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THE IMPACTS OF LIBERALIZED LAND MARKETS ON THE RESOURCE WATER: A PROPERTY RIGHTS APPROACH

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Abstract

In recent years, the liberalization of the land markets lead to a substantially increase in extent and pace of foreign entities securing land for agricultural production. Empirically, up to now, the effects that this large-scale land acquisition has on the agricultural water sector at a local scale has hardly been studied due to the fact that a heuristic framework on how to disentangle the various links is missing. A concept for a systematic study of the direct and indirect intersectoral linkages triggered by the initial acquisition of land is needed. From a property rights perspective, the proposed approach is based on eight patterns that structure the relationships.

Keywords

land acquisition, water acquisition, property rights linking patterns

1 Introduction

From past literature, liberalized markets, particularly less restricted land markets, are known for its potential to transfer land from less to more productive producers, to make it less costly for rural residents to take jobs in off-farm businesses, to reduce transaction costs of transferring land rights, to increase investment willingness and finally to get land transactions out of informality (DEININGER 2003). Liberalization of land markets also mean, the opening up of domestic land markets for foreign investors who can buy more easily and formally accepted agricultural land or rent agricultural land for long-periods (49 years-period or 99 years-period are common schemes). In Ethiopia[2], for instance, the development and agricultural strategy has been even based on the idea of inviting external investors in the country and providing them favorable conditions to receive the rights over large units of land (RAHMATO 2014). Nobody would doubt any more the fact that foreign actors securing land for agricultural production or to some extent also for environmental and wildlife protection (GREEN AND ADAMS 2014) has increased substantially in frequency and extent, particularly in (Sub-Saharan) Africa and (South-East) Asia (VON BRAUN and MEINZEN-DICK 2009; DEININGER and BYERLEE 2011; DEININGER 2011; ZOOMERS 2010; COTULA 2012; MARQULIS et al. 2013). Based on the latest figures from the Land Matrix[3] (accessed January 2015), the number for completed deals correspond to 2.7% of world's arable land (FAOSTAT, FAO 2015).[4] Currently, the focus of debate has been whether foreign direct investments in land is not more about access to land with lots of rainfall or irrigation potential – so it should really be seen as water acquisition or as water grabbing (PEARCE 2013; ANSEEUW et al. 2012; MEHTA et al. 2012; FRANCO et al. 2013; SKINNER and COTULA 2011; WOODHOUSE and GANHO 2011). If we want to stress the

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[2] Ethiopia is among the top ten target countries for agricultural foreign direct investment (RAHMATO 2014).

[3] The Land Matrix is an open access tool, where data are constantly advancing. It is a useful platform for researchers, NGOs and policy makers to collect and compare various land deals worldwide. For further benefits, but also challenges and critique see ANSEEUW *et al.* (2013).

[4] Arable land: used for temporary agricultural crops accessed at http://faostat3.fao.org/download/E/EL/E

negative impacts of water acquisition, we can follow MEHTA et al. (2012, p. 197) who define water grabbing as the process in which powerful actors are able to take control of, or reallocate to their own benefits, water resources used by local communities. Water is just as important as land and with this new focus of discussion, the interconnectedness of water and land now finally gets the attention it deserves. Moreover, compared to land deals, water resources are mobile and follow a hydrological cycle. Water grabbing therefore affects a greater number and broader range of users (FRANCO et al. 2013).

2 Literature review

When reviewing the particular literature on the link between land and water acquisition the scholarly attention to this issue turns out to be very sporadic.[5] Basically, there are three groups of literature:

Water as the driver

First, there are papers more dedicated towards political economy that look for reasons for the land acquisition phenomenon (ZOOMERS 2010). Increase in global food demand, rising food prices, bio-energy policies and population growth are seen as the main drivers of the recent processes of land acquisition. Important factors when deciding where to invest are the ecological characteristics such as fertile soils and humidity. When looking at the water conditions at the investor's home countries – such as drained fossil aquifers in the Gulf States - the possibility to produce water-intensive crops abroad is a strong driver, too (WARNER et al. 2013). ANSEEUW et al. (2012, 37) even conclude that access to water is the key driver for the location of land deals in some countries. The investing countries are often interested in intensified and high-value crop production which demands reliable and extensive water volumes. There is one straight-forward relationship raised by RULLI et al. (2013) stating that because about 86% of the human appropriation of fresh-water resources is used to sustain agricultural production, large scale land acquisition simply has to involve acquisition of freshwater resources including both rainwater and irrigation water. A typical investor in Southern Africa is cited by KRUCHEN (2013, 141) as saying: "When we search for land, its value is determined by water, water rights and the possibility of installing irrigation systems".

