

Top of hourglass:

We live in a world of divisions. Divisions of gender, race, wealth, education, etc. Whichever group is considered to be of the majority has greater power in making decisions. The problem is, when decisions are made have those with less power been considered properly? For instance, when the Global North (more economically developed) tells the Global South (less economically developed) what to do, do they really have the knowledge or experience to understand the complexities of what it means to be a part of the Global South? So we ask, can we trust people to take care of their resources? I will specifically focus on pastoralist communities as the imposed upon and those creating technologies for the pastoralists as the imposers. In addition, I will examine how climate change has affected pastoralists relationship towards technology, resources and who has control over said resources, specifically in the Horn of Africa.

In 1968, Garrett Hardin published an article titled "The Tragedy of the Commons". Hardin's basic argument is that if there is common property, such as rangeland, each pastoralist would use it egotistically; meaning, pastoralists' actions would be based on the idea of benefitting themselves. With this idea, each pastoralist would want to increase their herd size and allow them to graze on as much of the land as possible. Eventually, the land would become depleted because of overgrazing as a result of the increased amount of livestock by each pastoralist (Hardin 1968). If you were to ask Hardin if we can trust people to take care of their resources, he would say no. With "Tragedy of the Commons" there is no control over resources; thus, they wouldn't use them responsibly.

Elinor Ostrom, a major critic of Hardin, used game theory to analyze the decisions made by people using common property and open access resource environments (Steinberg 2015). Ostrom argues that Hardin incorrectly assumed that people cannot cooperate. Ostrom found that in an open access environment, Hardin's predictions were typically confirmed; however, Hardin overlooked shared ownership (Steinberg 2015). Ostrom found hundreds of local communities that developed rules for shared ownership and penalties for those that broke them. Ostrom discovered we can trust individuals to take care of their resources; though she encourages institutions to be a part of the process. However, these institutions need to be built on various scales with an appropriate understanding of the resource itself (Ostrom 2010).

With scale in mind, not all communities are able to agree upon shared ownership methods. For instance, some may find the effort more difficult than it's worth, while others agreements failed due to increased social and economic changes influenced by expanding globalization. In other cases, governments feel threatened by local communities' ability to self-govern property and purposely undermine their efforts (Steinberg 2015).

Steinberg, a major critic of societal rules and institutions believes that institutions have been built with the purpose of helping individuals manage their resources; however, that doesn't mean that society agrees on these institutions. Rules have been created to effectively run an organization, a society, etc. However, the challenge is that the rules set forth by those with power aren't necessarily suited for the community affected by these rules. "Organizations we rely on to make the world a better place are frequently ill-suited to the task" (Steinberg 2015, 49). When looking to make a change amongst a culture we must look at what is needed and not what's possible (Tait 2012). Organizations often have external pressures that affect their end decision. There are several competing priorities where the end goal is a mishmash of ideas that is the best compromise (Steinberg 2015). Organizations

are making decisions based on “efficiently pursuing goals through an assessment of the costs and benefits of alternative strategies” (Steinberg 2015, 50). These rules and routines affect the structure of how the organization operates. As a result, “U.S. government agencies work reasonably well at promoting transparency and fairness, but can be maddeningly inflexible in response to new problems and new opportunities to fulfill their mission” (Steinberg 2015, 51). This inflexibility allows solutions to only be derived from a pre-approved solution. Precedent has been set on how to tackle issues and when similar problems arise, organizations follow a similar strategy (Steinberg 2015). Even if we live in a world of egotistical thinking, collective power, exploits weakness; thus, requiring us to confront the power in order to change the rules (Steinberg 2015). Meaning, even if individuals make decisions based on our individual benefits change won’t be seen. Therefore, all local decisions aren’t truly local because they are constrained by a complex set of sometimes opaque agendas based on political realities that have little to do with local situations (Steinberg 2015). Technology and infrastructures affect the ability to change; therefore, when establishing new institutions we limit the flexibility for cultures to grow (Tait 2012). Without a deeper level of understanding of a culture we run the risk of limiting cultures ability to adapt by deciding what’s best for them. Cross-cultural game theory is a way to demonstrate how each culture address situations differently and how preconceived notions of how a culture would behave in that situation could be entirely wrong.

Cross-cultural game theory studies demonstrate how different cultures are given the same problem; yet each culture can have entirely different solutions. The Ultimate Game is an example of this game theory. In the Ultimate Game, the proposer makes a financial offer to a second person. The proposer cannot offer more than the amount of one to two days wages in that society. The respondent can either accept or reject the offer. If the respondent accepts then both players receive the proposed amount. If the respondent rejects the offer then both players receive nothing.

