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Open property and complex mosaics: variants in tenure regimes across pastoralist social-ecological systems

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Abstract: While it has repeatedly been observed that pastoralist resource governance systems tend not to conform to the assumptions and principles of mainstream scholarship on property rights and governance of commons, coherent theoretical reasons why this is the case are less common. One exception is the concept of open property regimes. This view holds that the quintessential features of dryland pastoralist systems – limited and highly variable rainfall, low resource density, mobility, and institutions and norms that emphasize flexibility and access – can result in pastoralist herders dynamically distributing and redistributing themselves across a territory without the assumed benefit of clear boundaries or of collective decision-making and rules. However, the open property regimes explanation describes some pastoralist systems better than others. This paper argues that some pastoralist systems are neither conventional commons nor open property regimes. Instead they tend to reflect another model, referred to here as a complex mosaic regime, in which there is gradation of strength and clarity of exclusionary property rights over different resources, in which property rights are often unbundled and allocated to different actors and governance mechanisms, and in which a prominent role is played by social processes and governance mechanisms other than property rights institutions. Social and biophysical characteristics that may be more conducive to complex mosaic regimes than to open property systems, particularly if all of those characteristics are found together, include a severe and chronic shortage of one or more critical resources, spatial heterogeneity of resources, scalar heterogeneity of interests, and a herd mobility pattern that involves occasional convergence on highly valued key resource areas. In elaborating the complex mosaic regime model, this paper addresses a blind spot in scholarship on property rights and commons, deepening the understanding of why pastoralist systems tend not to conform to mainstream theory, as well as helping to explain some of the differences among pastoralist systems. Understanding the

internal logic of alternative resource governance regime models and the social-ecological conditions that make one model more viable than another can help to guide national policies and the strategies of conservation and development actors.

Keywords: Commons theory, environmental governance, open property regimes, pastoralists, tenure

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1. Introduction

In mainstream conceptualizations of land tenure and governance of common pool resources, effective resource management is normally assumed to require secure, enforceable tenure over resources. Secure, enforceable communal tenure is assumed, in turn, to require clearly defined resource and group membership boundaries. This is the first of the well-known design principles for effective governance of commons (Ostrom 1990; Dietz et al. 2003). Secure tenure and clear territorial and social group boundaries are needed to ensure that free riding is minimized, that resource users feel assured of receiving benefits from the resource in the long term, and that the cost-benefit calculus incentivizes management. This scholarship has built upon both a continuously expanding body of empirical case studies and theoretical analyses such as through the use of game theory to establish that communities can, and often do, develop systems of rules and enforcement for managing common pool resources. The first design principle is understood as a cornerstone of these systems. Yet research on pastoralists has repeatedly disputed the applicability of this principle to pastoralist governance systems (e.g. Quinn et al. 2007; Moritz et al. 2013a; Robinson et al. 2017). In traditional pastoralist systems, norms and institutions emphasize flexibility and access to resources rather than secure ownership and clearly defined social and territorial boundaries (Cousins 2000; Fernández-Giménez and Le Febre 2006; Robinson and Berkes 2010).

Although there is a body of scholarship – based primarily on case study research – that identifies ways in which pastoralist systems do not conform to mainstream commons scholarship, coherent theoretical explanations why this is the case are more difficult to find. Two recent exceptions are based on the concepts of *open property regimes* (Moritz 2016) and *sovereign pastoral commons* (Behnke 2018). The latter explanation suggests that in many pastoralist systems the securing of access to a large territory, and an inclusive and flexible approach to group membership which builds the political and military strength needed to secure that territory, are prime concerns. These priorities take precedence over some of the characteristics normally assumed to be fundamental to effectively governed commons, such as clearly defined group and territorial boundaries and

the existence of rules to prevent overuse of resources. The *open property regimes* view similarly holds that the typical features of dryland pastoralist systems – limited and highly variable rainfall, low resource density, mobility, and institutions and norms that emphasize flexibility and access – can result in pastoralist herders dynamically distributing and redistributing themselves across a territory without the assumed benefit of clear boundaries or of collective decision-making and rules (Moritz et al. 2015).

While the *open property regimes* explanation is helpful, it describes some pastoralist systems better than others. This paper argues that some pastoralist resource governance systems are neither conventional commons nor open property regimes, but rather correspond to a model referred to here as *complex mosaic regimes* in which there is a gradation in strength and clarity of property rights over different resources, in which property rights are often unbundled and allocated among various institutions and governance actors, and in which governance mechanisms and social processes other than property rights play a prominent role in land and resource governance. Pastoralist systems characterized by high degrees of heterogeneity of resources across space and heterogeneity of interests across scales, by severe and chronic shortage of some critical resource, and by overlapping and competing claims may conform to the characteristics and dynamics that Behnke (2018) describes for sovereign pastoral commons, while having complex mosaic regimes rather than open property regimes as their internal governance system. In elaborating the *complex mosaic regime* model, this paper addresses a blind spot in scholarship on property rights and commons, deepening understanding of why pastoralist systems tend not to conform to mainstream theory, as well as helping to explain some of the differences among pastoralist systems.

