Water appropriation in the production of tobacco: governance, policies and sustainability

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Abstract: This paper links land and water appropriation processes, the related virtual water flows and a normative analysis of governance and sustainability issues. The intensive tobacco production in the Lerma Valley, province of Salta, Northern Argentina, was used as a case study. A conceptual framework of 'governance for sustainability' was used to guide the analysis and integrate quantitative and qualitative methodological tools. This conceptual framework includes two phases: (a) a descriptive stage, in which social and cultural aspects are described based on a historical and place-based analysis and the help of a quantitative indicator (virtual water); and (b) a more prescriptive phase where a normative evaluation of water governance is carried out in terms of some sustainability principles. Virtual water of tobacco production, expressed in population equivalents, was estimated to represent about half of the needs of the entire city of Salta (population 535,000). The paper also shows that local water governance ignores some of the social perspectives held by relevant stakeholders. We end by discussing a number of policy alternatives that could help improve the governance and sustainability of the system.

Keywords: governance; sustainability; tobacco; virtual water; water grabbing.

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1 Introduction

Virtual water is a biophysical indicator that represents the water used and contaminated to produce a product or service (Allan, 1998). Virtual water flows between countries and regions help visualise the social metabolism of the economy and can also reveal the movement and appropriation of freshwater resources (Madrid and Velázquez, 2008). The water footprint, a similar concept, estimates the hidden water use behind products, services, people, companies, countries, and regions (Mekonnen and Hoekstra, 2013). The water footprint is a multidimensional indicator which shows, for a specific place and period, water consumption volumes by source, and polluted volumes by type of pollution. Although virtual water and the water footprint are frequently used as synonyms, there are some conceptual differences between them; the virtual water is defined from the perspective of the production of goods and services in a certain place, while the water footprint is defined from a consumer perspective, since the transport of goods and their hidden water is also considered (Velázquez et al., 2011). Both concepts have captured the attention of politicians and decision-makers due to their potential to disseminate technical information to wider audiences (Wichelns, 2010). They have also been criticised for their apparent inability to promote lasting political changes (Velázquez et al., 2011; Weiss Brown and Slobodian, 2014; Vanham, 2015; Wichelns, 2015; Beltrán, 2016). It has been argued, for instance, that a virtual water analysis is frequently disconnected from local contexts and therefore ignores, among other things, social perspectives and power relationships embedded in local water governance schemes (Beltrán and Velázquez, 2015). For this reason, the sole estimation of water footprints or virtual water flows does not necessarily reveal the inherently political issues affecting the governance and sustainability of water management. In any case, the estimation of virtual

water flows from a specific activity is a valid way to reveal and assess appropriation processes. As a quantitative indicator, virtual water tends to be a straightforward way of putting the issue on the table and facilitating further discussions.

Land and water are inextricably linked, not only where land is destined for agricultural production, but also in urban–rural interphases (Bakker, 2010; McDonald et al., 2011; Arroyo and Boelens, 2013; Franco et al., 2013; Vanham, 2015). Access to land, and the associated land use, usually entails access to and control over the water entitled to that land. Power, be it political, social, economic, or a combination, which is generally contingent upon historical and cultural factors, has a strong influence on issues of land (and therefore water) tenure. In turn, land tenure has always consolidated power relationships, unequal or otherwise, in a mutually reinforcing loop. The connection between land, water, and food is also pretty straightforward, particularly in subsistence and traditional agriculture, where access to land and water is directly linked to the production and consumption of food crops. This relationship is not that evident in industrially oriented agriculture that focuses more on cash crops. In the latter type of agricultural production, land workers are not necessarily, or not always, land owners and therefore tend to gradually abandon subsistence agriculture practices. Local skills and product diversity are often lost in the process. Workers become more and more dependent on industrial agriculture and this reinforces the power exerted by traditional land owners and, more recently, large agricultural companies (Benson and Kirsch, 2010). This trend can be exacerbated by large-scale land acquisitions, a phenomenon sometimes referred to as 'land grabbing', that has attracted a lot of global interest in recent years (Borras et al., 2012; Oya, 2013). Land grabbing is usually associated with foreign companies or governments buying or somehow taking hold of land and water in the global South. Land grabbing is implicitly assumed to be detrimental to the livelihoods and interests of local communities and small-scale farmers, especially when the process of virtual water export is controlled by transnational agribusiness companies with increasing influence over government and local private sector (Vos and Boelens, 2016).