On the other end of a transaction, in the host country, socio-political characteristics are among the decisive factors for an investment. For instance, weak law enforcement and a legal system highly dependent on the power of ruling elites facilitate the investor's access to land transactions.

Consequences: hypothetical quantifications

Second, very rare hypothetical hydrological calculations, such as the one from RULLI et al. (2013), who uses the notion of land grabbing throughout, quantify land grabs associated freshwater grabbing rates at a global scale. Although the reliability of the data is questioned, it is the only global water acquisition assessment researchers could currently refer to (PEARCE 2013; SCOONES et al. 2013).

ZETLAND and MÖLLER-GULLAND (2013, 270) calculate an index of water vulnerability at national scales.[6] They combine this water vulnerability index with the pressure on land and draw conclusions as to potential trends. So, if both water vulnerability and pressures on land are high – as for the Sudan – the impact on people and environment is severe.

[5] A few research projects are now starting to investigate systematically the link between land and water grabbing, such as one by the European Commission (2013) which tries to estimate the amount of water resources that have accompanied land grabs worldwide.

[6] They point out, however, that the actual water vulnerability depends on local conditions.

Effects on the agricultural water sector

The geopolitical perspective explored under the first point does not specify how water is reallocated locally. That fact is slowly being recognized in the literature, but is not yet well understood. Thus, the third group of scholarly works encompasses qualitative case studies on the individual impacts of large scale land acquisition on the agricultural water sector (e.g. BUES and THEESFELD 2012 for Ethiopia; KRUCHEN 2013 for Mozambique, ZAMBIA and TANZANIA; HERZOG et al. 2012 and BAUMGART 2011 for Mali).

This paper seeks to follow up on this third point with attention to the actual local impact that land acquisition has on the water sector of the host country. What is missing is a conceptual framework that allows researchers to analyze cases in a systematic way and to compare cases. Analysing land and water acquisition from a property-rights perspective – as presented here – is a concept especially designed for the situation. It is intended to overcome the weaknesses criticized by OYA (2013) who noted the problems of implicit, untested assumptions and casual use of analytical concepts in many existing studies.

The perspective on bundles of property rights is combined with the transactions related to nature approach set out by HAGEDORN (2008) to shape the conceptual foundation provided. It sheds light particular on the effects land acquisition has on water acquisition and concentrates on the local redistribution and structural effects. It strengthens a comprehensive and systematic study of the direct and indirect inter-sectoral linkages triggered by an initial investment in land.

Eight patterns in the connection between land and water acquisition are presented as potentially important factors to consider: the ecological pattern, the judicial pattern, the resettlement pattern, the use pattern, the land use pattern, the conjunctive use pattern, the infrastructure pattern and the governance pattern. Attention to the patterns allows a researcher to classify the impact of land acquisition on the various rights and claims in the agricultural water sector. This helps not only in understanding the links between land and water acquisition, but also facilitates the comparison of cases and thus makes reliable general predictions possible. Similarities and differences of processes that connect acquisitions of the two resources are the focus.

3 An inter-sectoral view on land acquisition

In principle, larger-scale farming and particular capital intensive investments in the agricultural sector fostered by a liberalization of land markets can provide social and economic development opportunities for poor countries. But, cases with negative impact on the local population or on the environment have attracted public attention and triggered national and international policy debates. In these cases deals were often closed without consultation of the local population and without adequate compensation to them. Technically, land grabbing is defined by a change in ownership and tenure structure, and the way new landownership authority is exercised, which can lead to many negative effects. The issue is not necessarily regarding the amount of land acquired. Nonetheless, the size of the investment makes the consequences more obvious.

