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Markets and misfits in adaptive water governance: how agricultural markets shape water conflict and cooperation

Dustin Garrick [1,2], *Fabiola Alvarado-Revilla* [1], *Rob C. de Loë* [1] *and Isabel Jorgensen* [1]

ABSTRACT. Agricultural trade poses dilemmas for adaptive water governance as farmers and irrigation systems become integrated into global food value chains and are affected by their ongoing dynamics. The benefits and risks of agricultural trade and agrarian transitions are unevenly distributed, giving rise to complex interdependencies and externalities. Despite these growing linkages, the understanding of agricultural markets and their influence on water conflict and cooperation remains limited and dependent on context, which can lead to seemingly contradictory evidence. Progress has been hampered by boundary problems, disputed concepts, measurement issues, and divergent normative perspectives. Addressing these challenges will require that water governance scholars account more explicitly for agricultural trade when diagnosing collective action problems and assessing different modes of adaptive water governance. Drawing on the common-pool resource governance literature, we distinguish three separate, but interrelated, conceptual perspectives examining agricultural trade as an external factor in water governance: (1) market integration as a disturbance, (2) market integration as an opportunity, and (3) agricultural trade as a form of telecoupling with nested externalities. We compare these perspectives in terms of the externalities involved, their major claims about the relationship between market integration and collective action in the context of irrigation governance, and the broader implications for adaptive water governance. The comparison demonstrates the prevalence of institutional misfits and the common struggle of boundary shifting, i.e., matching water governance to the expanding problem-shed associated with agricultural markets. Institutional fit offers one important lens through which to consider the shifting boundaries (and actors) relevant for water governance, the scope and limits for strengthening fit through social learning, and the importance of nested governance to address nested externalities. These insights point the way for an agenda of research that examines the evolution of agricultural trade and adaptive water governance and pays explicit attention to the politics and power relations that shape who wins and loses and the different levers and entry points to improve management of the associated transitions and trade-offs. We conclude by arguing that future research should identify and examine pathways of adaptive water governance that strengthen processes of social learning and institutional nesting to address the external pressures and opportunities created by global food value chains.

Key Words: *agricultural markets; disturbances; food trade; institutional fit; market access; nested governance; value chains; water governance; water grabbing*

INTRODUCTION

Competition for water creates growing interdependencies and the need for adaptive governance in the context of broader socioeconomic and environmental changes. These trends have prompted interest in more adaptive forms of governance, with a focus on flexibility and capacity across a widening range of actors, interests, and decision-making processes, including an increasingly important role for informal networks and dynamic pathways for transformation across nested scales (Pahl-Wostl et al. 2007, Huitema et al. 2009, Chaffin et al. 2014).

These trends have also drawn attention to the nature of transitions in water governance (Huitema et al. 2009) and the role of fit and issues of scale in the emergence and evolution of adaptive water governance (Chaffin et al. 2014). The first decade of research on adaptive water governance was founded on the recognition that "selective pressures on environmental governance institutions increasingly have come from broad influence" with a focus on climate change, global change, and ecosystem demands (Dietz et al. 2003:1908). The 2010–2020 decade has brought more, and more explicit, attention to economic drivers in general, and trade in particular, as the systemic and cumulative impacts of trade and globalization highlight planetary boundaries and the concept of the Anthropocene (Gupta et al. 2013).

Globalization now connects local water challenges with regional and global pressures, expanding the "problemsheds" associated with water governance and drawing attention to production and consumption patterns that link distant regions across space and time (Theesfeld 2018, Mollinga 2020). Because agriculture represents the largest consumptive user of water, the globalization of agriculture in the form of agricultural markets and trade poses particular dilemmas for adaptive water governance (de Loë and Patterson 2017). These dilemmas involve problems defining the appropriate boundaries of water governance, the relevant actors and interests, and the decision-making processes and venues for facilitating cooperation and resolving conflicts.

In this context, there are growing calls to assess whether and under which conditions people can "use [agricultural] markets without being abused by them" (following De Moor 2015:54). Access to agricultural markets affords multiple benefits, including food security, livelihood opportunities, incentives for collective action, and resilience to droughts and climate change (Markelova and Mwangi 2010, Lund and Medellín-Azuara 2018). The benefits of agricultural markets have motivated agrarian transitions to commercial agriculture and international agricultural trade, accelerated by reductions in trade barriers, advances in technology, and investments in farmer organizations (Beckman

[1]School of Environment, Resources and Sustainability. University of Waterloo, [2]University of Oxford

et al. 2017). However, these advantages of agricultural trade cannot be considered separately from legacies of colonialism and capitalist modes of production that rely on expropriation and dispossession (Dell'Angelo et al. 2021). For example, the benefits of agricultural trade are not spread equally, and they come with unaccounted and unevenly distributed social and environmental costs, including localized water depletion (Dalin et al. 2017), social injustices associated with water grabbing (Mehta et al. 2012, Dell'Angelo et al. 2021), and free riding in the maintenance of collectively managed irrigation schemes (Araral 2009, Bastakoti et al. 2010). The last two decades have brought growing recognition of the potential for agricultural markets to disrupt long-lived land and water governance arrangements (Agrawal and Yadama 1997, Villamayor-Tomas and García-López 2017). The net effect in a given place and time is an empirical question and depends on the actors, scales, and time frames considered. It also depends on the politics and institutions that mediate the relationship between market integration and collective action (Epstein et al. 2021), help to address trade-offs between income generation and resource sustainability (Ringler 2021), and facilitate or restrict property rights for farmers and their participation in decision-making about accessing and using land and water (Theesfeld 2018).

We argue that the ability to use agricultural markets without being abused by them hinges on fostering the conditions for adaptive water governance. We focus on institutional fit as a focal variable for enhancing adaptive water governance in response to both the initial integration of traditional systems into markets and their ongoing dynamics. Institutional fit refers to the match between institutions and the problems they address (Young 2008, Cox 2012) and deals with multiple facets, including spatial congruence, spatiotemporal variability, and multilevel governance. Strengthening institutional fit in water governance in the context of agricultural markets involves an ongoing process of diagnosing boundary problems and enabling boundary shifting as diverse actors and institutions respond to the pressures and opportunities involved. Regions producing crops for markets must adapt to demand pressures, fluctuations in commodity prices, and changes in trade and agricultural policies.