The appropriation of land is by no means a recent phenomenon in many Latin American countries. In this region, current land tenure structure can be easily linked to land appropriation that occurred in the past. Not all land grabs can be classified as 'large-scale' (i.e. larger than 200 ha, following the criterion set by the Land Matrix) and many of the historical land grabbing processes went relatively unnoticed since they have been long legitimised by social institutions. On a similar note, water grabbing has been defined as '*… a situation where powerful actors are able to take control of, or reallocate to their own benefits, water resources already used by local communities or feeding aquatic ecosystems on which their livelihoods are based*' (Mehta et al., 2012, p.197). Unlike virtual water, water grabbing is not a mere indicator and needs to be approached from a historical and political site-specific perspective. The growing international trade of agricultural commodities, if anything, puts the issue of land and water tenure (and grabbing) on the table again. The concept of virtual water can shed additional light on issues of land and water grabbing, even in those cases in which the scale of the exploitation, in terms of occupied land, is not necessarily large.

The purpose of this paper is linking historical processes of land and water appropriation with the virtual water associated with the production of specific agricultural products. This appropriation is achieved through: (a) objective control of land and irrigation infrastructure; (b) promotion of norms and laws that legitimise the status quo; and (c) continuing validation of current practices by local discourses. The governance and sustainability implications of the appropriation process are discussed for

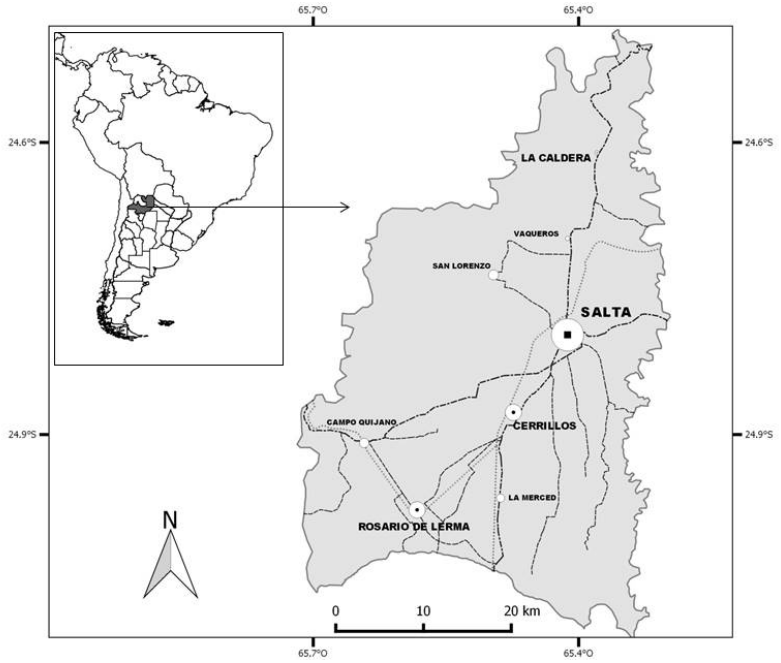
a specific case study: the intensive tobacco production in the Lerma Valley, province of Salta, Northern Argentina. The paper discusses some policy implications and suggests areas for further research.