The initial results show that fairness and reciprocity come with rewards: those that don’t behave cooperatively are punished meaning if you don’t take care of your resources appropriately then there will be consequences. This has been classified as the canonical model (Henrich et al. 2001). In an industrial society the canonical model predicted that the mean offers would be about 44% of the proposers wage. Henrich, took the Ultimate Game and played it with different cultures. Henrich’s study they found the range to be 26-58% (Henrich et al. 2001). This demonstrates that the canonical model under-predicted the offers made by the proposer in an industrial society. For individual society the model predicted a mean offer of 50% but Henrich’s study found the range to be 15-50% (Henrich et al. 2001). For an individual society, the canonical model doesn’t take into consideration different types of individuals, it isn’t representative of the array of circumstances individuals face; therefore, their mean didn’t demonstrate the range of proposed offers. In addition, in some societies rejections of low offers were often rare and in contrast, frequent rejections of offers above 50% occurred (Henrich et al. 2001). This again illustrates that, in the canonical model, an image of what an individual would propose is based on a select type of individual and not taking into account varying cultures and how that affects amounts proposed.

The canonical model predicted that everyone would free-ride with public goods (benefiting from the goods without exerting any effort or any form of payment), but in this study they found that some individuals did not free-ride at all (Henrich et al. 2001). This study showed that individuals’ actions are highly affected by group-specific conditions such as social institutions or cultural fairness norms (Henrich et al. 2001). For instance, the “respondent” in some societies may not accept the offer because they consider it to be a gift with hidden strings attached, one that in the future they will have to repay at larger costs. The strings attached to the offer may be considered too high to accept the “gift”.

TABLE 1—THE ULTIMATUM GAME IN SMALL-SCALE SOCIETIES

Group	Country	Mean offer ^a	Modes ^b	Rejection rate ^c	Low-offer rejection rate ^d
Machiguenga	Peru	0.26	0.15/0.25 (72)	0.048 (1/21)	0.10 (1/10)
Hadza (big camp)	Tanzania	0.40	0.50 (28)	0.19 (5/26)	0.80 (4/5)
Hadza (small camp)	Tanzania	0.27	0.20 (38)	0.28 (8/29)	0.31 (5/16)
Tsimané	Bolivia	0.37	0.50/0.25 (65)	0.00 (0/70)	0.00 (0/5)
Quichua	Ecuador	0.27	0.25 (47)	0.15 (2/13)	0.50 (1/2)
Torguud	Mongolia	0.35	0.25 (30)	0.05 (1/20)	0.00 (0/1)
Khazax	Mongolia	0.36	0.25	0.067	0.2
Mapuche	Chile	0.34	0.50/0.33 (46)	0.067 (2/30)	0.2 (2/10)
Au	PNG	0.43	0.3 (33)	0.27 (8/30)	1.00 (1/1)
Gnau	PNG	0.38	0.4 (32)	0.4 (10/25)	0.50 (3/6)
Sangu farmers	Tanzania	0.41	0.50 (35)	0.25 (5/20)	1.00 (1/1)
Sangu herders	Tanzania	0.42	0.50 (40)	0.05 (1/20)	1.00 (1/1)
Unsettled villagers	Zimbabwe	0.41	0.50 (56)	0.1 (3/31)	0.33 (2/5)
Resettled villagers	Zimbabwe	0.45	0.50 (70)	0.07 (12/86)	0.57 (4/7)
Achuar	Ecuador	0.42	0.50 (36)	0.00 (0/16)	0.00 (0/1)
Orma	Kenya	0.44	0.50 (54)	0.04 (2/56)	0.00 (0/0)
Aché	Paraguay	0.51	0.50/0.40 (75)	0.00 (0/51)	0.00 (0/8)
Lamelara ^e	Indonesia	0.58	0.50 (63)	0.00 (3/8)	0.00 (4/20)

Note: PNG = Papua New Guinea.

^aThis column shows the mean offer (as a proportion) in the ultimatum game for each society.

^bThis column shows the modal offer(s), with the percentage of subjects who make modal offers (in parentheses).

^cThe rejection rate (as a proportion), with the actual numbers given in parentheses.

^dThe rejection rate for offers of 20 percent or less, with the actual numbers given in parentheses.

^eIncludes experimenter-generated low offers.

Figure 1 Henrich et al. 2001

For example, the Aché, a hunter-gatherer community located in eastern Paraguay, will leave their hunt just on the outskirts of their village for residents to find and then be shared with everyone so that no one would know who actually caught that game. The meat would then be considered a common good for everyone with no strings attached. In addition, others may only share because of fear of being judged or affected by community gossip. Some groups shared only amongst their family-unit, while others shared generously when it came to public goods (Henrich et al. 2001). Figure 1 demonstrates the mean offer proposed by the proposer and the rejection rates as well as the rejection rate of low offers for their respective countries. For the Aché, the mean proposed rate is 50%, whereas the Machiguenga mean offer is 26%. This demonstrates that amongst different cultures, there are different acceptable offers. Thus it's challenging to know if we can trust people to take care of their resources because each culture has different interpretations of what that means.