In this context, institutional misfits stem from externalities, i.e., the unaccounted consequences of transactions associated with the production, marketing, distribution, and consumption of agricultural commodities across value chains. Value chains, in this context, include "all the stakeholders in the production of food and value-adding activities," although "food systems are far broader and are defined as the sum of actors, sectors and interactions along the food value chains" (Fan 2021:218). Problems of institutional fit arise when markets and their dynamics are considered outside of the realm of water governance decision-making, or exogenous. Treating agricultural markets as external creates problems in drawing the boundary around water problems because "actions on one side of a border" flow across to the other side (Daniell and Barreteau 2014:2372). Boundary problems can be very localized when local farmers cannot access markets due to remoteness and limited infrastructure. However, connecting farmers to markets can create new boundary problems through commodity prices and trade regimes that are beyond local control.

Addressing these challenges will require that water governance scholars account more explicitly for agricultural markets when diagnosing collective action problems and assessing different modes of adaptive water governance. However, progress has been hampered by disputed concepts, measurement challenges, and divergent normative, ontological, and epistemological positions.

Here, our aim is to suggest new directions, after first clarifying old ones, for a multidisciplinary audience (following the example of Schlüter et al. 2020). We draw on literature at the intersection of adaptive water governance and common-pool resource governance, a field with a nearly 40-year history of interdisciplinary research on collective action to govern shared natural resources. We distinguish and compare three separate but related conceptual perspectives examining agricultural markets as an external factor in water governance: (1) market integration as a disturbance (a form of negative externality whereby market integration leads to expropriation or undermines collective action by farmers), (2) market integration as an opportunity (a form of positive externality whereby connections to markets motivate the development or strengthening of farmer organizations that enable competitiveness and provide livelihood opportunities), and (3) agricultural trade as telecoupling (a mix of negative and positive externalities).

The mode of inquiry is patterned after recent contributions seeking to broaden conceptual perspectives in environmental governance, such as privatization in the oceans (Schlüter et al. 2020) and telecoupling in environmental governance (Newig et al. 2020). Like these recent examples, we seek to clarify important concepts, identify measurement challenges, and explore the governance implications of phenomena historically treated as external factors. We first identify boundary problems associated with the growing nexus of agricultural markets and adaptive water governance. We then distinguish and compare analytical lenses for examining the evolving relationship between agricultural markets and collective action in adaptive water governance. Then, we explore the potential and limits for institutional fit to guide "boundary shifting" in adaptive water governance by redefining the problemsheds addressed by water governance decision-making, strengthening fit through social learning to cope with variability responding to distributional conflicts, and accounting for nested externalities through nested governance arrangements that identify new entry points and levers for adaptation. Finally, we outline priorities for future research.

BOUNDARY PROBLEMS: AGRICULTURAL MARKETS AS AN EXTERNAL FACTOR IN ADAPTIVE WATER GOVERNANCE

The concept of externalities, i.e., the unaccounted and unintentional costs and benefits of production and consumption decisions, captures the challenge of defining the boundaries of markets and addressing their spillovers. Problems associated with drawing boundaries are not unique to markets: the connections across the water cycle and its human dimensions throw into question the boundaries around water governance decisions (Linton and Budds 2014, de Loë and Patterson 2017). Although the river basin is promoted as the "natural" unit of water management for addressing the externalities of water use, progress has proven elusive because of the diversity of interests, distributional conflicts among different interests, and transaction

costs and politics of managing conflicts (Blomquist and Schlager 2005, Molle 2009). As a consequence, issues of scale, fit, and multilevel governance have been a prime focus of the adaptive water governance literature (Huitema et al. 2009, Chaffin et al. 2014). In this context, the relationship between agricultural markets and water governance is beset by boundary problems: the transactions associated with agricultural markets involve complex interdependencies and externalities (Hagedorn 2007) while the adaptive governance of irrigation systems cuts across multiple levels and sectors (Gupta et al. 2013, Garrick et al. 2018).

Although it is nearly axiomatic that well-defined social and ecological boundaries are associated with successful governance of common-pool resources (Cox et al. 2010), the globalization of agriculture has made it increasingly difficult to establish such boundaries in a static or localized way (Ostrom et al. 1999, de Loë and Patterson 2017). Agricultural markets and the governance of irrigation systems involve different types of systems, actors, and governance arrangements. We examine two related boundary issues: (1) the system boundaries associated with agricultural markets and water governance and the growing nexus between the two; and, by extension, (2) the externalities, or institutional misfits, that arise from unintended or unaccounted flows linking agricultural markets with water governance.

The growing nexus of agricultural markets and water governance

Markets are laden with normative issues that make definitions elusive and contested; however, some minimum level of agreement is needed before progress is feasible. This situation presents a potential "definitional catch-22" (Hodgson 2019:215). A fixed reference point is needed to guide diagnosis and the specification of relevant variables and dimensions without foreclosing the ongoing debates about values, norms, and principles inherent to any discussion of markets and social-ecological systems (Schlüter et al. 2020). We adopt the definition of markets as "an institution through which multiple buyers or multiple sellers recurrently exchange rights to a substantial number of similar goods or services of a particular type" (Hodgson 2019:223). This definition is narrow enough to enable diagnosis but also embrace the diversity of markets spanning from the Athenian-style local marketplace to the globalized webs of imports and exports across national borders. The "transaction" is the unit of analysis for markets, a relevant arena for unpacking the layers of collective action.

Although markets are synonymous with competition and commodities, they are governed by institutions, rather than an invisible hand, with rules and norms governing exchanges and operating within a legal and institutional framework that establishes or sanctions the market (Hagedorn 2008). Focal actors can be identified based on the transaction as the unit of analysis and the roles of buyers, sellers, intermediaries, and third parties in relation to transactions across value chains (Liverpool-Tasie et al. 2020). Transactions are analogous to action situations in the institutional analysis and development framework and are embedded in a network and nested set of action situations (Möck et al. 2022). The length of the value chain depends on the role of different primary, secondary, and terminal markets linking producers and consumers (Poole 2017, Izzi et al. 2021). Many water governance institutions fail to account explicitly for agricultural markets, and agricultural transactions often fail to address impacts on land and water, giving rise to negative externalities that drive conflicts, collective action, and calls for regulation (Dell'Angelo et al. 2021).