2 Materials and methodology

2.1 Study area

The Lerma Valley covers an area of 600 km^2 and is located at about 1200 m.a.s.l. (Figure 1). Total population in this valley amounts to 620,000 inhabitants, distributed in eight urban conglomerates and rural areas, with about 535,000 inhabitants concentrated in the provincial capital, the city of Salta. In the last ten years, the population of the metropolitan area has increased by 28.8% on average, while that of Salta city has increased by 13.2% (INDEC, 2010). The climate in this valley is subtropical with a dry season (between April and November). Rainfall varies between 700 mm in the South to more than 1500 mm on the hillsides of the North. In this region, tobacco is grown on relatively small plots of land, usually much smaller than 200 ha. The production is almost entirely exported. Even though the tobacco industry has drastically improved its manufacturing process in recent years, tobacco irrigation in the Lerma Valley has remained virtually unchanged for almost a century. It is done mainly with surface water distributed among producers by means of a grid of irrigation canals and artificial dams. Together with tobacco leaves, a lot of virtual water is exported. This water could be destined for the local production of food and fibres that are instead increasingly being imported from other regions or countries.

Figure 1 The Lerma Valley, province of Salta, Northern Argentina. Main cities and towns are indicated. The size of the circles is proportional to population



In the Lerma Valley, as in other places, land and water grabbing are a consequence of past events of usurpation and dispossession (Franco et al., 2013). Local land tenure can be traced back to Spanish times, when this area was a transit point of commodities to Peru and Bolivia (Marchionni, 2000). At that time, land was acquired or appropriated not only for agricultural purposes, but also as a means to ensure a safer circulation of goods and people. The availability of water was the strongest incentive to control specific areas that could sooner or later be destined for agricultural production (Michel and Savic, 1999). The State, be it municipalities or incipient provincial governments, was traditionally in charge of water management in Salta, as in the rest of the country (Villarreal and Manzanal, 2011). Yet water distribution was always unquestionably unequal since water officials were easily influenced, if not directly controlled, by large-scale land owners and other powerful economic actors. In Salta, this institutional setting remained relatively unchanged up to the 1990s, when a new water code put water management directly in the hands of land owners, who became virtually water owners as well as even if they were not actually farmers (Azpiazu et al., 2005). Since land was still owned by the same elite, water management decisions continued to be asymmetrical since they were inextricably linked to pre-existing patterns of land tenure. For a number of reasons, large- and medium-scale land owners in the Lerma Valley started to lease their land to produce cash crops such as tobacco, thus becoming de facto employers of landless farmers that could not access irrigated land since all the water had already been linked to a specific number of properties. Today, only about one-third of all local tobacco producers actually own the land they work on FET (2015).

2.2 Estimation of virtual water flows

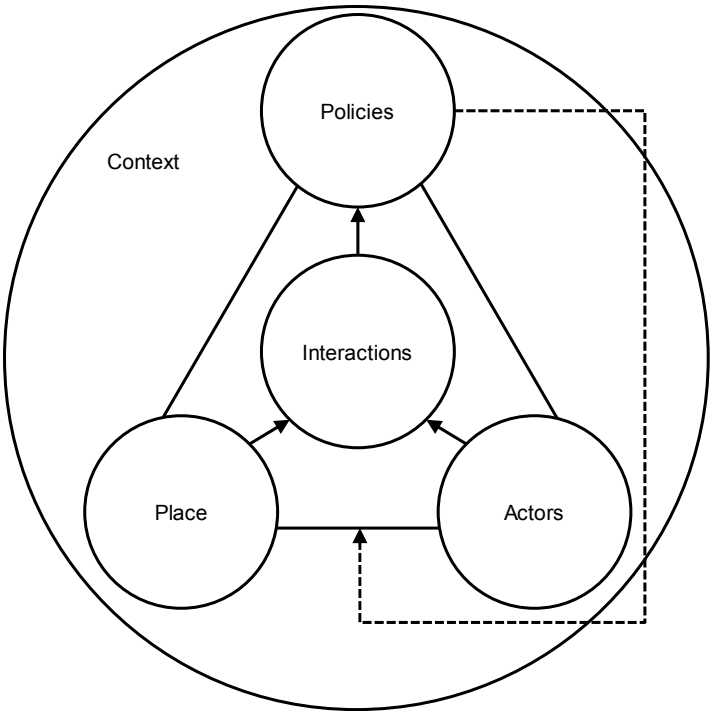
Virtual water was calculated following The Water Footprint Assessment Manual (Hoekstra et al., 2011). The green, blue, and grey fractions of the virtual water associated with the production of tobacco were estimated for the entire vegetative development of the crop, from the transplant of the sprouts to the harvest. Green water is defined as the volume of rainwater used by the plant or stored in the soil. Blue water is the volume of irrigation water used, either from surface or groundwater sources. Grey water is the volume of water required to neutralise pollution, considering the quality of receiving water bodies and local discharge standards. In order to calculate the different types of virtual water in the production process the crop water requirement (rain or irrigation) needed to cover the evapotranspiration was estimated. The program CROPWAT 8.0, developed by Food and Agriculture Organisation (FAO), was used. Data needed to run this program were obtained from local institutions. The software calculates water requirements volumes based on crop water requirements throughout the production phase (under local climatic conditions) and effective precipitation.