2. Resource governance and tenure in pastoralist systems

2.1. Ways in which pastoralist systems do not conform to mainstream thinking

The most influential idea of commons scholarship has probably been the categorization of tenure systems into not three but four broad types. To the categories of private property, state property, and non-property or *open access*, this scholarship identified a fourth category: group property or *commons* (Berkes and Farvar 1989; Bromley 1989). While mainstream commons theory firmly established that Garrett Hardin (1968) had mislabeled open access systems as *commons* and that functioning commons are widespread, basic commons theory does suggest, in agreement with Hardin, that in the absence of enforced rules a tragedy of overuse can be expected. To avoid such tragedy, the theory goes, property rights need to be allocated to some individual or group or to the state. Commons scholarship has defined a number of design principles for effective governance of commons, the first of these being *clear territorial boundaries and social group boundaries* (Ostrom 1990; Dietz et al. 2003). The implication of these tenets of mainstream thinking, when applied to a large landscape containing many parcels of land, is

that property rights should be established, whether as a contiguous series of commons or as a mosaic of parcels each under different types of tenure, but that no land should remain open access. A "simple tenure mosaic", therefore, is a landscape made of discrete parcels of land each with clearly defined tenure, whether they are all of the same tenure category or are a mix of different tenure types.

The description by German and Keeler (2010) of types of commons problems is instructive. Mainstream thinking on natural resource commons and property rights has focused overwhelmingly on the first of their problem types – the classical challenges for common pool resources of exclusion, free riding, and how to establish a functioning institution to govern the resource – and on the institutional requirements for overcoming these challenges (German and Keeler, 2010). The second and third types of commons problems cited by German and Keeler (2010) result from interactions between discrete parcels in larger landscapes. The second type of problem relates to interdependencies that connect discrete units of property under the same form of tenure, such as when one farmer's inadequate control of weeds and pests begins to affect his neighbors. The third type of problem relates to interdependencies that connect discrete units of property among unlike forms of property, such as when conversion of land on private property affects the viability of habitat on adjacent common land or when users of common pastures trek their livestock across private farms to reach those pastures. The fourth type of commons problem described by German and Keeler (2010) is concerned with how types of resources other than the land are governed and interact with property rights over land. Unfortunately, options to address the second, third and fourth types of problems have often emphasized the solution that is really meant to address the first: to establish, clarify and enforce property rights. At a landscape level, this implies ensuring that the tenure mosaic is complete. This same thinking is becoming prominent in development and conservation efforts targeting pastoralists. Influenced by mainstream thinking, multilateral organizations and development and conservation agencies are increasingly working with pastoralist communities to strengthen community governance organizations and demarcate boundaries, and working with national governments to develop communal tenure systems for pastoralist regions.

However, the applicability of this kind of mainstream thinking on commons and property rights to pastoralist systems has been called into question. One discrepancy between mainstream commons theory and what is observed in pastoralist systems relates to the first Ostrom design principle. Many traditional pastoralist systems have neither clear territorial boundaries or social group boundaries (Niamir-Fuller 1999; Cousins 2000; Quinn et al. 2007; Robinson et al. 2017). Instead, flexibility and fuzziness of boundaries is the norm. These institutional characteristics are an adaptation to the quintessential biophysical characteristics of most pastoralist systems. The high degree of variability in rainfall across time and space is fundamental. Coefficients in the variation of annual rainfall in pastoralist systems often exceed 30%, a level beyond which non-equilibrium dynamics are likely to dominate, with the principal driver of ecosystem dynamics being not

herbivore-forage interactions but rather the external driver of a highly variable rainfall pattern (Ellis and Swift 1988; Ellis et al. 1993). The lynchpin of pastoralist adaptation to this variability is mobility. Mobility enables herders to respond to the unpredictable and highly variable distribution of forage and rainfall, moving their herds to where forage is available and thereby making optimal use of resources (Mace 1991; Lane and Moorehead 1995; Niamir-Fuller 1998). The centrality of mobility and the need to access resources flexibly in different places at different times according to the vagaries of the climate create a situation in which access is more important than ownership and in which hard territorial boundaries would be a constraint to survival.

Another discrepancy between empirical observation of pastoralist systems and commons theory – or at least a simplistic application of commons theory – relates to the allocation of property rights and the observation that pastoralist systems tend not to conform neatly to any one of four categories of tenure systems (private property, state property, commons or open access). Pastoralist tenure systems are often a complex mix of different kinds of overlapping private and group rights – including rights of *use*, *management*, *exclusion*, and other rights – that are held by different, often overlapping and fuzzily defined groups, rather than being purely private, state, or communal, as well as being affected by unclear divergences between de jure and de facto rules (Niamir-Fuller 1999; Cousins 2000). This implies, too, that at larger scales many pastoralist landscapes are not simple tenure mosaics made up of well-defined, discrete property units.

There is also a deviation from commons theory in that many pastoralist systems seem to be open access without an overuse tragedy resulting. Commons scholarship has documented a myriad of examples of local communities autonomously developing common property systems to avoid overuse, and indeed the commitment to the idea of *commons* and the assumption that traditional pastoralist communities – like fishing, forest-dwelling, and other rural communities – must also have developed commons institutions is so strong that researchers and development practitioners will see commons even when the pastoralists themselves declare that their rangeland open access (Moritz et al. 2013a). It has been observed, moreover, that pastoralist communities often strongly resist the creation of any kinds of rules that limit access to resources. What mainstream commons theory has trouble explaining is that, without clear territorial boundaries or the collective creation of rules to limit overuse, pastoralist communities often manage to avoid the open access tragedy. Pastoral systems where this occurs have been described as constituting "coordination access regimes" (Swallow 1990) or "emergent commons" (Moritz et al. 2015).