Like markets, water governance has faced nearly constant critique of its vague concepts and calls for rethinking (Huitema et al. 2009, Araral and Wang 2013, Daniell and Barreteau 2014). There are increasing efforts to anchor water governance in diverse social science traditions that address governance in other domains, including public policy, public administration, and political economy (Araral and Wang 2013). Amid this conceptual confusion, few (now) dispute the broad contours of water governance as a way of capturing how "societies organize themselves to make decisions and take action regarding water" (de Loë and Patterson 2017:76–77). In this regard, water markets are seen as a paradigm for responding to water-related problems (e.g., tradable property rights or other incentives for addressing scarcity, pollution, or conservation). From this perspective, agricultural markets are considered primarily as an external factor, or as a component of the water-food nexus (Pahl-Wostl et al. 2021).

Finally, it is essential to distinguish between agricultural markets and water markets and to explain why the latter are largely beyond the scope of our analysis, despite being the focus of our broader research program (Grafton et al. 2011, Garrick et al. 2018, O'Donnell and Garrick 2019, Wheeler et al. 2020). Agricultural markets refer to a linked set of transactions "through which farmers sell their products, receive logistics and intermediation services and buy farm inputs" (Liverpool-Tasie et al. 2020:799); after products are sold at the farmgate, processing, marketing, and further transactions often occur before reaching the consumer. By contrast, water markets refer to a "composite of a variety of water products (temporary or permanent), each situated within a given water system with various boundaries that allows water to be traded from one given place to another, under a range of conditions" (Grafton et al. 2016:914). Water markets respond to scarcity and conflict over water induced by pressures arising outside of these boundaries, namely the incentives created by rising demand for agricultural products as agricultural regions become active in value chains and seek to export water-intensive products to commercial centers near and far. In the context of our study, water markets are an endogenous response (within the boundaries) of water governance systems to the pressures and opportunities created by agricultural markets, which are treated as exogenous to water governance systems (outside the boundaries).

The development of water markets is one option for strengthening adaptive water governance capacity to address the external pressures and opportunities associated with agricultural markets, but water markets are not a panacea (Meinzen-Dick 2007, Garrido 2011). Water markets must be designed and governed effectively (through diversion limits, tradable property rights, water accounting, conflict resolution) to address the full range of externalities associated with agricultural markets, including the social impacts and distributional conflicts that can fray local trust and long-term cooperation (Libecap 2007, Garrick and Svensson 2018). Both informal agricultural water markets, such as those for groundwater irrigation in South Asia or North Africa, and more formal water markets, such as those in southern Australia

have been associated with increases in agricultural productivity in response to the opportunities of agricultural trade. However, efforts have struggled to establish and enforce sustainable diversion limits and address environmental externalities and social equity (Grafton and Wheeler 2018). Finally, although the literature on water markets and their governance is now vast, analysis of agricultural markets in the context of water governance is relatively less developed and often beyond the scope of analysis for water governance scholars, despite recent attention to the water-food nexus (Pahl-Wostl et al. 2021). Efforts to account for agricultural markets in water governance remain hindered by conceptual confusion and measurement issues, to which we now turn.

CONCEPTUAL PERSPECTIVES: THREE LENSES ON AGRICULTURAL MARKETS AND COLLECTIVE ACTION IN ADAPTIVE WATER GOVERNANCE

We focus on the intersection of adaptive water governance and common-pool resource governance literature. Common-pool resource governance theory captures a diverse range of normative perspectives about markets and collective action, both critical and positivist. Despite increasing focus on the effects of market integration on irrigation governance in the past 25 years (particularly dating from the work of Agrawal and Yadama 1997), there are persistent conceptual issues, measurement problems, and barriers to accumulate knowledge across contexts and over time. Our insights are derived from influential texts exploring the relationship between market integration, collective management of irrigation systems, and adaptive water governance.

We started from the observation of three distinct, sometimes conflicting, perspectives about the relationship between agricultural markets and collective action in water governance within the common-pool resource governance literature (Fig. 1): (1) market integration as a disturbance, focused principally, but not exclusively, on the negative externalities of agricultural markets and their potential to undermine local cooperation (Agrawal and Yadama 1997, Agrawal 2003, Villamayor-Tomas and García-López 2017); (2) market integration as an opportunity, focused on the positive externalities of agricultural markets and their potential to motivate farmer organization (Meinzen-Dick et al. 2002, Markelova et al. 2009, Markelova and Mwangi 2010); and (3) agricultural trade as telecoupling (Dell'Angelo et al. 2017, 2021, Theesfeld 2018). The arguments and evidence from these papers are described below. To explore the available empirical evidence in each area, we traced papers cited by the article and papers citing the article using Google Scholar and Scopus to identify related research assessing the relationship between market integration and collective action in water governance, particularly irrigation governance. We identified studies that had addressed this relationship through case studies and qualitative data. Inconsistencies in defining concepts, variables, and causal mechanisms made it problematic both to screen and to compare results across the identified studies, particularly across distinct contexts. We instead focus on defining core concepts, variables, and the causal mechanisms and contextual factors shaping the effect of market integration on water governance, particularly the ability of local farmers to cooperate and sustain agricultural and irrigation systems. Finally, we assess responses to market integration, including efforts to strengthen institutional fit through changes to the actors, authorities, and incentives facing farmers.

Specifically, we examine each of the three perspectives in terms of:

1. How market integration is conceived, defined, and measured as an external factor;
2. The types of externalities and information asymmetries that arise;
3. The relationship between agricultural markets and collective action in irrigation governance, and the factors mediating that relationship;
4. The changes in the actors, authorities, information, incentives, and capacities to balance the benefits and risks of market integration and their ongoing dynamics.

After outlining each of the three perspectives, we then explore the prospects of institutional fit to better account for agricultural markets in our diagnosis of the collective action problems in water governance and designing institutional responses to them.