2.3 Description and analysis of water governance and water appropriation

Governance and sustainability are contested concepts, which are usually not appropriately defined. As stated by Calida (2016, p.24), '… *a comprehensively integrative concept of governance has yet to be produced*'. In this study, we use a conceptual framework that combines two specific concepts of governance and sustainability. Water governance in our case study was analysed following the 'governance for sustainability' (GFS) conceptual framework (Iribarnegaray and

Seghezzo, 2012; Vega et al., 2015). The concept was designed through the integration of other two conceptual frameworks: the governance analytical framework (Hufty, 2011) and the idea of a five-dimensional sustainability (Seghezzo, 2009). Hufty (2011, p.405) defines governance as '… *the processes of interaction and decision-making among the actors involved in a collective problem that lead to the creation, reinforcement, or reproduction of social norms and institutions*'. On the other hand, Seghezzo (2009, p.547) defines sustainability as '… *the conceptual framework within which the territorial, temporal, and personal aspects of development can be openly discussed*'. Combining both concepts, the GFS conceptual framework has the descriptive power of the idea of governance, essentially analytical and 'apolitical', with a normative phase based on the concept of sustainability, which is essentially prescriptive and therefore inherently political (Bosselmann et al., 2008; Plumecocq, 2014). The GFS framework assumes that governance is the necessary vehicle to move society towards more sustainable futures using sustainability principles as a roadmap (Wiek and Larson, 2012). GFS can allow for a critical vision of Social-Ecological Systems (SES) based on descriptive and prescriptive assessment stages. The evolution of SES involves a complex process of governance, in which different stakeholders exert their relative power to influence the perception of the problems and the policies designed to address them.

Figure 2 Schematic representation of the conceptual framework. Modified from Iribarnegaray and Seghezzo (2012)



GFS is defined as the formal and informal collective processes of interaction between actors to make decisions related to the generation of norms and policies based on principles of sustainability. According to this framework, most SES can be understood in

terms of five essential, interrelated aspects (see Figure 2): (1) *Place*: is the inseparable unity constituted by the natural and cultural environments (social institutions, cultural relations, discourses); (2) *Actors*: relevant social stakeholders, or social perspectives, affecting or being affected by decision-making processes; (3) *Interactions*: formal and informal engagement events between actors in physical or virtual communication spaces; (4) *Policies*: changes, policies, and other outcomes of the decision-making process; and (5) *Context*: social, legal, political, environmental, historic, and other external factors influencing the system at different spatial and temporal scales. This conceptual framework combines the descriptive power of the idea of governance (Hufty, 2011), the analytical depth of the concept of SES (Ostrom, 2009), and an essentially prescriptive and therefore intrinsically political notion of sustainability (Seghezzo, 2009). Place and Actors, the base of the triangle, represent 'real', objective and concrete things that exist in the present time. Politics, which is located in the upper (or the farthest) corner, constitutes the subjective projection of decision-making processes into the future. It is arguably very potent for both qualitative descriptions of SES and quantitative assessments using an appropriately selected set of indicators. In this work, we used this framework to guide the description of our case study and to make sure that we did not miss any essential element of the governance of the system under study.