All this results in a challenge for governance design: the kinds of tenure interventions normally proposed for securing communal land, strengthening customary property rights, and enabling proactive and effective resource management typically will result in a reduction in the flexibility inherent in traditional pastoralist systems (Turner 1999). The tension has been described as "the paradox of pastoral tenure" (Fernández-Giménez 2002). Many attempts to strengthen governance

by establishing clear boundaries and simple tenure mosaics, rather than resulting in improved resource management have contributed to fragmentation of rangelands (Sayre et al. 2013) and conflict (Scoones 1999). Laikipia County in northern Kenya for example, has a mosaic of tenure types, for the most part with well-defined boundaries (Glew 2012; Wade 2015), which in theory should provide for some degree of tenure security and certainty. Yet it has been argued that the tenure system operating in Laikipia is not well-adapted to the social-ecological conditions of the wider landscape within which it is set (Robinson et al. 2017). The problem for efforts to establish clearly demarcated commons in pastoralist rangelands is not simply one of territories that have been created too small for the extensive nature of pastoralist production. Even when attempts to establish, strengthen or reinvigorate pastoralist commons are done in relatively large territories to better match the reality of extensive livestock production, they still tend to be undermined by the bottom-up impetus for flexible boundaries and the ethos of open access typical of pastoralist cultures (Robinson et al. 2017).

2.2. Explaining pastoral systems: open property regimes and sovereign pastoral commons

While many authors have described ways in which mainstream conceptualizations of tenure and natural resource governance do not fit pastoralist systems, careful theoretical explanations *why* this is the case are less common. The most carefully articulated theoretical explanations as to why mainstream thinking does not fit pastoralist rangeland systems is the *open property regimes* explanation. The basis of the argument is that under the right conditions, pastoralist herders will dynamically distribute and redistribute themselves across a territory without collective or centralized decision-making and rules – in other words, in open access conditions – and that this results in optimal allocation of resources and also avoids the tragedy of overuse expected by mainstream commons theory in open access situations (Moritz et al. 2015). In an early articulation of the essentially the same idea, Swallow (1990) referred to "coordination access regimes". In coordination access regimes, as in open access, actors have no expectation that any collectivity will enforce rules restricting access and use of resources. However, unlike classical open access situations, in coordination access regimes actors will base their own use and potential overuse of resources based on expectations of others' actions derived from repeated interactions (Swallow 1990). Swallow (1990) argues that in these situations, norms and experience-based expectations of what others will do result in implicit contracts and coordination rather than rule-based management. Similar ideas have been explored more thoroughly in a recent series of papers by Moritz and co-authors (e.g. Moritz et al. 2013a, 2014; Moritz 2016) and Behnke and co-authors (Behnke et al. 2016). Drawing on complex systems thinking and on the ecology of habitat selection, these papers argue that herders who are able to get information on range conditions and on others' movements will distribute themselves optimally across a territory in an "ideal free distribution".

Rather than conventional commons based on collective institutions and decision-making, the result is an emergent commons (Moritz et al. 2015).

Although a detailed elaboration of the *ideal free distribution* model and how it describes herd mobility in some pastoralist systems will not be given here (see instead Moritz et al. 2014), I will briefly review the logic of how the characteristics of many pastoralist systems correspond to the model. One fundamental characteristic of pastoralist systems is the low density of forage resources. Low resource density contributes to high transaction costs for any property rights system and discourages the investment in exclusionary property rights mechanisms (Ostrom 1990; Behnke et al. 1993). The combination of this with a high degree of spatio-temporal variability, as seen in most dryland pastoralist settings, results in a situation where flexible mobility across broad territories is the most effective means of exploiting the resource. In the archetypical ideal free access model, there is also an assumption that agents have complete knowledge about the quantity and quality of every resource patch (Moritz et al. 2014). For pastoralist communities, with their traditional systems of scouts and of sharing information (McGahey et al. 2008), and now increasingly their use of mobile phones (Butt 2015), this assumption is not outlandish. If a herder knows that a certain accessible pasture has a good quantity and quality of forage but also knows that other herders are already there, then he can elect to go to another pasture. If movement is free and knowledge is complete, herders will distribute themselves across the pastures in the landscape in proportion to the quantity and quality of each patch (Moritz et al. 2014).

Under such conditions, any intervention that attempts to establish clear property rights, even group rather than individual property rights, and implement the first Ostrom design principle thereby placing limitations on mobility and access, is bound to result in increased transaction costs, a less than optimal distribution of herders across the landscape, and less than optimal resource utilization. Research on pastoralists has long recognized that these conditions give rise to norms that emphasize free access to the unpredictable resources (e.g. Swallow 1990; Fernández-Giménez and Le Febre 2006). Open property regimes, therefore, are not simply the unintended consequence of high mobility and the absence of state, private or common property institutions (Moritz et al. 2013a). The ethos of access in mobile pastoralist societies is profound. As Moritz writes, in these settings open access does not represent, as usually described in commons theory, the absence of rules; instead, "open access is the rule" (2016: 704). In open property regimes the rules are clear: herders of any age, status or social group have the right to access pastures for their livestock and may move into and out of pasture areas with no need to seek permission from anyone (Moritz et al. 2013b).

A similar theoretical explanation for the non-conformity of pastoralist governance systems to mainstream principles is the *sovereign pastoral commons* model (Behnke 2018). As with the idea of open property regimes, the starting point of this explanation is the set of social-ecological characteristics that is the archetype of pastoralist systems: spatio-temporal variability and

erratic productivity of the resource which necessitates extensive production and contributes to a prioritization of access over exclusionary property rights. However, whereas the open property regimes literature identifies non-equilibrium conditions as reducing the likelihood of overexploitation by ensuring that livestock numbers seldom stay for very long beyond what conditions can maintain, the sovereign pastoral commons explanation suggests that overexploitation may often occur, but that other strategic political considerations – particularly maintaining and increasing group size and defending the territory – take precedence. In sovereign pastoral commons, internal organization is not based on rule-based internal regulation as with classical commons; instead, it is based on four kinds of processes: (1) negotiation, (2) coercion, (3) competition, and (4) strategic preemption (Behnke 2018).