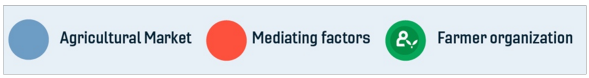
Market integration as a disturbance

Disturbances to social-ecological systems are "relatively discrete event[s]" disrupting "social or ecological communities, resulting in changes to the physical or social environment" (Fleischman et al. 2010:11). Schoon and Cox (2012) developed a typology of disturbances that refers to changes in the connectivity, flows, networks, and parameters that affect social-ecological systems, their structure, and function. Markets act as a pressure on traditional social systems or collectively managed resources expressed through demand (a "connectivity" disturbance linking a social-ecological system to a market) or the dynamics of commodity prices (a "parameter" disturbance affecting a social-ecological system after it is already connected). Therefore, the integration of traditional social systems, in this case related to agriculture and irrigation, into markets involves disturbances in two stages: the initial connection, and the subsequent dynamics (e.g., via the volatility of input prices; following Agrawal and Yadama 1997). When "locally situated groups, resource systems, and institutional arrangements" connect with markets (Agrawal 2003:248), the market pressure "leads to increasing anonymity among actors, which lessens mutual dependencies, loosens traditional social ties, and reduces the inter-linkages for possible reprisals in the case of adverse behavior" (Araral 2009:689). Low and gradually changing levels of articulation with external markets are thus seen as crucial for sustaining collective governance of the shared resources, although the effects are mediated by social, institutional, and contextual variables (Agrawal 2003).

According to the "markets as disturbances" perspective, institutional misfits stem from negative side effects as markets expose collectively managed agricultural lands to commercial pressures beyond the boundaries of local control (de Moor 2015:54). There is then a need to restrict external access to sustain collectively managed lands and waters, and the incomes they support, over the long term. These challenges are neither novel, nor particularly recent, dating to the enclosure movement, which exposed the "lurking" threat of "excessive exploitation due to commercialisation" (de Moor 2015:55). In the context of European agrarian transitions, institutions responded by restricting resource access according to household needs or the capacity to sustain cattle on private, instead of common, lands.

Fig. 1. Conceptual perspectives on agricultural markets and adaptive water governance.

	Market integration as a disturbance	**Market integration as an opportunity**	**Agricultural trade as telecoupling**
Boundary problems			
Description	Integration of traditional systems into commercial agriculture	Collective action to increase market access for smallholders	Spatial separation of agricultural production and consumption
Primary type of externality	Negative	Positive	Nested
Focal exogenous variables *(market integration)*	• Distance to markets • Pace of integration • Prices and subsidies	• Distance to markets • Transportation costs • Length of value chain	• Virtual water flows • Large-scale land acquisitions
Selected endogenous variables *(farmer organization)*	• Social interconnectedness • Free riding (payments or labor)	• Type and value of agricultural products • Farmer organization • Group characteristics	• Land and water rights • Control by local elites • Collective (re)action
Selected relationships and/or causal mechanisms	1. Low(er) and slow(er) articulation with external markets linked with high(er) social interconnectedness 2. Market proximity (distance) linked with free riding on labor to sustain irrigation systems 3. Commercialization of agriculture leads to individualization (i.e. privatization) of irrigation systems	1. Likelihood of farmer organization decreases with distance to markets 2. Smallholder competitiveness lower for longer value chains 3. Reduced welfare of small-scale producers when lack of trust, high transaction costs, non-inclusiveness, financial constraints, market power 4. "Outsiders" (public, private, NGO) can facilitate organization when local groups participate in rulemaking	1. Global water use efficiency gains from trade associated with depletion in exporting country 2. Large-scale land acquisitions in the context of weak(er) local institutions leads to higher risks of water grabbing, leading to conflict and food insecurity 3. Water grabbing enabled by favoritism and corruption by local elites 4. Net effects of LSLA involve complex causal chains linking land and water rights and use
Indicative References	Agrawal and Yadama 1997 Araral 2009 Villamayor-Tomas and Garcia Lopez 2018	Meinzen-Dick et al. 2002 Markelova et al. 2009 Markelova and Mwangi, 2010	Theesfeld 2018 Dell'Angelo et al. 2017, 2021



Another approach restricted sales of produce outside village boundaries or restricted transfers of rights to ineligible villagers. These responses sought "to keep the market out" (de Moor 2015:54) through protectionist policies that retained local control amid external threats. They are the model for current efforts to safeguard access for smallholders by defending customary land and water tenure arrangements, restricting exports, and limiting access and transfers of land and water rights to outsiders by requiring evidence of historical use or other forms of membership in local communities.

Once the markets are "let in", misfits arise from the dynamics of prices and policies that transform the incentives shaping local land and water use. In northern Mexico, unstable commodity prices, increasing input (fertilizer and energy) prices, and reduced access to credit and government support heightened the

vulnerability of collectively managed irrigation systems (Villamayor-Tomas and García-López 2017). Such pressures can be driven by and produce a chain of effects, or a "vicious cycle". For example, economic liberalization under the North American Free Trade Agreement weakened price controls and government support. These trends in turn were linked with efforts to privatize or decentralize irrigation systems, exposing contradictions: decentralization grants decision-making rights to individuals and community groups but can also exacerbate their exposure to threats posed by globalization.

Evidence from several cases about the effects of market disturbances lends support to expectations regarding the deleterious relationship between market proximity and collective management of irrigation systems (Agrawal 2003). In the Philippines, irrigation systems over an hour from commercial centers by public transport (buses, jeepneys, motorbikes) experienced lower levels of free riding in relation to recovering irrigation fees and securing labor for maintenance (Araral 2009). That said, the relationship was mediated by the governance system: systems managed by irrigators, even larger group sizes, were better able to sustain labor contributions than state-run schemes as the distance to markets decreased (Araral 2009). In Nepal and Thailand, commercialization of agriculture was linked with fragmentation of irrigation systems and increased competition for water, both of which undermined collective action for communal irrigation systems (Bastakoti et al. 2010). In these examples, greater articulation with markets reduced cooperation, particularly when irrigators lacked control before the pressure intensified.