3 Results and discussion

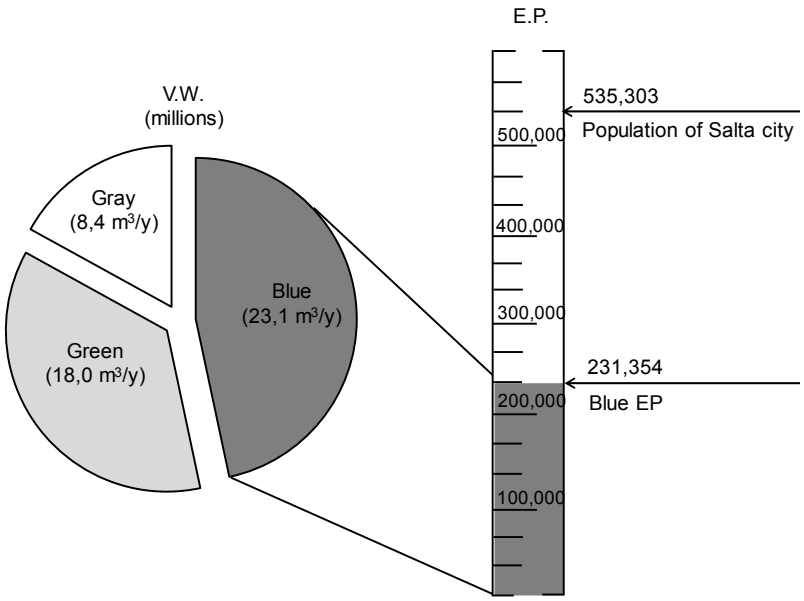
3.1 Virtual water of the production of tobacco

The water management system and the production of tobacco are inextricably linked in the Lerma Valley. This valley is a relatively highly urbanised area where the sustainability of the water management system has been questioned due to, among other things, a lack of adequate infrastructure and institutional deficiencies (Gatto D'Andrea et al., 2011; Iribarnegaray et al., 2012; Iribarnegaray and Seghezzo, 2012; Iribarnegaray et al., 2014). Competition over water resources exacerbates frequent events of seasonal water scarcity. A market-oriented legal framework and insufficient social participation led to striking disparities in water and sanitation services. Agricultural production in this valley, mostly tobacco but also a traditional dairy industry and an always struggling farming sector, competes with a rapidly growing but poorly planned urban sprawl. Tobacco is a high water-demanding crop and its water requirements are highest during the dry season, escalating tensions between tobacco producers, other farmers, the dairy industry, residential water users, the local water company, and other government agencies in charge of water resources management.

In order to display the values of virtual water more conceptually, virtual water values were normalised in terms of population equivalents (PE) (Lombrano, 2009). An 'equivalent citizen' was defined as the average water consumption of a citizen of the city of Salta per year (100 m^3/year), based on previous work (Iribarnegaray et al., 2014). Both surface and groundwater sources were taken into account, from which were deducted the amount of water lost by structural weaknesses of the distribution system, estimated at 35% (Iribarnegaray et al., 2012). The average virtual water values obtained between 2005 and 2014 is shown in Figure 3. Blue water fraction is particularly important due to its opportunity cost (Antonelli and Sartori, 2014), particularly in competence situations with urban areas. The virtual water volumes calculated only consider soil evaporation

and crop transpiration. It is possible that the volumes of water irrigation would be higher, if the characteristic inefficiency in the tobacco irrigation process were considered (Ledesma, 2012). The highest irrigation requirements of tobacco coincide with the time of the year with most drought stress in the region. This becomes important if we contextualise the problem of availability and social scarcity of water in the metropolitan area. Figure 3 also shows the specific population equivalents for blue water volumes used in the production of tobacco. Tobacco production requires a volume of blue water that could meet half of the annual needs of the entire population of the city of Salta. Considering that the production of tobacco is concentrated in a few months, the estimation of the equivalent population shows the importance of appropriation of water and the potential impact that policies promoting productive diversification with lower water requirements could have.

