries and allocate land to them. The advocates of expropriation see a major role of the state in the selection of beneficiaries and land allocation. It is often assumed that expropriation of land will lead to lower costs of land acquisition than purchase on the market, but this has often been contradicted by experience in Brazil, South Africa and elsewhere (Navarro, 2009; Sparovek and Maule, 2009; Lahiff, 2009).

The advocates of grant-assisted markets prefer self selection of beneficiaries through appropriate incentives and verification of eligibility being the most appropriate method. Binswanger *et al.* (2009), in the hope of forging greater consensus, discuss the rationales for these different approaches and provide case studies of how they work in practice. Comparative process and impact evaluation of alternative approaches is urgently required. This is even more important because the need for further redistribution is far from exhausted (Lipton, 2009).

4. Improving water management: policies, water rights and water (re-) allocation

The issues specific to water are discussed in this section. As for land, increasing scarcity of water is creating pressure on water rights and allocation policies. This section examines alternate institutional arrangements, water rights systems, and economic incentives for water allocation are examined. There is no one 'optimal' institutional arrangement for water; rather, it is critical to understand the potential contributions, facilitating conditions, and limitations of each (Merrey *et al.*, 2007; Meinzen-Dick, 2007).

4.1 State management and allocation

The state often claims ownership of water as an aspect of sovereignty (public trust doctrine) and the authority to allocate water. Government agencies also manage water in rivers and major canal irrigation systems. Quantity-based administrative water allocation is the traditional mode of operation in most large developing country irrigation systems and is by far the most common mechanism in use at all levels in the developing world today. While the state plays a key role in setting water policies and allocation at higher levels, it generally lacks the capacity to manage water at local levels, and corruption or performance problems plague many water agencies, even at higher levels. One way of addressing this problem, which has been applied in a number of countries (e.g. the Philippines, Taiwan, Australia) is to make water resource agencies self-financing by linking agency budgets to the user fees.

In this way, agency staff members become accountable to the users, who monitor whether they receive water, and may withhold payment if not satisfied. Within the agencies, linking salaries and bonuses to fee collection has been shown to give staff an incentive to allocate and deliver water to as many of the authorized users as possible, thereby improving efficiency and equity (Small and Carruthers, 1991). Decentralization measures and PIM are other measures that have been applied to overcome state capacity constraints at the local level, by transferring responsibilities to water users, who are presumed to have a stronger interest and capacity on the ground (Meinzen-Dick and Mendoza, 1996).

The growing challenges of water scarcity and competition make state capacity for water management critical, though the skills needed may differ. Instead of delivering water at the lowest farmer turnout and measuring water quantities, state capacity is increasingly needed to coordinate water users across systems and across sectors, bridging between irrigation, municipal, industrial, and environmental uses and users. This also requires increased attention to water quality, not just quantity. Improved hydrological forecasts are required to mitigate the impacts of climate change. As for land management, state capacity to register and enforce water rights is also needed for any formalization programmes to work.

4.2 Community management

There is a long history of community management of water, for example farmer-managed irrigation systems, such as the *subak* systems in Bali, *kulos* in Nepal, or *acequias* in the Americas. In many cases, farmer-managed

systems have been found to function at least as well as government-managed systems (Ostrom, 1992; Lam, 1998), and these comparisons have contributed to policies of irrigation management transfer or participatory irrigation management that call for farmers' participation in irrigation management at the tertiary and secondary level (Farley, 1994; Vermillion and Sagardoy, 1999). Community management, however, requires effective collective action institutions that have the authority to make decisions about water rights. While empirical studies of common pool resource management (including water) have shown that such institutions can develop spontaneously or through an external catalyst, the institutions are not always in place or strong enough to allocate water efficiently.