Market integration as an opportunity

Market access shifts the focus from keeping markets out to finding a way for farmers to work together to access higher value chains (Markelova et al. 2009, Chamberlin and Jayne 2013). Access affords opportunities for income generation and livelihoods for smallholders who struggle to compete in agricultural markets due to their remoteness. Efforts to connect smallholders with markets seek to reduce input and transport costs, which smallholders cannot afford due to the relatively low output prices they receive because of the smaller group of potential buyers and the costliness of meeting regional and international standards. The lack of supporting services, exacerbated by structural adjustment programs, can reinforce stagnation and underinvestment.

From this perspective, misfits stem from market imperfections, particularly high transaction costs and economies of scale in achieving the information and standards to access higher value chains. Collective action and cooperation by farmers are seen as priorities for addressing the connected challenges of accessing information about prices and product standards, reaching key market actors such as intermediaries and supermarkets, pooling risk and credit, and achieving economies of scale in production. A fundamental boundary problem lies in connecting sellers with potential buyers and making smallholders more competitive by pooling information, risk, and resources. Farmer organizations can strengthen links between smallholders and market actors such as supermarkets and enhance competitiveness by pooling savings for credit, creating branding strategies, and purchasing equipment that lowers the costs of reaching higher value chains (Markelova et al. 2009, Markelova and Mwangi 2010).

Once markets have been accessed, they continue to incentivize farmer organization, at least initially (Meinzen-Dick et al. 2002, Markelova et al. 2009, Takayama et al. 2018, Ola and Menapace 2020). In a classic study in Rajasthan and Karnataka, India, increased proximity to markets was associated with greater farmer organization, lower costs of registering organizations, and more commercial opportunities that increased the profitability of irrigation (Meinzen-Dick et al. 2002). Market access, like market disturbances, can set up a chain of effects. Contrastingly, this chain can foster competitiveness and motivate further cooperation, presenting a tension with the vicious cycle triggered by market disturbances. Unlocking this "virtuous cycle" can occur through membership in farmer groups, access to credit, and training (Ngenoh et al. 2019). However, the initial opportunities afforded by market access can come with deferred risks, including external demands incentivizing unsustainable land and water use, setting off the vicious cycle noted in the markets-as-disturbance perspective. As such, incentives for farmer organization may prove fleeting over time after the initial barriers are overcome.

Balancing local control with external support is the fundamental (boundary) problem: Who should make, monitor, and enforce the rules governing farmer organization and marketing? Parallels have been drawn between collective action in natural resource management and facilitating market access (Markelova et al. 2009). Group characteristics, institutional arrangements, the types of products and markets, and external environment shape the prospects for collective action. In the case of smaller scale farmer organizations, groups can build on past experience and existing local norms (Kruijssen et al. 2009). Larger group sizes can seek economies of scale through federations that organize smaller scale farmer associations, exemplified by cocoa farmers in Bolivia (Bebbington et al. 1996). External (government imposed) rules or initiatives can create problems when farmers are not involved in developing and tailoring rules to local conditions, an approach that was prevalent in government-sponsored cooperatives in the 1970s and 1980s. However, external assistance from the public, private, and nongovernmental organization sectors can build capacity or provide financing to support farmer organization and market links (Markelova et al. 2009).

Achieving farmer organization to enhance market access is seemingly a chicken-or-egg dilemma: competitiveness depends on cooperation to enhance access and take steps to reduce transport costs, adopt standards, and so on. However, cooperation becomes both more worthwhile and costly for more globalized value chains: "the longer the market chain is, the greater the disadvantages faced by smallholders in market access" (Markelova et al. 2009:4). Addressing this dilemma appears to rely on effective external support and roles, echoing broader trends in the discussions of networks, nesting, and polycentricity in adaptive governance (Huitema et al. 2009, Gupta et al. 2013). Farmer organization on its own may prove insufficient, depending on external actors, resources, and support. Moreover, the benefits of market access can prove short-lived without a parallel effort to sustain both the resource and collective action in the face of market pressures (Villamayor-Tomas and García-López 2018), creating a prime challenge for adaptive water governance. Despite broad acceptance of these "stylized facts" and empirical insights, our understanding of the nature of and variation in market access

has been hindered by conceptual and measurement issues, a topic we will return to in the conclusion (Chamberlin and Jayne 2013).

Agricultural trade as telecoupling

Telecoupling in this context refers to "human-induced processes in one part of the globe [that] impact in specific ways on a distant part (or parts) of the world" (Newig et al. 2020:21). Such problems involve a disconnect between the spatial origin of problems and their impacts (Eakin et al. 2017, Newig et al. 2020). The separation between the origin of problems and their effects is the essence of externalities and spillovers, a longstanding focus of governance scholars and economists. However, telecoupling is uniquely challenging because of the complexity and long distances involved when contrasted with transboundary environmental problems (involving neighboring territories), the cumulative global effects of local problems, or the local effects of global problems (Newig et al. 2020).

Telecoupling creates boundary problems associated with gaps in state authority across supply chains. These boundary problems stem from knowledge deficits, diverging interests, high transaction costs, weak legitimacy bases, and policy incongruencies (Newig et al. 2020). Thus, there is a case for global governance architecture to mitigate the nested externalities arising from globalized agricultural markets and vertically integrated multinational corporate actors. Part of this architecture considers issues of inclusion and representation of groups affected by telecoupling to avoid the current model, which relies disproportionately on voluntary mitigation efforts by private-sector actors (Newig et al. 2020, Smith et al. 2019).

Scholars engaged with the concepts of virtual water and, particularly, water grabbing have grappled with the implications of telecoupling for water governance (Hoekstra 2011, Rulli and D'Odorico 2013, Vörösmarty et al. 2015, Dell'Angelo et al. 2017, 2018, Theesfeld 2018). Virtual water is the volume of water "used to produce [a product], measured at the place where it was actually produced" (Hoekstra 2011:25). Virtual water involves a spatial mismatch between the location of water use and the consumption of end products (e.g., via export of agricultural commodities). Accordingly, virtual water is considered "exogenous" water that allows the importing country to reduce its dependence on local water resources. The Middle East is the paradigmatic example, where virtual water has helped to alleviate disputes over water (Allan 1998); however, water-intensive agricultural trade also relies on exports from water-scarce countries (D'Odorico et al. 2019). The corollary is that virtual water allows countries to externalize the environmental costs of their consumption (Hoekstra 2011, Dell'Angelo et al. 2018). These externalities have led to calls for global coordination in the form of information standards for water footprinting, an international water pricing protocol for full cost recovery, quotas on water footprints, and so on (Hoekstra 2011). The global remit of these proposals is seen as the only way to eliminate loopholes arising from misfits between consumption decisions and their impacts.