Figure 3 Virtual water fractions in relation to the production of tobacco in the metropolitan area of the Lerma Valley, measured as volume per year (left) and as equivalent population in terms of blue water fraction (right) (see online version for colours)

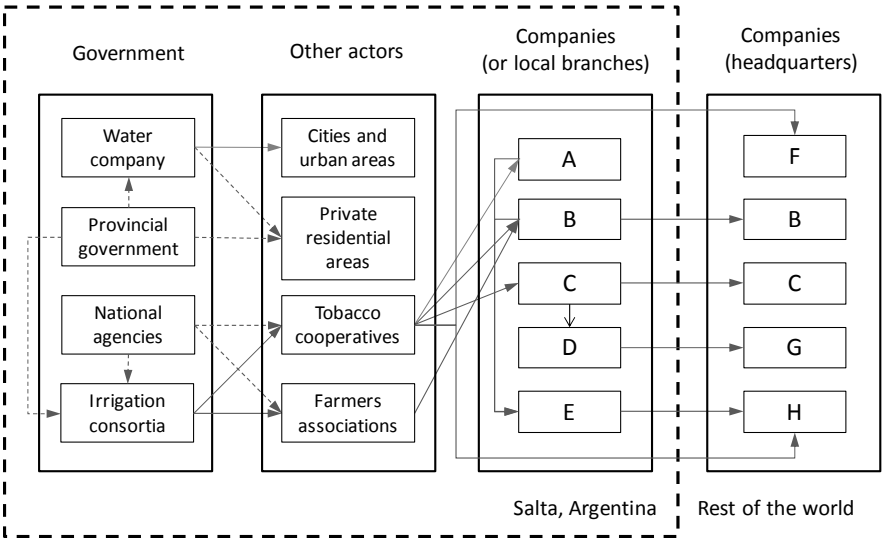


3.2 Water governance in the Lerma Valley

Water governance in the Lerma Valley involves multiple actors, including national and transnational tobacco companies. A simplified actor's map is provided in Figure 4. The water company, controlled and partly owned by the provincial State, is the largest water user. It provides drinking water services to cities, towns, and other urban or suburban areas, with the exception of some private residential areas which exploit their own water sources. Water withdrawal and wastewater discharge from these residential areas are subject to a certain degree of State control through the Water Company and provincial governmental agencies. Irrigation consortia are totally independent from the water company. They are in charge of about 70% of the water available in tobacco-producing

areas. They convey irrigation water to cooperatives and farmers associations. National governmental agencies provide technical assistance to these cooperatives and associations, particularly related to best agricultural practices. As expected, tensions over water access are frequent during the tobacco season between the water company and irrigation consortia. Tobacco produced by cooperatives and other farmers associations is sold to local companies, tobacco dealers, and local branches of a number of transnational companies (i.e. companies A, B, and C in Figure 4). However, some of the deals are made directly between tobacco cooperatives and the headquarters of transnational companies (companies F and H in Figure 4). Company F, for instance, does not have a local subsidiary in Salta nor does it make any deals involving a third party. Some companies may act only as intermediaries and do not deal directly with producers (companies D and E in Figure 4). Some of the companies submit tobacco to a certain degree of processing (in addition to drying) before exporting it. Local producers have hardly any say in the price they get for their product (Rodríguez Faraldo, 2014). This is especially detrimental to tobacco workers, whose salaries are always kept to a minimum on account of the uncertainty of the global market (Tubello et al., 2012). A similar logic is applied to natural inputs such as water. Producers need to ensure a sufficient availability of cheap irrigation water to keep productivity at a maximum. This is particularly sensitive for landless (and waterless) farmers, who need to be able to make a profit after internalising the costs of renting both land and water.