A careful distinction between large-scale investments in land with rather neutral or positive outcomes, compared to those with negative impacts for the local population, is not necessarily important when the focus is on exploring how to link the land and water sectors.[7] In that re-

[7] An analysis of whether a particular case of land acquisition turns into a land grabbing has to be based on multi-criteria analysis of the output and long-term results. This would require a debate about how to define such criteria, which researchers are just beginning to explore. We focus here on the fact that due to the transactions related to nature, the resources of land and water are linked and in order to steer against possible negative outputs we need to understand the detailed relationship between the two, even before the distinction between land acquisition and land grabbing is fully defined.

gard, ZETLAND and MÖLLER GULLAND (2012, 268) here, make a simple (maybe too-simple) distinction between "grabbers" and "investors", where grabbers are interested in maximising short-term production at the expense of long-term sustainability. This classification leads to the assumption that grabbers are more likely to deplete soils and abuse their preferential access to water and thus overuse water resources, whereas investors are regarded as saving water for the next season and invest in water conservation technology. But still, investors typically replace traditional farming with new processes, and have an impact on the intensification of the water consumption. So, whereas land grabbing is more likely to also lead to water grabbing, a rather fair large-scale land investment process can lead to both water acquisition and water grabbing.

In principle, this relationship can also be thought of the other way around, starting with an investment in the water sector that grabs water and has a subsequent land grabbing effect. The most gigantic cases of such kind are the Great Man-made River in Libya that pumps fossil aquifer water to the Sahara Desert or the Three Gorges Dam in China. For the purpose of this paper, the relationship studied proceeds from the land investment.

This paper seeks to present a concept that helps to study the ways that water acquisition can accompany land acquisition. This involves more than simply adding the water to the land market debate.

In order to be valuable from an investor's point of view, land needs to possess certain properties which taken together can turn land deals into lucrative business. One crucial characteristic is access to water resources, as discussed above. Water access, in case rainwater is not sufficient, can determine crop selection. Without possibility for irrigation land investors would face high risks in drought periods. Thus, water plays a central, but not always explicit official role in formal land deals (SMALLER and MANN, 2009; WOODHOUSE and GANHO 2011; WOODHOUSE, 2012; MEHTA et al. 2012, ANSEEUW et al. 2012, 37). There are many different ways in which access or withdrawal rights to water can be obtained – and many ways those rights can be exercised. What works is very much dependent on local conditions. Investor approaches to water rights acquisition can range from careful advance planning with open discussion to unannounced misappropriation of water after the land deal is done. A quantitative assessment of water acquisition associated with land acquisition is still missing (RULLI et al. 2013). On a global scale, the modelling of RULLI et al. (2013) becomes very interesting, as the model estimates a total virtual "grabbing" of water associated with land deals.

To scrutinize the processes under investigation here, the property rights perspective is the most useful. The focus here is changes in property rights on land that some higher body, usually the state, will agree to protect (BROMLEY 1992). As property rights theorists have shown, it is of course not the resource itself that is owned by the new investor, it is only a bundle of rights to use a resource that has changed ownership (ALCHAIN and DEMSETZ 1973). In their efforts to secure rights, foreign investors and local water users are often highly unequal actors in terms of bargaining power, knowledge, risk behaviour and economic endowments. Both are looking for ways to protect their individual customary water claims or state-guaranteed rights to receive water in terms of access, withdrawal, management, exclusion and alienation (SCHLAGER and OSTROM 1992). The most important water rights are the access rights – the right to enter a defined physical area, and the withdrawal right – the right to obtain the resource unit (SCHLAGER and OSTROM 1992).

Foreign investors as new users entering the arena are likely to undermine existing customary claims (ZOOMERS 2010; ISMAR 2013, 288; DEININGER 2011), including the existing water management system. Investors, taking water for granted or based upon agreements with governmental bodies, do ignore that most water is not likely to be freely available but is reallocated from existing local users.