Further research on the Ultimate Game demonstrated that individual's decisions are highly affected by emotions. Whether an individual chooses to accept or reject an offer is an emotional response. Levels of fairness/unfairness vary amongst different societal norms; thus, the emotional responses are a reflection on how the individual was raised to believe what is fair or not (Sanfey et al. 2003). Therefore, how an individual chooses to take care of a resource is based on one's emotions towards that resource. Trusting someone to take care of a resource then becomes a measurement of emotional attachment or need for that resource in the long-run.

Henrich's study shows us that the varieties of reactions are highly affected by economic and social interactions of everyday life in that particular society. Sanfey's study demonstrates the influence of emotions. Imposing one's ideas onto another group of individuals may not be successful because of differences in lifestyles. How I choose to live my life is very different from how you choose to live your life. There is no "one size fits all" method to development nor is there one way to utilize the commons.

With shared commons, institutions may be needed to help utilize the resource; however, there needs to be a deeper understanding of lifestyles prior to creating these technologies. In addition, not only is there a limited understanding of how different cultures approach dilemmas, humanitarian intervention can just be a cover-up for a political agenda.

Clapham, a scholar in humanitarian aid in the Horn of Africa, discusses how aid can be a mask for establishing power relations. The Ethiopian famine of 1984-5 is an example of a political agenda disguised as humanitarian intervention. Media, such as BBC, talked about the humanitarian intervention as 'biblical' implying that that the aid provided was in replacement of God's work (Clapham 2013). The work was described as the donors from the Global North helping save the starving African victims which further reinforced the image of Africa being a helpless suffering continent (Clapham 2013). In addition, the Ethiopian government played off the idea of being hopeless towards a 'natural disaster'/'drought emergency' to avoid questioning of government policy. Famine was a recurrent hazard caused in part by thin soils and uncertain rainfall; however, the event didn't become popularized until media came (Clapham 2013). The Global North response was heavily affected by government aid schemes and media's wording of the event. Once the Global North, particularly the U.S., became involved humanitarian intervention became a way to demonstrate a model for a new structure of global order (Clapham 2013). Then, instead of humanitarians in general doing God's work, it was the U.S. army doing it instead. The difference was the U.S. army wasn't equipped for the task. The Somali soldiers were better equipped for the terrain and they knew their way around the back streets and alleyways (Clapham 2013). In the end, Operation Restore Hope was a failure because of its own internal inadequacies and not because of changes in the global system (Clapham 2013). In the end, the Global North's attempt to deliver aid became another way to establish a stable framework of governance; without the understandings of the challenges each country faces individually. Outside groups attempted to create technologies for those living in the drought to be able to survive it.

I define technology as any new strategy that has been created for pastoralists with the attempt of dealing with climate variations and other challenges pastoralists are currently facing. Although pastoralists' strategies could be seen as a form of technology, other technologies have been created by other non-pastoralists with the hope of enhancing the pastoralists' lifestyle and to make them better prepared for the dilemmas they face due to climate change.