Figure 4 Relevant stakeholders in the water governance in the Lerma Valley (Salta, Argentina). Full arrows show material and water flows; dashed arrows indicate institutional relationships. Based on Rodríguez Faraldo (2014)



Interactions between the paradigmatic actors shown in Figure 4 are abundant and complex. Most stakeholders are institutionalised and have a relatively clear role in the system. Even basic workers, at least those officially hired by companies (there are still a lot of illegal workers), are supposedly represented by well-established unions. They even receive a basic salary, subsidised by the State, in between production seasons. Perception of the problems affecting the system vary greatly between actors and so do their social

perspectives, determined by experience, history, and interests, in combination with local culture and social discourses (Hufty, 2011). Different perceptions of the problems generate conflicts during real or virtual interaction events (Hoppe, 2010) but could also enhance the governance process by providing a higher diversity of potential solutions and policies (Iribarnegaray et al., 2015). However, there are also formal and informal limitations for full social participation. Land owners and large-scale producers have historically had enough lobbying power so as to shape the current legal framework, which is relatively restrictive in terms of public participation. Irrigation consortia and the water company are probably the most influential stakeholders, either through direct water and infrastructure management or by their influence on state agencies and other stakeholders, such as water consumers and tobacco producers. Other actors with genuine interests in water governance, notably agricultural farmers and landless tobacco producers but also, to a certain extent, consumers and urban developers, let alone environmental organisations and scholars interested in water management, remain virtually excluded from the formal decision-making processes. Their views have therefore little or no impact on water policies, infrastructure programs, land use planning, and any other type of concrete result able to enhance the system in a significant way. We can thus argue that through objective possession and formal property of both land and water resources, local landowners (whether they are actually farmers or not) are literally grabbing a significant proportion of all the available water in the Lerma Valley, essentially hijacking the entire decision-making process. The situation described cannot be separated from the regional and international context. On the contrary, the export of commodities without or little added value is a direct consequence of the global process of increased globalisation in which large companies, often transnational, take hold of natural resources such as land and water. This production mode is known to affect local livelihoods, exacerbate income inequality, and promote a process of steady concentration of political and economic power.

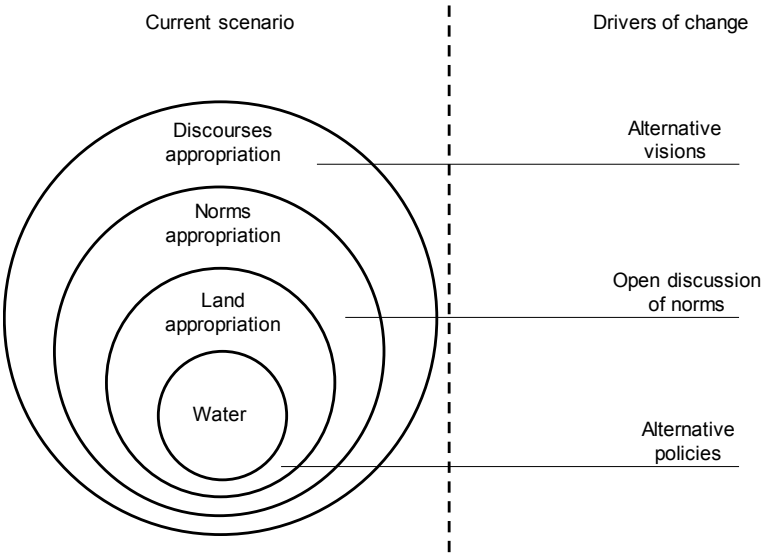
3.3 The challenge of governance for sustainability

Governance 'for' sustainability proposes an in-depth evaluation of current governance schemes and a prescriptive analysis in the light of some sustainability principles (Wiek and Larson, 2012). Actors are core political factors, since they are the ones perceiving the problems, discussing them in interaction spaces in which they attempt to influence other actors, and eventually promoting specific policies to solve them, either jointly or in isolation (Bovaird, 2005). The opinions and social perspectives of those actors with more power will certainly have greater influence on overall policy-making and therefore on the evolution of local institutions, which are eventually the result of political actions (Dussel, 2014). Norms and policies are both outcomes and constraints of the governance process, constantly changing as a function of the visions, perspectives, and interests of the most influential actors. Powerful actors and their particular views of local water problems end up using institutions to promote norms, policies, and even material infrastructure that are only conducive to their own interests (Hommes and Boelens, 2017). As a consequence of such process, water governance in the Lerma Valley seems to be in a '*state of resignation*' (Benson and Kirsch, 2010, p.460), where the rules are implicit and hardly alterable, something that could promote the social renunciation to alternative scenarios.