4 Linking Patterns

An investigator who structures a study along the line of the patterns of land acquisition will gain a better understanding of the particular link between the land and the water sector during the land acquisition process. The initial situation of property rights regimes on land can be very diverse and may impact on the situation in the water sector (FRANCO et al. 2013). Tracking the patterns will help to disentangle this analytical complexity. The eight patterns are elaborated based on the literature on various land and water acquisition cases. The patterns allow differentiation between direct and indirect impacts of land acquisition on the distribution of property rights on water and thus, help ensure that intersectoral effects are not overlooked. This list of patterns may not yet be complete, but it is comprehensive enough to facilitate comparing cases and clustering similarities and differences. In the long run, this allows us to sharpen the analysis of observed cases.

The patterns encompass the general changes in property rights in water, be it an increase or a loss in a certain set of property rights, and with any involved actor, not necessarily the investor. Thus, the patterns describe the impact of the transaction in a neutral way, possible from any actor's perspective and not necessarily describing a "grabbing" case with negative social impact.

Further, the patterns focus on land acquisition and its impact on irrigation water. The connection between agricultural irrigation systems and drinking water systems is excluded[8], such as household plot watering and husbandry feeding.

The main share of large-scale investment in land is reported for arid and semi-arid areas which require irrigation to achieve a profitable and reliable agricultural production (COTULA 2011). Thus, while globally most agricultural production is based purely on rainwater, the framework put forth here assumes, in line with RULLI et al. (2013) and FRANCO et al. (2013), that a large share of foreign direct agricultural investment in land shows a pattern where after the investment additional water – besides the annual rainfall – is required for efficient production. For those countries (e.g. Tanzania and Sudan) where, according to the hydrological model by RULLI et al. (2013) blue water grabbing (water supplied by irrigation) is predicted, the ecological pattern applies to the investment, which means that water other than rainwater is needed to sustain agriculture. This connection is framed under the **ecological pattern**[9] and refers to an impact of the investment on land on the property rights in water.

Even in countries with at first sight favourable natural water condition, however, the new cropping or production system (a land use change or an intensification of production) can depend on additional water input, from ground or surface water. Irrigation can help to avoid vulnerability to the variations in water supply which if not protected against could lead to highly insecure rate of returns of the investments.

Second, is the **judicial pattern**. Following the disentangled property rights by SCHLAGER and OSTROM (1992), it has to be checked whether access, withdrawal, management, exclusion or alienation rights on water are explicitly mentioned in the land buying or leasing contract, or have been part of the negotiation. If mentioned this is a factor that directly impacts on the resulting water acquisition. To study changes it is important to understand the initial relation between property rights on land and water even prior to experiencing a foreign investment in land. In some countries, a farmer need to pay the land tax to the government, or rent land from another farmer to acquire canal water extraction rights, or groundwater pumping rights. In other countries the owner of surface land is the owner of the water under it. Such an unspeci-

[8] ARDUINO *et al.* (2012) provide a paper looking at the relation between land grabbing and drinking water particularly.

[9] As rainfall is strongly linked to other ecological conditions such as temperature range and storage characteristics of the soil, this pattern is identified here as the ecological pattern and not a humidity pattern.

fied property right would imply that the landowner can extract water without restriction (THEESFELD 2010). For instance, in the Islamic school of thought it is rather common to clearly distinguish between land rights and water rights: The digger of a well – whether on his own land or on unoccupied land – automatically becomes the owner of the well water as soon as digging is completed (CAPONERA 1992, 70). These relationships have to be clearly understood before studying the impact a change in land rights might have. In some cases, as described for South Africa by WOULDHOUSE (2012), in practice, water and land reforms are interdependent and cannot be treated in isolated policy and juridical processes, but as FRANCO et al. (2013) lay out, formal water and land management have been often separated from each other.

Further, as described above we find a pluralism of formal rights and customary claims that may even contradict one another. Moreover, we often find de-facto property rights functioning on the ground that could be made up of combinations of both, formal secured rights and customary claims. Host countries may feel forced, along with land deals, to also make water deals, granting investors rights to water that is already governed by customary regulations. Particularly in African countries such legal appropriations ignore local needs (ISMAR 2013, 288). So even if the formal situation is laid out clearly it may be difficult for local users to defend their customary access and withdrawal claims (FRANCO et al. 2013).

A starting point is to find out which kind of water rights are vested with the state, which is often the entity negotiating the land deals. The formulation of agreements in the water sector is often subordinated and left to the local actors.