However, while together these four categories of processes are different from how classical commons are organized, they are also somewhat different from each other. The fourth in the list – strategic preemption – fits well with the idea of open property regimes and ideal free distribution: herders move freely into any area that best suits them and if other, later arriving herders see that forage has already been exploited by others then they can move on to some other pasture area. The ideal free distribution/open property regimes explanation in its abstract theoretical form as well as in the empirical examples used to bear witness to it, suggests a process that is normally peaceful and based on emergent self-organization (Moritz et al. 2013b). This implies, however, that first and second kinds of internal organization processes proposed by Behnke (2018) – negotiation and coercion – do *not* correspond very well to the open property regime model. If in open property regimes, as noted above, there is no need to seek permission for accessing pastures and distribution of herds is based emergent and peaceful self-organization, this means that negotiation is essentially unnecessary and coercion unlikely – the right of access precludes the need for negotiation and ideal free distribution preempts coercion.

In other words, there are various kinds of processes and mechanisms that can structure internal organization in sovereign pastoral commons. The sovereign pastoral commons model encompasses what is entailed in open property regimes but is broader. In his exposition on sovereign pastoral commons, Behnke (2018) describes political economy dynamics at a broad territorial scale. These dynamics are based on factors such as the imperative maintaining access over large territories, the role of group membership in helping to maintain this access, and the interaction of these systems with neighboring pastoralist groups and with states. This helps in turn to shed light on the kinds of ongoing shifts in group membership and alliances, and changes in territorial boundaries that are often witnessed in pastoralist systems. However, the internal logic of the sovereign pastoral commons model does not necessarily require an open property regime as its system of internal governance. An open property regime is an option but is not the only possibility. The next section explores kinds of pastoralist systems that do not conform to the open property regime model.

3. A different governance model

3.1. Complex mosaic regimes

The model of an *open property regime* describes some pastoralist systems better than others, To understand the conditions under which it may not apply, it is important to recognize that not all pastures in a pastoralist's landscape are alike – each pasture may have different characteristics that make it useful and desireable at different times and for different reasons. Some pastures, for example, are far from permanent water sources and are only practically useful during the rainy season, whereas others are closer to permanent water sources and naturally become dry season pastures. Different pastoralist systems may have different balances of rainy or dry season pastures. It is common as well for pastoralists to also have a third category of pastures: drought fallback areas. Having drought fallback pastures in good condition can be critical for coping with a highly variable climate.

In situations where there is a shortage of some critical resource but where the shortage is only occasional or is not severe, the self-organized distribution of herds may be expected. This is the basic logic of ideal free distribution: if *Herder B* sees that *Pasture X* is the most desirable pasture in the landscape but that *Herder A* has already placed his herd there and begun to exhaust its forage, then *Herder B's* cost-benefit analysis may determine that moving to *Pasture Y* is the preferable option. However, if the shortage of some critical resource – dry season pastures close to reliable water sources for instance – is severe and chronic and results in the critical resource only being available in a small number of places, then we would not expect open property regimes and the dynamics of ideal free distribution to emerge. If *Pasture X* is the *only* location that can allow *Herder B's* animals survive – not to mention the animals of *Herders C, D* and *E* – the emergent result will not be distribution but convergence and competition. Such situations may be more conducive to conflict than to peaceful self-organization, as well as creating incentives to establish property rights over critical resources. They may also create incentives to develop rules for management: in landscapes that do not have a good balance of different kinds of pastures, an unrestricted open access situation that results in ideal free distribution may be fair in the short term but result in no pastures being left in very good condition during drought. Instead, when good quality pastures close to reliable sources of water are in short supply, rules ensuring that herds are moved away during the rainy season can benefit all.

Proponents of the open property regime model recognize that it does apply well to some pastoralist systems including much of East Africa (Moritz et al. 2013a), and it is these kinds of conditions with severe and chronic shortage of some critical resource that may explain why. The weather patterns and nature of many East African landscapes result in pastoralist migration patterns that are different than much of the West African Sahel. Whereas the quintessential mobility pattern in the Sahel involves cyclical north-south transhumance that follows the movement of the rains and the availability of forage, herd migration in much of East Africa is characterized by scattering in multiple directions in the rainy season

and converging on pastures close to permanent water in dry seasons and especially during drought. These are caricatures and do not describe all the nuances and variations of either Sahelian or East African pastoralist migration patterns, but as a general pattern this distinction may help explain why the main examples used to illustrate open property regimes come from the Sahel and why it has been suggested that the model does not apply well to much of East Africa. The *ideal free distribution* model of pastoralist mobility and the principles and norms implied by the concept of *open property regimes* together do provide an accurate description of some *parts* of some East African rangelands – rainy season grazing areas particularly – but they do not adequately describe how the high-value, often contested resource areas, such as drought fallback areas, have traditionally been used or governed.

This begs the question of what kind of governance regime is more likely to found when conditions militate against open access regimes but when the quintessential characteristics of dryland pastoralist systems – low resource density and great spatio-temporal variability – nonetheless prevail. The governance model proposed here, one which is adapted conditions of severe and chronic shortage of some critical resource, can be called a "complex mosaic regime". Unlike simple tenure mosaics, in the complex mosaic, claims and rights overlap, different kinds of rights may be unbundled and allocated to different actors and governance mechanisms, some land may remain open access, and property rights institutions generally play a less prominent role in the governance system than they do in many other contexts. Complex tenure mosaics with overlapping, multi-level allocation of rights have been described in tropical forest settings by Felker et al. (2017).