The complexity of the water appropriation process in the Lerma Valley is shown in Figure 5. Water governance seems to be in a sort of steady state as a result of past land

(and water) appropriation. This appropriation is constantly being consolidated by the continuous and subtle construction of a favourable legal framework which, in turn, strengthens the material appropriation of ancient and current landowners, but also newly arrived transnational tobacco companies. This complex appropriation mechanism is also reinforced by discourses and traditions built on the material situation on the ground, acting as powerful subjective symbols of the legitimacy of current ways of nature appropriation (Hommes and Boelens, 2017; Dussel, 1991) (Figure 5, left). A potential process of social change through more sustainable water governance will not occur spontaneously because it requires redirecting governance processes in a conscious and planned manner (Kuzdas and Wiek, 2015). Considering that the actual legal and discursive scenario makes disputes and opposition by less powerful stakeholders increasingly difficult, we believe that governance for a more sustainable water management probably needs new, even external discourses, perspectives, and technologies in current interaction spaces (Figure 5, right). Assuming that a more democratic and inclusive governance can be considered in line with basic sustainability principles, local institutions have a significant role to play in allowing and promoting the inclusion and open discussion of those alternatives. This is easier said than done, since political corruption and the strong lobbying capacity of powerful actors can make this process extremely difficult.

Figure 5 Current situation (left) and possible drivers of change (right) needed to move the water governance system towards a more sustainable scenario



4 Final remarks

The constant growth of urban areas and the ever-increasing food demands force decision-makers to rethink water and food production strategies in the Lerma Valley. Virtual water, as a 'quantitative' indicator of water appropriation, has the power to clearly

illustrate water and land policy outcomes in terms of water flows. The blue fraction of the virtual water used for tobacco production in the Lerma Valley represents the water consumption of almost half of the city of Salta. Expressing virtual water in terms of population equivalents gives the methodology a strong place-based connotation, and facilitates the understanding and dissemination of this type of data to a wider audience. Even though the estimation of the virtual water provides interesting quantitative information on the impact of the production of tobacco in the region, this indicator by itself is not able to fully describe the complex social interactions that characterise the entire decision-making chain. Yet this indicator, which is strongly influenced by long-standing water policies promoted by specific stakeholders aiming to retain their material and symbolic power, provides valuable information about the governance outcomes of past policies. The blue fraction of the virtual water, which is basically irrigation water, has a very high opportunity cost in the Lerma Valley. Knowing that most of this fraction is virtually being appropriated by tobacco companies can inform debates and help evaluate alternative agricultural activities with lower water demand and higher social impact. The assessment of governance processes is generally addressed from a purely descriptive perspective that may have no impact on the discussion and deliberation of potential drivers of social change. The normativity of any sustainability concept, on the other hand, allows a critical evaluation of current governance scenarios and promotes political or policy debates. In our case study, the conceptual framework used was arguably very useful to perform a critical place-based analysis of local water governance. It was also instrumental to identifying possible ways of actions aiming to improving the sustainability of the entire water governance system. The historical appropriation of both land and water resources allowed more powerful actors, such as landowners and later international companies, to adapt the legal framework to their interests (vested or otherwise) and limit the impact of other perspectives and interests on the local water governance. Water governance in the Lerma Valley needs to be more openly discussed if the system is to transcend consolidated discourses anchored in long-standing power disputes. We believe that new discourses and social perspectives are currently missing from interaction and discussion spaces. A more comprehensive description of the social perspectives held by all relevant actors in the water governance of the entire Lerma Valley seems necessary to complement the findings of this study.

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