Water grabbing is a related form of telecoupling linked with global financial flows and the appropriation of water resources associated with large-scale land acquisitions (Dell'Angelo et al. 2018). Water grabbing by definition involves a boundary problem due to the zero-sum division of costs and benefits between the grabber and grabbed: large-scale land acquisitions export the benefits of water use and constitute "grabbing" when expropriating communally managed lands through violence, coercion, and other more subtle forms of power asymmetry (Mehta et al. 2012, Dell'Angelo et al. 2018). Blue-water grabbing is particularly damaging because it is specifically "appropriations of irrigation (i.e., blue) water in regions affected by undernourishment and where agricultural production is constrained by blue water availability" (Dell'Angelo et al. 2018:276). Consequently, when market integration involves grabbing, it jeopardizes the lives of the "grabbed", who are often already marginalized. For example, in Ethiopia, at least 2.5 million ha have been acquired by foreign investors (Teklemariam et al. 2017), many of which were likely farms < 2 ha. Even grabbing from small-scale land acquisitions, such as the 20 ha of foreign-owned flower farms in Oromia region, Ethiopia, can change water governance patterns by reducing local farmers' property rights to water (Theesfeld 2018). These land acquisitions and their local impacts can create flashpoints of violence, coercion, and contestation, and produce "collective re-actions" (Dell'Angelo et al. 2021).

Water grabbing creates misfits because acquiring property rights to land, which is often collectively managed by customary tenure arrangements, is used as an indirect means to control water and divest local groups of livelihoods and other benefits (Theesfeld 2018). Local elites and power asymmetries can play an important role in granting favorable access to foreign investors (Theesfeld 2018, Dell'Angelo et al. 2021). Whether large-scale land acquisitions lead to dispossession and displacement is both a political and empirical question, however, because such investments may improve infrastructure, enhance knowledge and other capacities, and spur more inclusive governance arrangements such as participatory user associations (de Schutter 2011, Theesfeld 2018). Assessing the net effects of these land acquisitions over the long term is riven with conceptual and measurement problems and may fail to consider the opportunity costs and counterfactuals. In other words, the costs and benefits of large-scale land acquisitions, and their distribution, must be compared with alternative patterns of investment and irrigation development for smallholders, livelihoods, and poverty alleviation (see de Schutter 2011).

Although water governance institutions at the local, regional, and national levels mediate the impacts of agricultural trade, the virtual water and water grabbing literature highlight powerful new actors (multinational companies and land investors). The virtual water literature also overlaps with that of collective action in terms of the actors it identifies as facilitators of market access (including intermediaries and secondary market actors). Even when not using the term "telecoupling", both the virtual water and water grabbing literature highlight that consumption in one location is affecting resources located far away in other parts of the world, and that considering both consumers and producers is necessary for addressing the negative impacts of agricultural trade (e.g., Hoekstra 2017, Dalin et al. 2019, D'Odorico et al. 2019, Soligno et al. 2019, van Oel et al. 2019).

BOUNDARY SHIFTING: THE POTENTIAL AND LIMITS OF INSTITUTIONAL FIT

The contrasting conceptual perspectives demonstrate a common struggle of boundary shifting: matching water governance to the

expanding problemshed associated with agricultural markets, their externalities, and information asymmetries. Boundary shifting involves challenges of institutional fit to facilitate inclusion of new actors (e.g., private sector) and marginalized actors (e.g., Indigenous peoples, in many jurisdictions) alike while strengthening venues for social learning and conflict resolution. Improving institutional fit in this context involves three primary issues: (1) expanding the problemshed of water governance to improve the congruence, or match, between the problems and opportunities created by agricultural markets and the relevant actors, authorities, and institutions governing water; (2) building adaptive capacity to cope with market integration and its ongoing dynamics, such as commodity price shocks or supply chain issues; and (3) and addressing nested externalities and coordination across sectors and levels of governance (following Cox 2012). These issues correspond with themes in the literature on adaptive water governance, namely the shifting boundaries of complex social-ecological systems, a focus on transitions and desired states, and the scope for polycentric governance, respectively. We discuss how scholars of adaptive water governance can better account for external factors associated with agricultural markets by focusing on institutional fit in terms of the boundaries of social-ecological systems in water governance, and the development and design of nested governance institutions to address nested externalities across global food value chains.

Resituating markets within social-ecological systems

Agricultural markets have shifted from the periphery to the core of water governance, particularly in irrigation-dependent regions, but remain either an external factor or hold an ambiguous position when establishing the boundaries of social-ecological systems typically used for water governance decision-making (irrigation systems, subnational jurisdictions, basins). For example, in the social-ecological system framework developed by Ostrom and colleagues (Ostrom 2007), commodity markets often form part of the external social and economic settings, although market integration, in turn, affects endogenous variables such as resource dependence and the property rights governing access and withdrawal (Janssen et al. 2007). The literature on barriers to access highlights how the characteristics of agricultural products, rather than only the characteristics of the resources used to produce them, shape the prospects and potential for collective action (e.g., with increased incentives for organization to overcome long marketing channels; Markelova and Mwangi 2010, Fischer and Qaim 2012).

The decision whether to treat agricultural markets as internal is not straightforward. Proximity to markets in the form of commercial centers, towns, or cities, strengthens the argument for shifting the boundaries to encompass new actors such as brokers and intermediaries. Land acquisitions leading to changes in crop selection and, particularly, changes to social and production relations (e.g., contract farming) can reduce the scope for local autonomy and control and require greater attention to new and powerful actors and the inclusion of marginalized groups, especially women (Adams et al. 2019). The prospects for boundary shifting are less clear-cut for agricultural policy (government support, trade agreements) because market integration into global value chains rarely comes with legitimate avenues for directly influencing broader agricultural and trade policies.