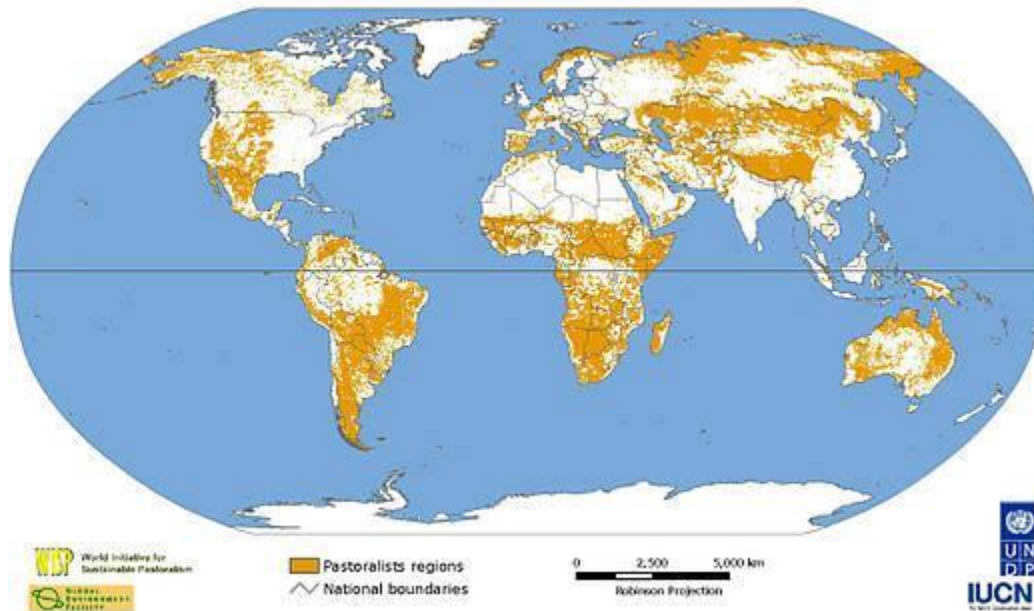


Figure 2. World Initiative for Sustainable Pastoralism (2008)

Google Tour

Situated context

This paper uses pastoralists, located in the Horn of Africa, as a case study to examine how they use their resources. In addition, how their resources have been affected by climate change and how technologies have played a role in determining their relationship. Pastoralists are defined by how they have adapted to land and how they obtain resources for their livestock. There are three classifications for pastoralists: nomadic - meaning their mobility is high and in irregular patterns; transhumant - when there are regular back-and-forth movements between relatively fixed, sedentary locations; and any other form of pastoralism that normally consists of less mobility (Rota 2009). Pastoralism is normally chosen as a lifestyle when conventional farming is limited or not possible. It is also a lifestyle that is well adapted to extreme weather conditions (arid land or frozen land). Pastoralists are considered to a minority group with little importance in the world when in fact that produce 10% of the world's meat and in Africa they cover 66% of the continent (Nori et al. 2008)

In the Horn of Africa (see map below), pastoralists have to deal with heterogeneous and dispersed resources that are dependent on seasonal, yet, unpredictable rainfall (Nori et al. 2008). The unpredictable rainfall patterns are much to blame for the lack of productivity in the arid rangelands affecting animal and plant production (Nori et al. 2008). The World Initiative for Sustainable Pastoralism (WISP) uses computer simulations to predict long-term regional climate change. In East Africa the climate analysis predicts that parts of the region will become significantly drier consequently decreasing the growing seasons. Southern Kenya and Northern Tanzania, on the other hand, will become wetter with increased length of growing season (Nori et al. 2008). Overall, the region can expect increased irregularity and decreased predictability (Nori et al. 2008). As modern development and climatic pressures pastoralists to survive and produce meat it has caused tension and violence to increase in the Horn of Africa (Meier et al. 2007). Limited grazing lands and available water are the two largest issues

pastoralist face (Meier et al. 2007). As climate change and tension has become more prevalent, pastoralists and outside groups have attempted to mitigate the issues. The question then becomes, how have pastoralist communities in the Horn of Africa adopted land use technologies related to climate change, and in what ways have pastoralist communities been affected and has this affected pastoralists decision power?



Game

Pastoralist communities have several strategies that help ensure livestock survival. For instance, they select their livestock on the basis of survival for the climate conditions they face: i.e. camels for extremely dry locations or yaks for areas in high elevation and cold climates. They also depend on diversification of livestock. If their livestock consists of camels, goats and cattle and if a virus were to break out that targeted goats, camels and cattle would continue as a source of income. Furthermore, maximizing stock numbers safeguards a greater survival rate. Pastoralists also depend on mobility as a way to sustainably use the rangeland. If an area were to be sparse they move to another location, moving to the food rather than farming the food. In addition, pastoralists have reserves of rich-patch vegetation areas that they depend on during dry seasons or drought (Rota 2009). If it were to be a particularly dry season then pastoralists will also split their herds. By splitting their herds they reduce the competition for the limited resources because each group will travel to different locations. All these strategies are ways pastoralists are able to use their resources efficiently and effectively depending on varying climate and other challenges they might face along the way.

Although pastoralists in the Horn of Africa have several strategies for survival, there are constraints that prohibit or make it challenging for them to utilize their tactics. Some of these constraints include, but are not limited to, sedentarization policies, water development, market constraints and growing population pressure (Rota 2009). Pastoralist communities have survived for centuries because of their mobility, diversity, flexibility, and resource sharing (Fernandez-Gimenez et al. 2006). Recently, there has been a noticed decline in pastoralist communities; Fernandez-Gimenez attributed this to several outside factors, which include political and administrative boundaries that didn't take into account the pastoralists' traditional movements, the usurpation of tribal law by national and subnational governments, the ability to earn income from wage labor in lieu of herding animals, and the provision of goods and services by governments (i.e. roads, water, schools, clinics) that encourage

pastoralists to settle in one place (Fernandez-Gimenez et al. 2006). As technology permits the expansion of sedentary agriculture practices into marginal lands traditionally utilized by pastoralists, the amount of available rangeland is decreasing. Over time, pastoralist communities in the Horn of Africa have been forced to adapt to the changes around them. I will be focusing on four technologies that have been created by or for pastoralists in a world where climate change is a reality: cement markers, access agreements, Index Based Livestock Insurance (IBLI) and enclosures.