A wide range of factors affect the viability of organizations for water management, but Coward (1986:227) argues that property rights are a critical factor. The creation and ownership of irrigation property – including water and structures – form the basis for relationships among the irrigators, which “become the social basis for collective action by irrigators in performing various irrigation tasks”. User groups cannot make decisions regarding water if they have no rights – *de facto* or *de jure* – over that water. The authority of user groups to allocate water needs to be recognized both internally by the membership and externally, particularly by rival claimants to the water.

State sanction of locally accorded water rights is not always required (especially in remote areas) but becomes increasingly important with increasing market penetration, population pressure, and government presence. As a result, community management is usually found at the local level, but may extend to higher levels where user organizations are strong, and have formed federations that can allocate water between base-level units. A major advantage of user allocation is the potential flexibility of adapting water delivery patterns to meet local needs. Because those directly involved in water use – either for agriculture, home consumption, or industry – possess more information on local conditions than the agency staff, they do not have to rely on rigid formulas for allocation. The result can be improvements in output per unit water, or in equity, or both. Where local institutions are not strong enough, either to promote self-monitoring among the membership or to hire specialists for this task, user-based allocation is unlikely to provide sufficient incentives and enforcement for individuals to use water most efficiently (Meinzen-Dick and Mendoza, 1996).

PIM is a good example of combining decentralization of the functions of the water authority with community management of tertiary canals. Conditions for success include clear specification of rights and responsibilities, capacity development of the members of the irrigators, and effective financial control over revenues and expenditures by the community. However, these conditions often do not exist and therefore PIM has not been adopted at a large scale.

Compared to state and community management of agricultural water, private-sector irrigation development has been limited to groundwater development and, to a lesser extent, smaller commercial surface water systems growing high-value crops. For example, all groundwater irrigation in the United States and two-thirds or more of groundwater irrigation in Bangladesh, India and Mexico is privately managed (see also Lipton *et al.*, 2003). In India, and elsewhere in South Asia, public investments in large surface systems have facilitated private irrigation investment. More recently, private investment in treadle pumps has been taking off. Private concessions for the development and sale of irrigation water are feasible if there are good prospects for profitability as is private-sector funding through revenue bonds (Barker and Rosegrant, 2007).

4.3 Water markets

Market-based allocation of water resources refers to an exchange of water (use) rights. It is considered one of the key mechanisms required to use water more efficiently and many studies have shown empirically and theoretically the benefits of such markets (Rosegrant *et al.*, 2000; Ringler *et al.*, 2006; Easter *et al.*, 1998). For water markets to function effectively there needs to be a well defined original allocation of water rights, an institutional and legal framework for trade, and the basic necessary infrastructure to allow water transfers. This section describes formal and informal markets, ground and surface water markets, and quasi markets that can be implemented using simpler mechanisms.

In mature water economics, characterized by increasing scarcity values for water (Randall, 1981), and increased emphasis on water demand management, market allocation of water resources might be an option. Further requirements include state recognition of private water rights, and especially water rights that are separable from land, as well as and state regulation of these transfers (Scott and Coustalin, 1995; Easter *et al.*, 1998). Water markets can empower water users, by requiring user consent to any reallocation of water, and compensating the user for any water transferred. Marketable rights to water induce water users to consider the full opportunity cost of water, including its value in alternative uses, thus providing incentives to economize on the use of water and gain additional income through the sale of saved water. Finally, a properly managed system of tradable water rights will provide incentives for water users to internalize (take account of) the external costs imposed by their water use, reducing the pressure to degrade resources (Rosegrant and Binswanger, 1994).

Water markets can be found in a few developed and developing countries. In Asia, informal groundwater markets are common. In Chile, Australia, and the United States formal surface water markets can be found. Water-trading efficiency depends on the prevailing infrastructure, the legal environment, the water scarcity situation, and the number of buyers and sellers with varying needs in the market (Easter *et al.*, 1998).

Given the complexity of implementing true water markets, a charge-subsidy approach could be implemented in a first step, where water is bought from or sold to an intermediary agency at an agency-fixed price that could be varied by location over time depending on relative water scarcity and other conditions (Rosegrant *et al.*, 2005).