On the surface, many agricultural and trade policy domains remain external because they are "not systematically influenced by other system elements" (Marshall 2015:894). Indeed, changes at the level of individual irrigation systems rarely lead to changes in national agricultural policies or global trade regimes. Notable exceptions occur when local producers form cooperatives, adopt protectionist policies, carve out niche markets, develop certification schemes, or otherwise exert control over how they connect to commodity markets or mediate their dynamics. In several instances, the grassroots political struggles made by isolated local agricultural groups or leaders can produce changes in national agricultural policies or trade regimes, as illustrated by the water grabbing experience and the spread of collective "reactions" (Dell'Angelo et al. 2021). Marshall (2015:882) also focuses on integrating "transformation activities" into food systems analysis to account for situations in which "value is added to resource units appropriated". Whether agricultural markets are treated as internal or not, feedbacks between global or regional processes and local responses can produce a dialectical relationship that mirrors experiences with other slow- and rapid-onset pressures in the context of adaptive water governance.

Scholarship on strengthening institutional fit to account for agricultural markets highlights the importance of missing or marginalized actors and new or neglected action situations. In the case of missing actors, the literature on barriers to market access illustrates the importance of intermediaries and external actors, and the telecoupled perspective highlights foreign investors and multinational companies. These processes of market integration also expose structural barriers faced by women and Indigenous peoples. New arenas for collective action, cooperation, and conflict resolution occur within value chains and in other policy sectors such as agricultural and energy policies that deal with price supports and other forms of subsidies, topics that are carefully discussed in the extensive literature on the water-food-energy nexus (e.g., Pahl-Wostl et al. 2021). Agricultural market integration also highlights neglected action situations such as the internal dynamics of producer groups, associations, or forums, and the scope for examining farmer organizations and multinational corporations.

Fit suggests that multiple objects are related in ways that generate desirable outcomes (Cox 2012:54), which is closely linked with the focus of adaptive governance scholars on "end states" that reflect governance priorities (Chaffin et al. 2014). Social fit considers the "extent to which a governance system addresses people's diverse beliefs, norms, values, and expectations in a social-ecological system" (Acton et al. 2021:3). In this context, desired outcomes include both end states and the processes that generate them (Koontz et al. 2019). The three strands of literature demonstrate that agricultural markets, like any institutions and policies involving redistribution, are inherently about trade-offs, particularly given the potential asymmetries among those who reap the benefits and those who accrue the costs of agricultural production and its impacts on water. Efforts to strengthen institutional fit as water governance becomes increasingly bound with agricultural markets must therefore look beyond conventional efficiency measures of markets and draw attention to other possible end states, including efficacy (in sustaining common-pool resources and livelihoods), equity (norms of fairness and reciprocity), and coherence across levels (in

managing the externalities of trade). Procedural criteria include accountability (to ensure those affected by trade can hold decision-makers to account), representation (of diverse voices and values), and social learning (to gain information and insights and to preserve the flexibility to respond to them).

Returning to the opening question whether it is possible to "use markets without being abused by them" (de Moor 2015:54), it is clearly not possible to answer it in a static sense. All three strands of literature point to complex causal chains and feedbacks that can induce either a virtuous or a vicious cycle, depending on preexisting institutions and their adaptive capacities to adjust to the fairly gradual onset of market integration, limited shocks, and complementary roles of external actors and support (Agrawal 2003, Markelova and Mwangi 2010). Therefore, trajectories and transitions become important for assessing whether integration of agricultural systems in markets generates cooperation, livelihood opportunities, and resource sustainability vs. unfettered competition, capture by elites or external actors, and a race to expropriate and exhaust resources.

The complex, multiscale, and dialectical relationship between agricultural markets and water governance suggests that social learning is particularly important when diagnosing and seeking to strengthen institutional fit. Social learning can be defined as "acquiring knowledge, making sense and abstracting meaning, and disseminating knowledge" (Ernst 2019:4) through processes that are fundamentally participatory in nature. Markets are frequently seen as an institution for coordinating dispersed information about products and preferences through price signals. However, the boundary problems, externalities, and information asymmetries, as well as issues of market power wielded by key value chain actors, suggests that greater attention is needed to what Ernst (2019) identifies as "intermediate outcomes" that facilitate social learning, including trust, conflict resolution, and network building. These attributes are difficult to foster in high-intensity contexts in which large disparities in power and capacity make it difficult to grapple with the integration of markets and their dynamics. Compounding this difficulty is the challenge of fostering these attributes at the lowest level(s) possible (per the principle of subsidiarity) and at the multiple, nested levels that the telecoupled aspects of agricultural markets often warrant.

Nested governance for nested externalities

Strengthening fit through boundary shifting and social learning highlights the need for action at multiple levels. Across all three perspectives, agricultural markets involve nested externalities, whereby "actions taken within one decision-making unit simultaneously generate costs or benefits for other units organized at different scales" (Ostrom 2012:356). Such externalities are prevalent for many multiscale and global phenomena. In the case of market pressures as disturbances, connectivity and commodity price shocks cascade across value chains possibly to cause localized depletion. In terms of barriers to market access, activities of external actors such as nongovernmental organizations, governments, or development banks seek to generate positive externalities by fostering livelihoods, alleviating poverty, and creating structural transformations. Telecoupling involves nested externalities that link consumers with spatially distant producers.

A common thread in the discussion of externalities is the need for a (bio)regional approach that better accounts for the interdependencies and asymmetries of the costs and benefits involved. A default prescription is a regional, national, or global architecture to plug regulatory gaps and loopholes across value chains, e.g., through government sponsorship of farmers' associations or co-management, trade regulation, or nationally enforced restrictions on land acquisitions (Newig et al. 2020). However, in many cases, progress has proven elusive because of high transaction costs, which, in turn, are affected by distributional conflicts and information problems. Regarding nested externalities contributing to climate change, the question 10 years ago was: Do we need to wait for global agreements to act? (paraphrasing Ostrom 2012). The analogous question for water governance is whether a regional or global response is needed to address the water challenges associated with agricultural markets.