Tech 1

An example of pastoralist issues can be seen in Chad and the use of Lake Chad as a common water source. This example demonstrates the challenges of a shared common. There are four countries surrounding Lake Chad and thus there is a serious need for conflict resolution in the area.



Figure 3 Map of Lake Chad

The Central Governments in the Chad Basin has been generally supportive towards pastoralists' mobility and have guaranteed pastoralists access to common-pool grazing resources (Mortiz et al. 2013). The government has meetings to organize different stakeholders and roughly 50,000-100,000 cattle every year (Mortiz et. al 2013). However, these meetings are time consuming and cost inefficient. During these meetings they decided to protect transhumance pastoralist's corridors by creating cement markers that establish roughly 150 different paths (Mortiz et al. 2013). With these paths, pastoralists can now only use the resources along these paths, meaning a reduction in tension between farmers and pastoralists. In addition, to help eliminate conflict amongst the pastoralists themselves, each region has separate paths to reduce tension over resources.

This solution was created out of a lack of trust; pastoralists not trusting the farmers to usurp their land and farmers not trusting the pastoralists to allow their livestock to graze on their private property. Both actors are competing for limited resources. With the markers in place, if a pastoralist grazes outside of them then it's a clear violation. If a farmer uses land inside the cement markers for agricultural purposes then again it's a clear violation. Neither group trusted the other to use the shared commons properly, so by creating a visual division of land one can clearly point out when the other is in violation.

The introduction of cement markets is a short term solution. Pastoralists are transhumance because they are searching for resources. Their traditional use of general paths is influenced by resource location continuously changing. Pastoralists' paths are determined by ever changing climatic conditions. Mobility is essential for pastoralism. It has been noted that the Turkana, in northwest Kenya, move an

average of ten to fifteen times a year to find available resources (Meier et al. 2007). By creating fixed migration routes, pastoralist mobility becomes decreased and therefore limits their mobility, decreasing available resources. In semi-arid and arid locations there have been frequent, severe droughts which also affect migration routes (Meier et al. 2007). Pastoralists aren't the only group feeling this pressure, farmers and other land actors are also struggling to cope; thus continuing to increase tension.

Furthermore, conflict between pastoralists and farmers have been because of fertile land. Although transhumances leave no/minimal traces of their paths they tend to set camps along the way; however, how they get there is different each year (Mortiz et al. 2013). These pre-determined campsites are sought after by agriculturalists because of the livestock's manure. Although the cement markers in theory would guarantee pastoralists access to the marked land, the land that pastoralists migrate on has become desirable because of the nutrients from the livestock's manure. It's possible that with a determined route, that land could increase in nutritional value. In addition, that land could also become over-grazed due to the set boundaries, causing the pastoralists to defer from the path and increase tension with other actors. Instead of creating permanent paths, could blocks of land be allocated towards pastoralists that allow free range along the land but also prevents their land to be usurped by farmers? Further research would need to be done in order to understand the pros and cons of this system.

Tech 2

Due to pastoralists' seasonal lifestyle, other actors, including private ranchers, farmers, urban residents, wildlife park wardens, and forest officers, encounter pastoralists on a seasonal basis. In Kenya, pastoralists can't graze in the Maasai Reserves because the government felt cattle competed with wildlife for resources. Kenya's economy is so dependent on wildlife tourism that pastoralists' needs were categorized as less essential by the Kenyan Government (Lengoiboni et al. 2009). With more land being acquired for agricultural purposes or being protected for wildlife, pastoralists have limited available rangeland. Pastoralists hold no rights to previously accessed grazing lands and because other stakeholders want to protect their private property and perennial crops, pastoralists are often denied access to this land (Lengoiboni et al. 2009). Pastoralists cannot register land ownership because of their seasonal migration; however, those that are wealthy enough, meaning they are more than subsistence pastoralist, have been able to buy land around Mt. Kenya, which makes them part of the community and gives them decision making rights (Lengoiboni et al. 2009). With decision making rights, pastoralists are able to attempt to protect land from becoming an agricultural farm and remain a common good.

In an attempt to promote good relations among the other actors and pastoralists, grazing committees and land administrations have been established. This gives pastoralists legal agreements that allow them controlled access to the private land. If pastoralists allow their livestock to overgraze or graze during the times other than those agreed upon beforehand, then the pastoralist is punished (see table below for varying punishments)(Lengoiboni et al. 2009).