Two sets of ideas are helpful for understanding how complex mosaic regimes function. The first relates to the idea of *bundles* of property rights. One idea from theory on commons and property rights that has received far less attention than either the Ostrom design principles or the four-fold categorization of tenure types into private property, state property, commons and open access is the idea that there are different types of property rights that can be unbundled and allocated to different actors and governance mechanisms. Commons scholarship itself has pointed out that what we call "property rights" is not a single entity, but rather is a category made up of different types of rights. Schlager and Ostrom (1992) identify rights at three levels: operational, collective choice, and constitutional. The operational level includes rights of access and of withdrawal. The allocation of these rights is determined by rules and decisions at the collective choice level, and rights to participate in decisions at this level include rights of management, exclusion and alienation. The allocation of these collective choice rights is determined by rules and decisions at the constitutional level. An important implication of this understanding is that property rights do not need to be allocated on an all-or-nothing basis to a single individual or group. Timing of the right can also be an important aspect of unbundling with selected rights allocated to different actors or governance mechanisms at different times or under different conditions.

This in fact is typical of some customary tenure systems such as found in western Niger for example (Vanderlin 2005). For some resources in some pastoralist systems, what may be most effective is parsing different kinds of rights according to the timing, method of use and location, and allocating these different bundles of rights to different users (Robinson et al. 2017). In these kinds of regimes, therefore, while tenure over an entire landscape may be described as a mosaic, it is not a simple mosaic with each parcel clearly demarcated and rights to each parcel belonging to a clearly defined individual or group.

However, while unbundling of property rights and allocation of different rights to different groups or governance mechanisms is part of many pastoralist governance systems, it is not that property rights are clearly and comprehensively allocated for all or even most of any group's total territory. In complex mosaic regimes, claims – assertions by particular individuals or groups of certain rights, whether rights of exclusion, management, access or withdrawal – often overlap, with competing claims remaining unresolved. The complexity of resource use patterns in these situations should not be understood as implying that an equally intricate property rights system is what is needed for effective governance of that complex system. In complex mosaic regimes, fuzziness and flexibility dominate. The paradox of pastoral tenure (Fernández-Giménez 2002) is a paradox related to securing resources while at the same time maintaining the quintessential pastoralist flexibility, and, importantly, *the difficulty of reconciling these two objectives through tenure*. A resolution for the paradox lies in recognizing that tenure and property rights institutions are only one type of resource governance institution, and that institutions are only one component of governance systems.

This recognition is one facet of a second set of ideas that sheds light on the functioning of complex mosaic regimes – a set of ideas that revolves around an understanding of what *governance* is. It is increasingly accepted that *governance* is not a synonym for *government*, nor is it simply "what governments do" (Young 1996; Stoker 1998; Biermann et al. 2009). Oran Young has described governance as a social function related to the management of interdependencies among actors, social coordination and resolution of tradeoffs (1996). Further development of this idea has suggested that governance is rather an interconnected *set* of social functions: social coordination, shaping power relations, setting direction, and building community (Robinson et al. 2012). These functions may be carried out by governments, but they are also carried out by other kinds of actors and by an array of other interacting factors including institutions, networks, deliberative processes, norms, values, and cognitive frames. Property rights institutions are only one of many components that may carry out these functions.

Pastoralist systems generally, whether open property regimes or complex mosaic regimes, tend to contradict the first Ostrom design principle: the existence of institutions that establish clearly defined groups who have clearly defined rights of exclusion and management for clearly defined parcels of land. However, whereas in open property regimes these kinds of institutions and defined rights are largely or entirely missing, in complex mosaic regimes, such rights are clearly defined for

a subset of resources but remaining fuzzy and flexible for much of a group's territory. In complex mosaic regimes, moreover, property rights function alongside other governance mechanisms and social phenomena that deliver governance. This is particularly important for challenges of governing common pool resources that go beyond discrete property units – the second, third and fourth types of problems described by German and Keeler (2010). For these kinds of problems, which often manifest at a landscape scale, effective governance solutions often take the forum of *hybrid institutions* – "institutional arrangements governing the interdependencies among discrete property holders and regimes" (German and Keeler 2010: 573), typically involving creative combinations of contractual and regulatory approaches to governance. German and Keeler (2010) describe how hybrid institutions address problems beyond the individual parcel of land and mediate interactions in what I have called *simple tenure mosaics*. In complex mosaic regimes where property rights are unbundled and distributed, and are fuzzy for some resources and absent for others, hybrid institutions may be even more apt.

In many pastoralist systems, mechanisms other than tenure institutions and formalized rules include negotiation and informal norms (Niamir-Fuller and Turner 1999). Other mechanisms prominent in these kinds of pastoralist systems include deliberative forums and traditional meetings which, even though they are often convened on an ad hoc basis and do not represent permanent organizations, are nevertheless institutions (Goldman 2006; Robinson et al. 2010). Such meetings result in collective decisions, but these decisions seldom relate to drawing or changing boundaries, especially not permanently. Rather, one of their main functions is to establish consensus (Robinson et al. 2010).

Table 1 summarizes key features of complex mosaic regimes, contrasting them with open property regimes. It is important to note that the complex mosaic regime, like the open property regime and classical commons, is a model. The

Table 1: Comparison of two pastoral resource regime models.