Much as with climate change, the nested externalities associated with agricultural markets suggest that every level counts, as does coordination within and across levels. Nested governance, in which decision-making is organized across multiple layers (Marshall 2008), captures the need for networks and capacity building from the level of farmers and farmer organizations to increasingly regional water and agricultural policy fora. The longstanding interest of adaptive governance scholars in polycentricity and polycentric governance systems, i.e., the organization of governance across multiple formally independent decision centers that take each other into account (Ostrom et al. 1961, Carlisle and Gruby 2019), can offer insights and guiding principles or criteria for diagnosing and assessing such governance capacities. Acton et al. (2021:2) identify four attributes of polycentric governance contributing to both fit and adaptive capacity, following Carlisle and Gruby (2019):

1. Multiple, overlapping decision-making centers with some degree of autonomy;
2. Decision-making centers employing diverse institutions;
3. Choosing to act in ways that take account of others through processes of cooperation, competition, conflict, and conflict resolution;
4. Decision-making centers that participate in cross-scale linkages of other mechanisms for deliberation and learning.

Applying these attributes to the context of agricultural markets and adaptive water governance highlights the importance of nesting farmer decision-making and farmer organizations in federations (Markelova et al. 2009) and employing diverse institutions that locate decisions where there is existing capacity and trust to build on. These strategies might include the role of producer cooperatives and reliance on forms of social mobilization to contest and demand conflict resolution through collective reactions to coercive processes of water grabbing.

In the context of agricultural markets and water governance, fit also spans sectors, particularly the distinct but overlapping spheres of agricultural and water policy, which have been described as nexus issues (Hoff 2011, Pahl-Wostl et al. 2021) and networks or layers of action situations (Möck et al. 2022). Production relations, property rights (land, water, and

infrastructure), and polycentric governance arrangements are focal institutions that link collective action in agricultural supply chains and water governance, presenting diverse entry points for strengthening institutional fit in this context.

CONCLUSIONS

The growing nexus between agricultural markets and water governance exposes the misfits arising from the links that farmers and irrigation systems have to external actors, institutions, and incentives. Some of these connections have long been recognized in the literature on common-pool resource governance, whereas others have been the focus of more recent research examining virtual water and water grabbing. Despite this mounting interest, there remains a fundamental tension: agricultural markets can erode or encourage cooperation, or sometimes both at the same time or in sequence. We have argued here that agricultural markets are an important challenge and opportunity for adaptive water governance and that the lens of institutional fit can guide scholars and practitioners to understand how to harness the benefits of agricultural markets while limiting, or at least adapting to, their risks.

Our contribution has been to distinguish three related conceptual perspectives for understanding the evolution of agricultural markets and water governance institutions. These three notions, i.e., agricultural market integration as a disturbance, market integration as an opportunity, and agricultural trade as telecoupling, are complementary in that they explain different components of a dialectical, and indeed adaptive, relationship between agricultural markets and water governance institutions. By presenting them together, we identify and clarify important concepts, variables, and relationships scattered across the three strands of literature and show the potential for institutional fit to guide: (1) the (re)definition of system boundaries in water governance, (2) the processes of social learning and transitions in response to patterns of conflict and cooperation arising from boundary problems, and (3) the nested governance arrangements to account for nested externalities caused by the integration of agricultural systems into markets and the subsequent dynamics. Despite the implicit connections among these three perspectives and their shared foundation in the common-pool resource governance tradition, they rarely take account of each other directly. Bridging this gap is essential, especially for water governance scholars and practitioners, who have historically not given enough attention to the crucial role of key external drivers such as those linked to agricultural markets.

We see several important opportunities for future research. First, we believe there is scope for much more careful incorporation of markets in general, and agricultural markets in particular, into diagnostic assessments of social-ecological system governance. Markets occupy a rare position in social-ecological system frameworks. They are simultaneously an exogenous or external factor situated in the social and economic setting, yet can emerge within specific subsystems through value-added products (linked to resource systems, resource units, and transformation systems, the latter following Marshall 2015), and the governance systems and actors involved (as when commodity markets drive resource scarcity and create political windows for privatizing access). With their focus on capacity, the role of fit and scale, and the importance of informal networks and dynamic pathways for transformation, scholars of adaptive water governance are well equipped to open the "black box" of markets to account for their diversity and the ways in which different actors and institutions govern them.

Second, the conceptual confusion around agricultural markets is inextricably linked with measurement and modeling challenges evident in the literature. Not only is there a proliferation of variables used to measure market-related disturbances, barriers to market access, and the telecoupled dynamics of agricultural trade, there is also limited agreement about how they should be measured. For example, market proximity is common to both the disturbances and opportunities perspectives, but measurement approaches vary widely. The advances in diagnostic approaches can go hand in hand with priorities and standards for indicators that address connectivity to markets and their ongoing dynamics. Progress in other fields of adaptive governance, particularly in the field of climate change, can offer useful guidance.

Third, the conceptual and measurement advances can support more longitudinal and comparative research to understand the evolution and performance of different modes of adaptive water governance and support contextualized generalization about the recurring patterns and different pathways (Cumming et al. 2020). A network of long-term observatories can offer insight about the appropriate levels and levers for addressing the challenges and opportunities involved. Such observatories and comparisons should extend to other common-pool resources, moving beyond freshwater to fisheries in the first instance, given the extensive experience with global value chains in the seas (Crona et al. 2015).

Finally, any discussion of markets, including agricultural markets, touches on deeply seated normative issues around values, beliefs, interests, incentives, and actors, as well as the power relations and politics that shape who wins and who loses. Recent advances in the field of polycentric governance to locate power and inequality are particularly important priorities to understand the legacies, framings, discourses, and practices wielded in the context of market integration and dynamics (Morrison et al. 2019, Mudliar and Koontz 2021).

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Author Contributions:

Dustin Garrick: conceptualization, analysis, writing, editing, development of figures and tables; Fabiola Alvarado Revilla: conceptualization, literature review, analysis; Rob de Loe: conceptualization, editing; Isabel Jorgensen: writing, editing.

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All relevant literature is reported in the literature cited.

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