While formal water markets, such as those in the United States or Australia require developed regulation, information systems, infrastructure, and supporting technologies, informal water markets, such as the groundwater markets of South Asia function without such requirements, but at much smaller scales. The Chilean water market is a mix of formal and informal elements, with trade across larger distances and permanent trades generally registered and formalized, whereas temporary leases within canals remain largely informal. In the United States, trading of water quality rights has been piloted in several states (Cline *et al.*, 2005) and appears promising to reduce the overall water quality burden in water bodies and rivers.

The appropriate role of state, market, and local collective action institutions needs to be identified for sustainable agricultural water management under increasing scarcity.

4.4 Information management and recording of water rights – registration and administration

As the formalization and recording of water rights is not as advanced as land rights, only few countries have developed water rights registers. This section reviews the challenges of recording water rights, especially in recognizing customary water rights and ensuring that the process does not create undue burdens, especially for the poor or marginalized to secure their water rights.

In Chile, a large share of water rights has been recorded as well as permanent sales of water. Most water use rights, however, are only temporarily leased and such leases are not recorded in official registries. While the Chilean example is generally considered successful, a significant share of relatively poor and minority water users remain unregistered.

In Mexico, the water law establishes a Public Registry of Water Rights maintained by the National Water Commission. All transfers of water rights need to be recorded in the Public Registry (Rosegrant and Gazmuri Schleyer, 1996).

The Yellow River Conservancy Commission in China has supported several administrative pilot water transfers from irrigation districts to industries, where industries invested in canal lining and then obtained either all or a part of the water resources saved through lining. In the case of Hangjin Irrigation District (HID) in Hangjin County, Inner Mongolia, water-use rights of individual irrigators in the irrigation district were recorded following the water transfer project.

While water-rights registries can overcome transaction costs during actual water-rights trading, the cost of registration can be high. Chile used to have a special programme to legalize water rights titles on a collective basis to reduce fixed costs such as legal fees. The government spent about US\$1 million to register 24 000 users in 1 396 associations during 1991-1993 (Rios Brehm and Quiroz, 1995).

4.5 Economic incentives to improve water allocation

Economic incentives for water management include prices, taxes, subsidies, quotas, and ownership/rights. These incentive measures, when implemented appropriately, can affect the decision-making process and motivate water users to conserve and use water efficiently for irrigation and other uses. Economic incentives play out differently under differing enabling institutions. The most important among these institutions are water rights for farmers and other water users. Other institutions that influence economic incentives include the rule of law and good governance, the relative focus on public systems versus private development, the role of decentralization in the form of farmer management of irrigation systems, and the existence or absence of river basin organizations.

Water pricing is the most common economic instrument used. In a review of the World Bank irrigation and drainage portfolio covering 68 projects water pricing was most common (52 out of 68 projects) (Dinar, 2001). Prices, however, are generally far below full capital cost recovery in both developing and industrialized countries (OECD, 1999; Dinar and Subramanian, 1998; Barker and Rosegrant, 2007). At the zero or low levels of current irrigation water prices in many countries, irrigation water use is highly price inelastic; and

prices high enough to induce significant changes in water allocation (or recover capital costs) would severely reduce farm income (Ringler, 2005; Perry, 2001; Löfgren, 1996). However, water pricing policies can improve efficiency and sustainability when combined with appropriate supporting policies (Rosegrant *et al.*, 1995; Dinar and Mody, 2004; Gardner, 1983).

For many developing countries that are facing water scarcity and rapid urban-economic growth, paying farmers to use less water can be an attractive alternative that supports rural-to-urban water transfers while providing compensation to long-term irrigation water users. If adequately compensated, irrigators can then invest in on-farm advanced irrigation technologies and/or switch to less water-consuming crops (Rosegrant *et al.*, 2005).