Characteristic	Open property regimes	Complex mosaic regimes
Nature of mobility	Unrestricted mobility resulting in ideal free distribution	Mobility involves occasional convergence on highly valued key resource areas
Social group boundaries	Flexible	Flexible
Territorial boundaries	Downplayed or non-existent	Boundaries fuzzy and flexible for most resources
Rules, property rights and governance	Rules establish right of open of access rather than exclusion	A gradation of strength and clarity of exclusionary property rights Unbundling of property rights accompanied by competing and overlapping claims Prominence of hybrid institutions and governance mechanisms other than property rights

context-specificity of real world situations is such that few if any cases will perfectly conform to one of these models. The argument here is that different social-ecological characteristics will conduce to different tenure regime models.

3.2. Traditional Borana resource governance

As an example of a complex mosaic regime, I offer the governance system of the Borana in southern Ethiopia and parts of northern Kenya, as it was traditionally. As such, this system is described in past tense. Despite pervasive changes due to the extension of the state, demographic changes, and other factors, however, many aspects of the system described still function to some extent. The description is based primarily on secondary sources but also draws on the author's own experience conducting research in Borana communities since 2007 (see Table 2).

Unlike the seasonal movement pattern of the West African Sahel based on the cyclical following of the north-south movement of the rains, the Borana migration was traditionally more about dispersing out in the rainy season to grazing areas that can only be used when rain has fallen and ephemeral surface water sources are available and then in the dry season converging on more reliable, high quality pastures in bottomlands and on permanent water sources – deep hand-dug wells called tula. The characteristics of traditional Borana governance system corresponded with many features of the sovereign pastoral commons described by Behnke (2018). The area was vast, the livestock production system extensive, and boundaries contested; through most of its history, the state was either absent or antagonistic; and access involved negotiation and strategic pre-emption. Membership was also fluid, and the dynamic that Behnke describes of incorporation of new communities into the broader group being a key part of building and maintaining political and military strength applies to the Borana system which has long maintained a polity that has included not only the core Borana clan sections but also a shifting set of client communities such as the Gabra.

Table 2: Traditional Borana resource governance – a complex mosaic regime.

Characteristics	Features of the traditional Borana system
Nature of mobility	Convergence toward a relatively small number of reliable permanent water points and drought pastures in dry seasons and especially drought
Social group boundaries	Flexible social group boundaries: Rights of use and of making decisions on use based primarily on residence, which was flexible
Territorial boundaries	Boundaries fuzzy and flexible for most resources: Boundaries generally understood but not precisely defined except for the most local resources
Rules, property rights and governance	A gradation of strength and clarity of property rights: Strong, exclusionary property rights not expressed for most land. Property rights strongest for wells and for local community exclosures for milk herds, weaker for warra pastures, and essentially open access for fora pastures Prominence of governance mechanisms other than property rights: negotiation and deliberative decision-making were prominent

While the traditional Borana system does seem to have had many of the features of sovereign pastoral commons, it was nevertheless very different from the open property regimes described by Moritz (2016). Instead, the traditional Borana governance system is more accurately described as a complex mosaic regime than an open property regime. Clan-based property rights over wells, which require a great deal of manual labor to establish and maintain, were clear and strong (Tache and Irwin 2003). Property rights over land did play a role in the Borana system, but the clarity and degree of exclusion for property rights for different categories of land fell along a continuum (see Table 3). The largest land management unit was the dheeda. Although the territories of the respective dheedas were generally known, their boundaries were fuzzy and flexible (Flintan et al. 2011; Tefera et al. 2016). The jaarsa dheeda (the council of elders for the dheeda), led by the abba dheeda (lit. *father of the range*) had a strong role in organizing herd mobility, although in modern times its role has greatly weakened (Tefera et al. 2016). There were two broad categories of pasture types: the warra pastures which were used preferentially for lactating, nursing and weak animals, but where the "dry" herd could also graze during the dry season, and the fora pastures which were used only by the dry fora herds (McCarthy et al. 2003). Fora pastures were essentially open access, whereas access to warra pastures was more restricted. The next lower management unit below the dheeda was the madda, typically organized around a cluster of tulas. Each madda included several ardas or clusters of villages or camps, and each arda was associated with a sub-dheeda grazing unit called a reera (Tefera et al. 2016). Warra pastures normally were restricted to those assigned to a particular arda, but this was flexible and the warra pastures could be opened to others in times of drought (Kamara 2000; McCarthy et al. 2003). Within the warra area, each arda might have one or more communal exclosures with protected pasture for the milk herd. These exclosures had the most restrictive rules, rarely being opened to non-arda members (McCarthy et al. 2003). Where property rights did exist over some resources, these rights were unbundled and allocated flexibly to

Table 3: Borana land management categories.

Land management unit (from largest to smallest)	Description	Gradation of boundaries and property rights
Dheeda	The largest land management unit	Boundaries fuzzy. Rights of exclusion and management minimal and flexible
Madda	A land and resource management organized around a cluster of permanent water sources	
Reera	A sub-dheeda grazing unit serving one or more arda	
Arda	Clusters of olla (camps)	
Qallo	Exclosures	Boundaries and rights of exclusion and management clear and enforced

different actors and processes in the system. Management and exclusion rights would be exercised in normal years by a council of elders at the level of *madda*; however, in droughts, decisions on management, use and exclusion could be taken at a higher level such as the dheeda. Herd movements within the warra pastures were coordinated by negotiation (Homann et al. 2008). Traditional meetings, held at various levels from the level of a single mobile camp up to occasional meetings of the entire Borana nation played a key role in revising and enforcing norms and negotiating access to key resources (Coppock 1994; Kamara 2000).