SKINNER and COTULA (2011) and WOODHOUSE (2012) investigated land deals and found that investors frequently want to secure water rights formally, and usually get them. The long term leases on state-owned land now more and more allocate water rights to foreign investors. Yet the rights allocated may differentiate between unrestricted access to canal and ground water to access with conditions regarding dry season crops. Water payments might be fixed through volumetric billing, or left to be negotiated per hectare depending on the type of irrigation used. Even when a land contract makes no specific reference to water, water may still form part of the deal, as governments may agree to invest in water-related infrastructure (SKINNER and COTULA 2011), or, customary access claims to a river can simply become invalid, because the way to the river across land now owned by an investor can be denied, as shown by KRUCHEM (2013, 148) for a case in Zambia.

Looking at the water and land sector at the same time during land deal negotiations is a big challenge due to the socio-ecological complexity of such systems. This is noted in the FAO Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (FAO 2012), which excluded the relation to the water sector in the fear of never being able to complete this Guideline, when adding that complexity (FRANCO et al. 2013).

No matter whether a change in land rights is mentioned in the formal contract or not, it often happens that small-scale local farmers, who might only have traditional or informal access claims to land, which are more invisible, are dispossessed. The land is often officially declared as abandoned, which results in the fact that the newly established formal recognition of property rights on land for the investor might lead to driving local farmers off that land. Attached to the land might have been access to water, either by natural access to a canal or river, or by pumping rights on that plot. The now-landless farmers have to look for new land (assuming they are not migrating to the towns) and that therefore increases not only the competition for land, but also the pressure on the water resources at neighbouring locations, which may lead to a change in the actual property claims on water. This is called **resettlement pattern**. Instead of a positive spill-over effect to the sector, the big investment might also have the effect that more local small-scale farmers at neighbourhood locations resign from agricul-

ture. In short, the resettlement pattern describes the effect of having more or less water users at adjacent plots.

Even if no resettlement or dispossession of land is involved, simply the fact that investors enter the arena leads to an increase of the number of farmers using irrigation. But what counts more, the investor is not only one additional, but often a more intensive water user. This is often due to more advanced techniques. Physical water availability is under more pressure and resource scarcity increases. When grabbed land is irrigated, the associated appropriation for water can reduce the availability and the quality of irrigation water in the neighbouring and particularly downstream farmland areas. This **use pattern** stands for the strongest direct impact on water acquisition.[10]

The most stand-alone pattern of all other patterns is the **land use pattern**. It describes a process which has a direct impact on water acquisition. This means, no matter whether the new production is on humid fertile soils, or on dry soils that require irrigation, whether water rights have been mentioned in the land deal or not, whether the land has been in fact abandoned or occupied by other farmers, investors often favour more water intensive crops (ISMAR 2013, 287) such as sugar or rice (PEARCE 2013) or monoculture forest plantation of pines or eucalyptus which extract large amount of water (KRUCHEM 2013, 151). In a hydrological model RULLI et al. (2013) assume that the grabbed water may range between a minimum value corresponding to crop water use in rain-fed agriculture and a maximum value corresponding to the case of irrigated agriculture in conditions that optimize crop yield. If that was the intention, the investor might have checked already the options for additional water intake before the investment, or the investor is willing to invest in irrigation infrastructure, too. In such a situation one can assume a change in property rights in water as a direct consequence.[11]

With **conjunctive use pattern**, a fact is specified that particular plant requirements can call for a higher share of surface canal water (diverted from rivers or rain-fed tanks), if for instance that water is less contaminated than groundwater. Certainly, pumped groundwater is cooler and cannot be used with sensitive crops. But, some crops require water at an exact point in time in the vegetation cycle and are very sensitive to a postponing of an irrigation run. This often requires individual groundwater pumping, which is more cost-intensive but more reliable compared to canal irrigation water which needs to be shared and its availability might depend on the withdrawal of the user further ahead. The general shift in water sources has an indirect impact on the available water for other users and their withdrawal and access options. In fact, a more integrated view on water management would require distinguishing between blue water and green water, the latter tied to the land as green water is stored in the soil, absorbed by the plants and evaporation in the air, and the former being irrigation water. Nonetheless there are many hydrological interdependencies in a water catchment (FALKENMARK 1995) which mean the green water affects the blue water.