5. Joint land and water management

Although land and water are often treated separately, often by different agencies, the resources are inextricably linked. Yet they are usually governed by different policies, rights and institutions. Even where the need of a joint approach appears to be obvious, as for example in river basin management, little integration has occurred. This section will discuss the very limited progress in joint land and water management that has been made in two land use systems: pastures and watershed management. How to improve on the situation will require more research and policy experiments.

5.1 Pasture management

The management of pastures requires mobility of the animals to make optimal use of pasture resources within and between years. Survival and productivity depends on both animals' access to water wherever they migrate, and to pasture land. Without access to water, pastures cannot be exploited. Range land specialists distinguish two different pasture models. The equilibrium system defines areas with more or less regular climatic conditions, where seasonal migrations are relatively short, and where normally the quality of pasture land can be controlled by the number of livestock. Pasture systems in the Alps, and in the Mongolian mountain and forest steppe zone fall into this category. In non-equilibrium zones highly variable climatic conditions movements of livestock cannot follow regular patterns and have to be organized according to the availability of fodder, which is different from year-to-year. Migration distances are large and herders may not return to their home areas for several years. Climatic variations and climate change are more important to the quality of the pasture than the livestock number, and the range typically recovers even after prolonged droughts (Fernandez-Gimenez, 1999).

Territory-based systems of herder organization and pasture management are more likely in equilibrium systems, rather than disequilibrium systems; although even in the former allowance must be made for mobility in bad years that go beyond allocated territories. The rights system in the Swiss Alps is based on specific territories and populations. Fully autonomous associations of villagers control access to the high mountain pastures, including the allocation of grazing rights to households based on animal number, and collective management of the herd during the summer pasture seasons. During the winter season animals return to the villages and are managed by the individual households and fed hay harvested from individu-

ally owned meadows. Within a new legal code, the Mongolian Society for Range Management is developing territory-based approaches to herder-led management systems that show promise in the equilibrium and mixed equilibrium-disequilibrium systems the mountain zone, the forest steppe and the central steppe of Mongolia. The society recognizes that a territory-based approach to herder management is inappropriate and is looking for other models of herder organization. Elsewhere progress on building territory-based systems has, however, been limited even in equilibrium systems. Pasture degradation therefore remains a major issue in many such areas of the world.

In disequilibrium system “nomadic pastoralists do not own the land over which their cattle range either individually or by group. Their use and grazing rights are, however, recognized under customary law. In this process water plays a vital role as the location of water sources influences pastoralists’ choices of grazing areas, opens up new pasture areas and thus improving animals’ nutritional status. Consequently water rights are the key to control and utilization of arid and semi-arid areas. Here pastoralists are at a double disadvantage: holding no formal rights over land the law does not permit them to hold formal rights over water” (Hodgson, 2004). States often undermine such rights further by appropriating land and water ownership, and disregarding customary rights. Limiting mobility of nomadic pastoralists by moving them to group ranches has failed to lead to productive and sustainable systems.

Finally the customary rights of pastoralists are also being undermined by the sedentarization of agriculture in the more fertile areas that were traditionally used as dry season or winter grazing areas. Many of the low lying areas (the dambos or fadamas) in Africa have been converted from grasslands to drained and irrigated cropland. The crop residues from such areas would normally be sufficient to substitute for the lost pasture areas, but cultivators may want to use them for their own cattle, following crop-livestock integration. Conflict has been frequent and has to be managed carefully by the respective communities and states alike (McIntire *et al.*, 1992). The slow progress made in providing legal grazing and water rights to nomadic herders is illustrated in Box 3.

BOX 3: ATTEMPTS TO PROVIDE FOR THE LEGAL RIGHTS OF PASTORALISTS

Attempts to provide in law for the needs of pastoralists have not always been followed through in practice. For example in Nigeria, notwithstanding a 1965 grazing reserve law that gave regional governments the power to acquire land for reserves, a 1978 Land Use Decree that extended the scope of that law and a National Agricultural Policy of 1988 that specified that reserves should cover a minimum of 10 percent of national territory (9.8 million ha), by 1998 only 313 reserves covering 2.8 million ha had been acquired by the regional governments, of which 52 had been gazetted.