4. Differences among pastoralist systems

Just as there are biophysical characteristics that make dryland pastoralist systems very different from some other kinds of resource systems and help to explain why they tend not to conform to some aspects of mainstream thinking on commons and property rights, it is plausible that there are also material characteristics that help to explain social and institutional differences among pastoralist systems. I have already mentioned the severe and chronic shortage of some critical resource as potentially making open property regimes unworkable. However, the kinds of biophysical, as well as perhaps demographic and political, characteristics that conduce to either open property regimes or complex mosaic regimes are certainly more complicated than mere shortage of a resource. One dimension of difference among different pastoralist systems that has a role to play is the relative homogeneity/heterogeneity of pasture resources across space. A distinction is made here between the spatio-temporal variability of the resource, which was discussed above, and its degree of spatial heterogeneity. The spatial heterogeneity of the resource refers not to the changes that are observed from year to year with changing rains, but to persistent differences such as differences in soils, in relative security/insecurity, or in proximity to other resources and facilities such as water or markets. If resources are relatively homogeneous across a landscape, then one will not expect there to be a severe and chronic shortage of some resource that draws herders to converge and compete; instead ideal free distribution could be expected. Spatial heterogeneity in resources, on the other hand, creates the possibility that ideal free distribution and an open property regime may not function. The territory of the Borana, for instance, has the key biophysical characteristics common to dryland pastoralist systems: rainfall that is sparse and variable. However, it also highly heterogeneous with significant variations in elevation and soils, the mean annual precipitation ranging from 182 mm. in the south to 993 mm. in the north[1], and the high variability in rainfall itself varying across the territory with co-efficients of variation ranging from 18.5% to 42.5%[2].

[1] Calculated using data from Climate Hazards Group InfraRed Precipitation with Station (CHIRPS). URL: http://chg.geog.ucsb.edu/data/chirps.

[2] Calculated using data from University of East Anglia Climate Research Unit. URL: https://crudata.uea.ac.uk/cru/data/hrg.

Differences in biophysical conditions and resource management systems among the Turkana of Kenya are another case in point. Moritz (2016), citing earlier research on the Turkana (e.g. McCabe 2004), describes northern Turkanaland as an open property regime in which boundaries essentially play no role and herders move freely. Moritz admits that the open property regime model does not describe southern Turkana sections, suggesting that they are pastoral commons (2016). Yet, there are important ways that traditional resource governance in southern Turkanaland cannot be described as classical commons. For instance, property rights over land are not clearly defined everywhere; instead, there is a gradation in the expression of property rights over different categories of land, with permission needed to access land in some places and not in others. Territorial boundaries and the tenure system, moreover, are both flexible and subject to negotiation and competing claims (McCabe 2004). In other words, traditional land and resource tenure in southern Turkanaland corresponds more closely to the complex mosaic regime model than it does to classical commons. Importantly, whereas the Turkana have a shared cultural and linguistic identity, biophysical characteristics distinguish the north and the south. The north is much less biophysically diverse than the south, with vast distances between different types of landscape resources, whereas the landscape in the south is much more varied (McCabe 2004).

While spatial heterogeneity seems to be one characteristic that contributes to the emergence of complex mosaic regimes, it is not on its own a sufficient driver. Heterogeneity in the landscape does not in itself mean that there will be shortages or that self-organized distribution of herders will not be effective. Another characteristic that may interact with spatial heterogeneity of resources is heterogeneity of interests, especially across scales and levels. The term *scale* here refers to particular dimensions – spatial, jurisdictional, temporal, analytical, etc. – and *levels* as the units along a scale (Gibson et al. 2000; Cash et al. 2006). The issue is not simply that neighboring pastoralist communities may have differing interests and overlapping, competing claims on sections of the landscape, but also that they may engage with the landscape with very different mental geographies and conceptions of scale. Different ethnic groups, and sometimes even different populations within an ethnic group, may have different ways of categorizing territories and therefore a different set of levels making up their spatial/jurisdictional scale. As a result, there may be multiple, incongruous scales based on the traditional systems of different pastoralist ethnic groups, as well as that of the state. Differing degrees of mobility among pastoralists will also result in their respective interests in different resources being qualitatively different, as when certain pastures may be seen by more mobile pastoralists as being a shared drought fallback area, while more settled local pastoralists consider the same area as "their" local pasture which they may want to manage more intensively and to claim property rights over. New interventions such as the creation of community conservancies, grazing committees or some other community governance structures can add to this complexity by bringing new ways of defining and demarcating space. The challenge for governance design is not simply that different stakeholders have

different interests, but that differing interests are connected with different conceptions of scale. If different groups want the same resources but at different times or under different conditions, those who are less mobile and have more localized interests may begin to have lowered transaction costs for establishing property rights and commons institutions, and may develop greater cultural affinity to particular local territories and a stronger sense of ownership. However, other, less frequent users may still have a powerful interest in occasionally accessing key resources on the same land. This scalar heterogeneity of interests inevitably leads to different groups expressing qualitatively different claims over the same pieces land. In such situations, the potential for conflict is great.