One side-effect of a planned land use change accompanying the investment in land might be additional investments in the infrastructure (irrigation, drainage, roads). This **infrastructure pattern** is of course a very crucial one and represents an indirect impact on water acquisition. With a change in the infrastructure and technology, almost every user faces a change in de-facto water access and withdrawal rights. Depending on the individual location related to the

[10] Apart from the use and availability of water, also the access to water points is crucial for some agricultural groups such as for pastoralists. The impact of land grabs for this group would require an individual property rights analysis.

[11] But not every severe land use change does lead to a big change in the property rights on water. The kind of production involved is of course crucial for the impact on the water sector. In Australia, where about 10 % of the total global grabbed land is happening, the most of the grabbed land is used for livestock production. This land use change does – although large in size – only involve little amount of water grabbed (RULLI et al. 2013).

infrastructure or canal outlet, the users might have at their disposal more or less water in various quantities and qualities, at different times, at different prices. Infrastructure investment does not only comprise big dam, reservoir or canal system construction, but also irrigation techniques such as drip or spray irrigation, or even computer-driven water regulation to steer humidity in greenhouses. It may also include investments in drainage systems, of which surrounding farmers can take advantage as well. Usually, also the management rights change with a reconstruction of the infrastructure. In line with that the technical options to exclude users might get more effective.

Compared to rain-fed production systems, or the gravity-flooding of fields, the investment in canal systems and the upgrade in irrigation techniques allows the investor, primarily, to use irrigation water for a second or more harvesting season and crop rotation. The crop production and water acquisition is becoming less season dependent. This may change the actual withdrawal and access rights in the whole water and irrigation catchment area.

Getting involved in irrigation infrastructure reconstruction and management leads, in the long-run, naturally to an involvement in water governance. "Water grabbing" is not only about the capturing of the water itself, but, as well about taking over the power to decide how it will be used (FRANCO et al. 2013). If the governance systems are not adequate, farmers can face a, what is called, institutional water scarcity (SADOFF et al. 2006, p.13), despite physically plentiful water availability. The previously informal or even formal agricultural water governance system may change. HERZOG et al. (2012) stress for Mali the importance of the regulations on water access rights in time and space, compared to a too-narrow focus on water volumes. **Governance pattern** stands for this indirect impact and describes a medium or long-term change in formal water rights and in the customary water claims. A new governance pattern may not only include a new form of water user association, but also specific decisions and rule changes on how to elect the chairman, on how to set up irrigation turns, on new measures of water charging, on new sanctioning systems, or on new workforce requests for maintenance. The possible creation of a formal land market as a long-term consequence of opening up an area for foreign land investments has an impact on the water governance, as well. With the development of a land market often comes along the creation of water rights (DE SCHUTTER 2011), and creation of the water rights can later serve as a basis for new governance arrangements.

A change in the governance structures of an irrigation system might also be first, and then in turn require an infrastructure change.

Table 1 summarizes and depicts how the eight linking patterns describe a change in certain bundles of property rights. Each pattern does implicitly show that it is not the rights or claims that link the land and water sector, but the transactions related to nature (HAGEDORN 2008). According to the functional interdependence of the process, the water has to be physically at the same spot where the agricultural production happens on the land. The underlying interconnectedness of the transactions related to nature (HAGEDORN 2008, 359) is easy to grasp in e.g. the land use pattern, where different biophysical condition of a crop require different amounts and quality of water to maximize crop yield. Water has either to be available or to be moved with the help of technical infrastructure. These additional properties of the transactions have to be considered in an institutional analysis in nature-related sectors.