The Rural Code of Niger ... creates a principle of ‘priority rights’ to guarantee herders the right to control the use of the land that they had traditionally used. Under the Rural Code, while grazing land is considered to be common property, herding groups are allowed to use the same mechanisms to establish priority rights that farmers may use to establish exclusive rights, in other words private property. The effective content of priority rights has not yet been established by implementing regulations or observed experience, however, so that the adequacy of the legal guarantee is as yet unknown. In short as far as the interests of pastoralists are concerned the interface between formal land tenure rights and water rights is at the same time both vital to their future survival – and largely irrelevant.

Source: Hodgson, 2004, p 65

5.2 Watershed management

Addressing land and water degradation often requires a watershed approach, including problem identification, land-use planning, and institutions for coordinating between upstream and downstream areas. Integrated land and water management through watershed rehabilitation has been successful in China's Loess Plateau area (see Box 4). Integrated watershed or river basin management is also useful for runoff and to control point source and non-point source pollution, a key intervention area in most developed countries. For example, the Rhine River pollution spill of 1986 prompted the successful cooperation of the riparian states (WMO, 2002).

Payment for Environmental Services (PES) has increased in importance as a mechanism for conservation of land and water resources and has most often been used in watersheds. PES typically connects upstream land users, often farmers, with downstream water users. Upstream land users may be paid for, example, to maintain current forest areas or plant additional trees, for not grazing on sloping lands, or any other land activities that could affect water quality and quantity for downstream cities, reservoirs, industries, or tourism areas. PES schemes are used in Central and Latin America (Brazil, Colombia Costa Rica, Ecuador and Honduras), the United States, Indonesia and elsewhere. Similar to other land and water improvements, formal or informal land and water property rights need to be established and recognized. PES functions better in small watersheds where there are few service providers and beneficiaries.

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BOX 4: WATERSHED REHABILITATION IN THE LOESS PLATEAU OF CHINA'S YELLOW RIVER BASIN

Successful watershed rehabilitation programmes were implemented on the Loess Plateau of China's Yellow River Basin by the Government of China and the World Bank through terracing, strip farming, sediment retention dams, and the large-scale planting of trees and grasses. About 2 100 small sediment control structures were built, capturing an estimated 25 million tonnes of sediment per year. These measures improved both land and water quality by reducing soil erosion and river sedimentation. Unsustainable farming practices, including deforestation, overgrazing, and poor land reclamation practices, together with growing population pressure over the last 100 years, resulted in reducing protective vegetative cover on the Loess Plateau to 20 percent of the total area (Bruinsmar, 1999). Grazing bans, particularly on sloping lands, generated dense natural vegetation cover at minimal costs. Artificial grasses (mainly astragalus and alfalfa) were planted on flat or gently sloping wasteland as fodder for penned animals and to reduce unsustainable grazing on slopes.

Sources: World Bank, 2003b; 2007

6. Important elements for successful reform

Reform of land and water policies, rights and institutions is driven by inefficient and inequitable historical legacies, including access to land and water by women, poor people, indigenous groups and herders; by inefficiencies and inequities that arise from poor legal and administrative systems; by old and new challenges that arise in the context of increasing scarcity of land and water; and by increasing competition for their use from urbanization, environmental services and biofuels. Reform efforts are undertaken by many countries in the hope of achieving high gains in efficiency, equity, conflict resolution, and to redress past inequities. For example, almost all countries in sub-Saharan Africa “have developed or are in the process of completing the development of national land polices. Many, among them Tanzania, South Africa, Rwanda, Mozambique, Botswana, Burkina Faso, Mali and Ghana have gone so far as to enact laws to implement significant aspects of those policies” (Okoth-Ogendo, 2006).