Table 2: Nature of spatiotemporal access agreements created by pastoralists and non-pastoralist land use actors

Land use actors	Type of negotiation	timing	rules	penalties
farmers	- spoken	- not specific	- leave when rains begin - pay grazing fees - pay overnight stay fees	- eviction - access denial
private ranchers	- written	- renewable 14 days - renewable monthly agreements	- pay grazing fees - follow grazing plan - no night grazing	- eviction - deny future access
urban residents	- spoken	- not specific	- pay grazing & fees - pay overnight stay fees - no destroying fence	- reinforcement through local leaders
wildlife park wardens	- spoken	- not specific	- no grazing in park - access to water points only	- eviction - confiscation of livestock
forest officers	- N/A	- not specific	- N/A	- suspension

Figure 4 (Lengoboni et al. 2009)

That being said, a majority of land use actors (farmers, urban residents and wildlife wardens) prefer to use spoken agreements to grant pastoralists access, while only private ranchers use written agreements (Lengoboni et al. 2009).

The table below demonstrates how often each actor enters an access agreement with a pastoralists. Access to private land is allowed with the prerequisite of the pastoralists forming a grazing association. This grazing association/committee acts as communication between ranchers and the communities, their duty is to collect a grazing fee (per head), regulate the alternation of herds and conflict resolution/mediation (Lengoboni et al. 2009). The grazing committee is a communication link between the rancher and the pastoralists. This means that the pastoralists themselves don't interact with ranchers. If any party has an issue they go directly to the grazing committee. In addition, if the pastoralists were to break the contract then they would be evicted and have their livestock confiscated until they pay their fine and their punishment is often reinforced by local leaders. Once the agreement has been made, ranchers must allow those pastoralists onto their land for the allotted period. The only way the contract could be broken is through a change in hand of ownership of land, or by the pastoralists breaking the guidelines.

4.3 Access agreements

Table 1: Non-pastoralist land use actors forming spatiotemporal access agreements with pastoralists

		make agreements with pastoralists to allow access				
			never	sometimes	always	Total
Land use category	Farmers	Count	15	1	0	16
		% within Category	93.8%	6.2%	.0%	100.0%
Private ranchers		Count	0	1	1	2
		% within Category	.0%	50.0%	50.0%	100.0%
Urban residents		Count	11	1	1	13
		% within Category	84.6%	7.7%	7.7%	100.0%
Wildlife park wardens		Count	3	0	1	4
		% within Category	75.0%	.0%	25.0%	100.0%
Forest officers		Count	4	1	1	6
		% within Category	66.7%	16.7%	16.7%	100.0%
Total		Count	33	4	4	41
		% within Category	80.5%	9.8%	9.8%	100.0%

Figure 5 (Lengoiboni et al. 2009)

This strategy is different from other forms of agistment agreements because there is a third party, the grazing committee, which is regulating the transactions. Whereas agistment agreements are a way for grazers to get more resources for their livestock. The interactions can be between someone they trust or between strangers; however, regardless of who the grazers make agistment agreements with there's still anxiety felt by both parties. This anxiety is in part because the agreements are made informally or through social contracts (McAllister et al. 2011). By using game theory, a study was done to measure how uncertainty and variability affect behavior in a pastoralist community when making agistment agreements. All of the agreements made were informal and non-binding to realistically represent the reality of the agreements without an intermediary.

In this experiment the participants (Griffith University students in Brisbane, Australia) had the opportunity to enter in a non-binding partnership. This allows either party to remove themselves from the agreement at any time. For those in partnerships the "first mover" decides how much money to give to their part, the "second mover". Then the second mover decides how much money to send back. If the second mover responds, then the amount of money the second mover responded with would be multiplied. This multiplication represents what each mover gained from the trade (McAllister et al. 2011). It is important to note that in an agistment agreement, gains can only be made by the actions of the second mover; therefore, in order for gains to be profitable there must be trust between both parties (McAllister et al. 2011).

The results of the study showed that if trust is observed then there's potential for profit; however, if trust isn't reciprocated then the payoffs for the trusting individuals will decrease (McAllister et al. 2011). The results of the study demonstrated that in this circumstance humans aren't strictly egotistical beings (McAllister et al. 2011). In addition, if individuals are living in an uncertain or vulnerable climate, as pastoralists are, then trust and reciprocity increases (McAllister et al. 2011). In addition, repeated interactions between partners increased trust; this is demonstrated through first movers. The profit is based on the actions of the second movers; thus, if the second movers send a respectable amount of money back then the first movers are likely to enter into a partnership again in the variable treatment. In the fixed treatment or the fixed returns, fewer partnerships were made. The variable treatment then

shows a higher level of trust because the first mover doesn't know what the multiplier will be. The study indicated that this could be explained by the second movers increasing the multipliers to show how much they value this relationship in hopes of it continuing in the future (McAllister et al. 2011). Overall, the second movers did better in the fixed treatment, while the first movers did better under variability (McAllister et al. 2011). The results discussed the idea that variability is part of our social norms; however, trust is more rewarded in a variable system (McAllister et al. 2011). See figure 6 below for data for fixed treatment and variable treatment (McAllister et al. 2011).