In these kinds of settings, spatial heterogeneity of the resource, severe and chronic shortages of certain key resources, and scalar heterogeneity of interests together result in dynamics that are different from those in an open property regime situation. Such conditions result in some groups occasionally being acutely motivated to access forage in territory normally considered to belong to other groups. Spatial heterogeneity can result in certain key areas such as drought reserve pastures being highly contested, and heterogeneity of interests makes it difficult to divide up the landscape so that each social group has a key-resource patch of its own that is reliably sufficient every year. In these situations, heterogeneity and overlapping and competing claims also make it less likely that herders will distribute themselves ideally across the landscape. If conditions happen to arise that allow each individual herder to move freely resulting in ideal free distribution in the short term, lack of protection for drought reserves and other pastures near markets, settlements, and permanent water may result in less than optimal outcomes in the long term. In other words, open property regimes cannot be expected to achieve a strong degree of fit for these kinds of social-ecological contexts. These conditions open the door for a role to be played by property rights, although not in the form of simple tenure mosaics, but rather in more variegated, complex forms with rights being unbundled and accorded to different actors or governance mechanisms, as described above, and with a role to be played by other mechanisms such as hybrid institutions.

The relevance of claims and interests implies that it is political and demographic factors as much as biophysical conditions that drive pastoralist resource governance toward complex mosaic arrangements rather than an open property regime. In its understanding of these factors, the complex mosaic regime model of resource governance is consistent with the political-economy dynamics described for sovereign pastoral commons (Behnke 2018). Some of the characteristics that conduce to sovereign pastoral commons – demographic pressure, acute scarcity, and competing claims – also make complex mosaic regimes more tenable than open property systems. However, Behnke's description (2018) of sovereign commons seems to encompass a broader range of possibilities than complex mosaics, and while his description of political and military competition between sovereign groups differs from the description of open property regimes as typically being peaceful (Moritz et al. 2013b), he nevertheless describes pastoralist systems that

have the political dynamics of sovereign pastoral commons but whose resources are governed internally as open property. Of the four kinds of mechanisms of internal organization for resource access cited by Behnke (2018), one of them, strategic pre-emption, is fully consistent with open property regimes. Yet, as discussed above, two of the others – negotiation and coercion – are not. The kinds of external pressures that help to drive sovereign pastoral commons – conflict with other pastoral communities and the absence or antagonism of the state – may be consistent across a variety of different pastoralist systems even as other factors such as the nature and degree of heterogeneity of interests within a pastoralist polity differ, leading these systems to have either open property or complex mosaic regimes as their internal resource governance system.

5. Conclusion

In situations in which resource density is high, exclusion relatively easy and transaction costs low, resource governance systems based on private property are likely to dominate. Scholarship on commons holds that when resource density is lower and transaction costs and the difficulty of exclusion increase, common property regimes become more appropriate and more likely to be witnessed. In many real-world situations, rather than only commons or only private property, a mosaic of different tenure types will exist within a landscape – a simple tenure mosaic. Dryland pastoralist systems, however, tend to be characterized not only by very low resource density and high transaction costs for establishing and enforcing systems of property rights, but also by great spatio-temporal variability of resources. These characteristics help to explain why pastoralist resource management tends not to conform to some of the principles and tenets of mainstream thinking on commons and property rights.

One theoretical explanation for this divergence conceives of many pastoralist systems as *sovereign pastoral commons*, in which the securing of access to a large territory – and an inclusive and flexible approach to group membership which builds the political and military strength needed to secure that territory – take precedence over internal management of the resources within the territory. A related view is based on patterns of mobility that correspond to a model of *ideal free access* and institutions that establish *open property regimes*. However, this paper has argued that some pastoralist systems are neither commons, nor simple mosaics, nor open property regimes. Rather, they are *complex mosaic regimes*. Complex mosaic regimes exhibit a gradation of strength and clarity of exclusionary property rights over different resources, in which property rights are often unbundled and allocated to different actors and governance mechanisms, and in which a prominent role is played by social processes and governance mechanisms other than property rights institutions.

This paper has proposed a set of characteristics that may be more conducive to complex mosaic regimes than to open property systems, particularly if all of those characteristics are found together. These include severe and chronic shortage of

one or more critical resources, spatial heterogeneity of resources, scalar heterogeneity of interests, and a herd mobility pattern that involves occasional convergence on highly valued key resource areas. It is important to note, though, that *commons*, the *open property regime*, and the *complex mosaic regime* are all models, and any particular real-world situation is likely to have features that do not correspond to abstract social science models. Nevertheless, the articulation of these models and of the kinds of biophysical and social characteristics within which they are most likely to be effective opens the way to articulate testable hypotheses. Comparative case study analysis, for example, could test whether characteristics such as the concentration/sparseness, spatio-temporal variability, and spatial heterogeneity of a resource base have tended to correspond to different models of traditional resource regimes. Analyses based on game theory or simulation modeling could explore what kinds of resource regime model produces the optimum results under different biophysical characteristics such as the concentration/sparseness, spatio-temporal variability, and spatial heterogeneity of a resource base.

Such models do affect how people think and act. The model of *commons* and related ideas of community-based conservation and community-based natural resource management have influenced how governments, donor agencies and non-governmental organizations have been attempting to support pastoralist communities. A wide range of scholarship on pastoralists has indicated ways in which policies and programs based on this model are often ill-suited to pastoralist systems. The articulation and differentiation of alternative models, and the testing of hypotheses about them, can become key steps on the path to developing theories of resource governance which more accurately reflect real-world situations and provide more effective guidance. Clear articulations of alternative models of environmental governance regimes, and of what kinds of social-ecological characteristics are likely to conduce to different models of resource governance regimes should make it easier for policymakers and the development community to design policies, programs and projects that are more suited to the social-ecological characteristics of the systems at which they are targeted. The set of policies that can effectively address the paradox of pastoral tenure in open property regimes is likely to be quite different than in complex mosaic regimes, both of which will be different from settings where conventional commons are appropriate.

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