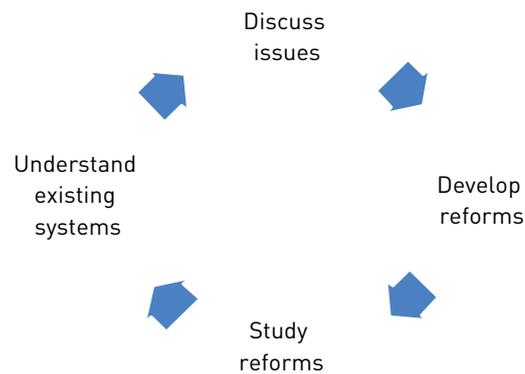
Similarly, Bruns *et al.* (2005) review eight completed efforts at reforming water rights across the developing world. Reform efforts must start with the recognition that there are no one-size-fits-all solutions, but that these have to be adapted to a country’s or region’s situation. Therefore, the focus is on important principles, policies and institutions that can increase efficiency in natural resource use and thus help stem or possibly even reverse ongoing degradation rather than panaceas. Moreover, no reform effort starts with a blank slate on which an ideal system can be created. Despite these constraints, policy discussions about land and water management are often impoverished by polarization around a few idealized options, such as integrated water resources management (IWRM) in river basins, or the commoditization of land or water into fully individualized and tradable rights. Such polarization constrains the consideration of many desirable, feasible, and/or lower cost options.

A careful assessment of the existing situation is needed with respect to (i) the role of land and water in the national development framework, (ii) the constitutional and legal status of these resources; (iii) the systems of rights and the distribution of such rights; (iv) systems for the administrations of rights and transfers in land and water; (v) land and water use management; (iv) and implementation of regional and international land and water policy commitments.

Reform must be based on an understanding that it is a long-haul process, spanning not just years, but decades. Many years of discussions and debate usually precede the formulation of land and water policies and the drafting and passing of legislation. Parallel and/or repetitive processes involving dialogue with stakeholders, policy and institutional experiments and other learning processes, are often needed, as suggested in Figure 3.

Reforms are often opposed by existing right holders if they do not recognize their pre-existing rights. Beneficiaries of distortions, subsidies, and other privileges will staunchly defend them. “Even if new laws and regulations are enacted, they may remain unimplemented, opposed by powerful stakeholders, constrained by lack of institutional capacity or crippled by unworkable stipulation. Registration procedures may make it difficult or impossible for some existing users to have their rights recognized. Security for some users may come at a cost of reinforcing inequities and institutional rigidity that excludes others. Reforms may achieve economic gains, but leave environmental demands unmet.” (Bruns *et al.*, 2005, p. 284). It is therefore important to choose the objectives and sequencing of reforms, as well as their specific policy, rights and institutional changes so that they can be adopted within the existing historical and political context and implemented.

FIGURE 3: WATER AND LAND RIGHTS LEARNING



Source: Bruns et al. (2005).

Important process elements for reforms include:

- Sequencing of reform allowing for public consultations and consensus building processes that are informed by technical knowledge and judgment.
- Actively involving those affected or legitimate representatives in the decision-making process regarding land and water (re)allocation processes as well as investments.
- Secure property rights for both land and water.
- Providing different options for the definition of such rights and the corresponding administration systems to accommodate different situations encountered in the same country.
- Consideration of the feasibility of direct command and control versus indirect incentives approaches.
- Appropriate land and water management information systems, conflict resolution mechanisms, and management systems.
- Political will generated by dialogue and debate, and by organization of the groups that stand to gain from the reforms to:
 - push through the policies, legal reforms and issue the associated regulations;
 - provide for the necessary financial allocations for the institutions in charge of implementation, and for their institutional capacity development;
 - implement the allocation, registration, and updating of the rights that are being created, redistributed or formalized; and
 - enforce the rights created, formalized or reallocated in transparently and equitably.
- Continued development of the capacity of the state, communities, and user associations to allocate and administer rights systems, and avoid and manage conflict, including the information systems and technologies needed to do so.

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