Table 2. Mean behavior over 10 rounds.

Round	Fixed treatment				Variable treatment			
	1st Mover transfer	2nd Mover transfer [†]	Multiplier	Retained partner [‡]	1st Mover transfer	2nd Mover transfer [†]	Multiplier	Retained partner [‡]
1	48.2	17.6	4.0	n.a	72.3	46.3	4.0	n.a.
2	48.8	19.3	4.0	17%	79.1	60.6	5.1	70%
3	54.7	23.3	4.0	20%	79.0	45.3	2.9	63%
4	58.5	23.6	4.0	27%	82.1	44.2	5.8	47%
5	65.5	26.4	4.0	50%	81.0	41.4	2.2	73%
6	59.4	25.4	4.0	50%	82.3	44.6	4.9	67%
7	71.0	25.4	4.0	37%	82.9	45.6	5.9	73%
8	65.6	25.6	4.0	37%	82.1	41.0	3.1	73%
9	75.0	29.9	4.0	57%	81.4	39.5	4.0	67%
10	72.6	27.9	4.0	67%	80.5	46.5	2.1	60%
Mean	61.5	24.3	4.0	40%	80.3	45.5	4.0	66%

[†] Mean Second Mover transfers are before application of the multiplier.

[‡] Retained partner refers to the percentage of partners that retained the same partnership from the previous round.

Figure 6 McAllister et al. 2011

Having pure-private-property rights isn't viable in a fluctuating environment. The best outcomes are achieved when an intermediate amount of trust is place in others (McAllister et al. 2006). When spatial variation is high then the best outcomes occurred when there was a much higher degree of trust in others (McAllister et al. 2006). When spatial variation is low the benefit of being trusted is marginal (McAllister et al. 2006). Agistment agreements in the Horn of Africa are important because of the unpredictable weather conditions as long as individuals are able to trust each other. By having a third party grazing committee the risk of trusting an individual is decreased and allows for greater levels of profit.

Tech 3

Index Based Livestock Insurance (IBLI) is another form of technology that has been created to help pastoralists in Kenya tackle changing climates, specifically drought. Pastoralists' production goes through "boom and bust" periods. Research on these dramatic changes demonstrates that these shocks lead to human suffering, particularly during busts (McPeak et al. 2010). In addition, during booms, research showed that pastoralists made financial decisions that prevented them from truly gaining from the boom (McPeak et al. 2010).

Figure 1: Standardized NDVI (1982-2008) for North Horr and Kargi

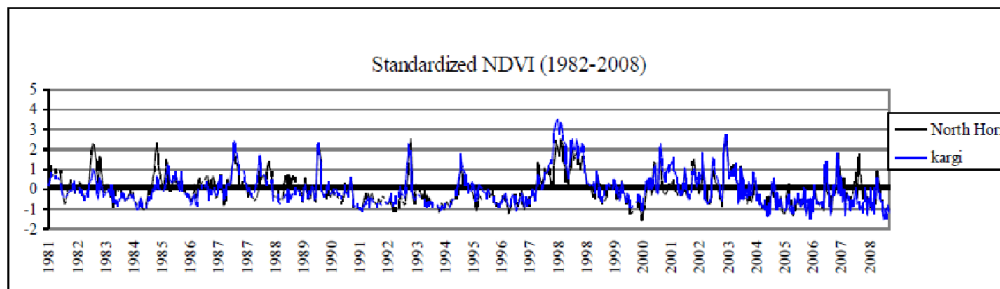


Figure 7: Standardized NDVI (1982-2008) for North Horr and Kargi in Northern Kenya (McPeak et al. 2010).

IBLI is measured by Normalized Differential Vegetation Index (NDVI) (McPeak et al. 2010). The NDVI is an indicator of vegetation coverage and it monitors drought. If NDVI is low then that indicates drought and those who purchased IBLI at the beginning of the season would be compensated accordingly (see graph above for distribution of NDVI in Northern Kenya). Pastoralists can purchase IBLI based on each 'livestock unit' meaning per one animal. If NDVI is at or lower than the set level of vegetation then the insurance payout will be based on percentage of incremental loss (McPeak et al. 2010). By creating IBLI, pastoralists now have access to a financial instrument that allow them a way to manage the risk of the "boom and busts". The challenge with IBLI is that not all pastoralists are financially stable enough at the beginning of a season to buy the insurance. Moreover, the insurance can only be bought at the beginning of each season meaning there are limited times when one can decide whether or not to purchase the product. This form of insurance only accounts for death due to droughts. If the livestock were to die because of disease or bad water, then they wouldn't be compensated. Pastoralists aren't paid based on number of deaths, they're only compensated on predicted number of deaths due to lack of vegetation (see graph below for varying livestock deaths in Northern Kenya).