Table 1: Linking patterns of land and water property rights

Pattern	Applied research questions addressing changes in the agricultural water sector	Possibly affected water rights and customary claims: Access (Acc), withdrawal (W), management (M), exclusion (E), alienation (Al)
1. Ecological pattern	Do the natural water conditions require irrigation?	Acc, W, M, E, Al
2. Judicial pattern	Are water rights explicitly included in the land negotiation or contract?	Acc, W, M, E, Al
3. Use pattern	Does the competition for water and the total uptake increase?	W
4. Resettlement patterns	Does the competition of water users increase off-side the new investment farm?	Acc, W
5. Land use pattern	Does the change in cropping structure entail a change in irrigation?	W
6. Conjunctive use pattern	Is there a shift in the share of ground and surface water use?	W, Acc
7. Infrastructure pattern	Does the building of new infrastructure or its reconstruction change the actual irrigation habits of the users?	Acc, W, M, E
8. Governance pattern	Do informal or even formal water governance arrangements change?	Acc, W, M, A, E

5 Conclusion

With the opening up of land markets and the substantially increase in frequency and extent of large-scale (often-foreign) investments in land worldwide, we cannot study the effects on the land sector in an isolated way. Therefore, with the proposed pattern perspective the various impacts of large-scale investments in land on disentangled property rights on water could be studied. Likewise, the patterns help to study the links between the land and the water sector in a more systematic way which will facilitate a comparison of cases.

ANSEEUW et al. (2013) provide a selection of ways and procedures to decide what and how a land transaction might get included in any kind of database of large-scale land acquisition. The procedures are already so diverse that numbers for total land acquisition range from 67 mio ha reported in the Transnational Land Deals for Agriculture in the Global South Report to 230 mio ha reported in the Land Rights and the Global Land Rush Report. Adding to this diversity of procedures another layer – namely the one of the amount of water changing its potential user – makes any quantification hardly possible. Thus, the only way to go in linking

both sectors is either to calculate a hypothetical hydrological model as done by RULLI et al. (2013) for the global scale or to provide a conceptual basis to analyse the effects at a local scale, as proposed in this paper.

The next step now has to be the investigation of the applicability of the eight proposed patterns with numerous empirical case studies. Additional fieldwork can specify and validate the elaborated patterns. Assuming a number of cases could be structured along the lines of these patterns, various impacts on disentangled property rights on water could be studied. The tricky problem for analysts is that land and water acquisition can happen simultaneously, but often the effects on water are subsequent to the change in land rights. This involves particular challenges for empirical field studies.

In fact, if the link between land acquisition and water acquisition continues to be not officially recognized at higher administrative scales, this can lead to long-term non-sustainable development from a social and ecological view. Farm managers and wealthy investors might be winners of an unannounced overhaul of property rights, pushing for new institutional arrangements in the water sector that favours them. Additional disadvantages for already less-powerful local actors can be the result, risking in the end social conflicts. Further, only if the impact on the water sector is obvious and the loss is formally recognized, do local farmers have the chance to opt for additional compensation, besides the one they sometimes receive for the lost land.

Additionally, such negotiations often take place at highest political level not including stakeholders with local social and ecological knowledge. Knowledge about the social determinants of such land acquisition processes would help to design political intervention to strengthen for instance exactly the disadvantages of weaker actor groups in a bargaining process, if desired. Likewise, any change in cropping systems (such as towards large-scale monoculture) or irrigation infrastructure building should consider local ecological impacts.

The duration of the land acquisition can be crucial for the effects in the water sector. Investors often officially rent land, usually for between 49 and 99 years, but there are also short-term contracts between 5-10 years, or a dissolution of contracts after a couple of years. Depending on the investor's time-horizon for the engagement, the investor will plan different strategies for his involvement in the agricultural irrigation sector. Infrastructure investments or governance system changes require long-time commitment in order to be profitable. The deterioration of the natural resource, such as water level depletion and contamination, is very likely if land investors do not have a long time-horizon and are only keen on short-term profits (ZETLAND and MÖLLER-GULLAND 2012).

Water grabbing shares with land grabbing its negative connotation. But, when talking about how the property rights of both sectors are linked it should not be overlooked that there can be, in principle, positive feedbacks for the water sector from the initial land take. Investments in infrastructure are likely to happen and stay in the country even if the investor leaves. Knowledge and management capacities might have increased due to trainings and more qualified jobs for local people. More transparency in the processes how an irrigation schedule is elaborated, e.g. by a state-managed irrigation company, might be due to the request of a more powerful investor. Likewise, new governance forms, such as water user associations getting all parties involved and being more participatory, could be, at least, a theoretical option. Particular empirical work with a focus on the water acquisition may bring to light evidence of these positive linkages.

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