Figure 3: Reason cited for livestock mortality in the four Marsabit sites quarterly 2000-2002

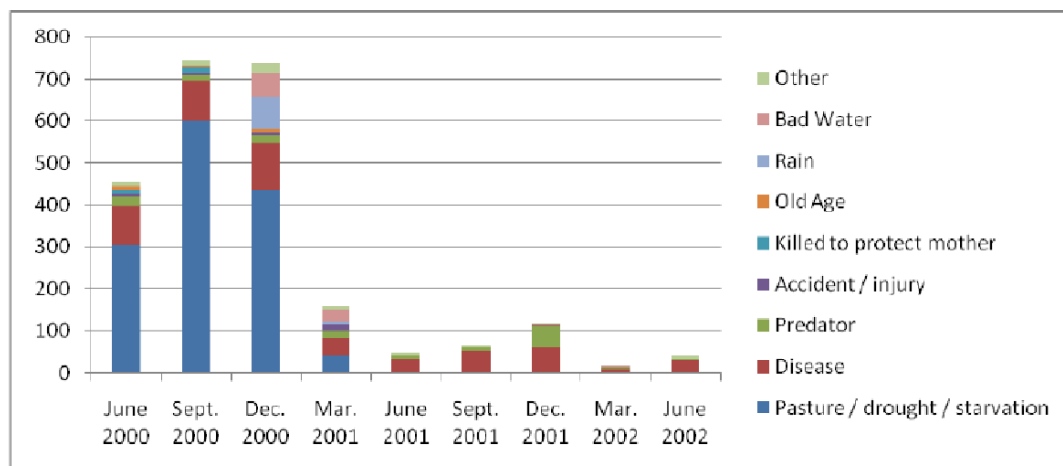


Figure 8: Reasons cited for livestock mortality in the four Marsabit site quarterly 2000-2002 in Northern Kenya (McPeak et al. 2010).

This graph demonstrates that drought/starvation are the main causes for livestock death for pastoralists in Kenya. IBLI is considered to be better than traditional insurance because IBLI doesn't require an insurer to monitor the pastoralist's activities (Mude et al. 2010). Not only is this more cost effective, it is also a more accurate way of measuring loss. Regardless of whether not a pastoralist faces losses that year, as long as the NDVI reaches the strike point the pastoralist will be compensated. This indicates more of a reward for the pastoralists because IBLI recognizes the inherent challenges that come with the rangeland in the Horn of Africa. This means that fewer individuals are becoming poor because of drought and allows for greater economic growth (Mude et al. 2010). That being said, there are challenges to IBLI as well. The data/images used to calculate NDVI must be of high quality, there must be an optimal insurance index to maximize profit and reduce poverty, there must be a demand for IBLI (meaning pastoralists need to understand the cost/benefits of it) and there needs to be a cost effective way of delivering the IBLI payout in remote areas (Mude et al. 2010). In addition, there needs to be local agents to help facilitate the interactions. This provides pastoralists with an individual they can approach for any inquiries or issues they've faced.

The pilot IBLI was launched in Marsabit, Northern Kenya; however, if IBLI were to become widespread the strike point and cost per head would have to be adapted. Various locations face various levels of drought; thus, certain strike points might be too high or too low for other areas. In addition, based on travel routes, calculating strike points or cost per head may be challenging.

Tech 4

Rangeland management and building of grazing enclosures has been used as a technique by the Borona pastoralists of Ethiopia for the past fifty to sixty years (Solomon et al. 2006). By building enclosures they limit the area where their livestock can graze, which allows the other areas time to grow more vegetation. These enclosures are typically found at the pastoralists seasonal camps. When building a small enclosure pastoralists use bushes as fences. Large enclosures were "delineated by natural

features and protected by decree” (Solomon et al. 2006). The amount of young/sick livestock and the availability of forage in a given year determines the size of the enclosures. 54% of Borona pastoralists said they felt that the available rangeland wasn’t being utilized to its maximum potential because: 1) inaccessible distance, 2) lack of infrastructure, 3) mountainous topography, 4) fear of wild animals 5) unavailability of water. However, they stressed that their primary constraint is recurrent drought (Solomon et al. 2006). The elders in the community stated that available rangeland has decreased over time but it has been particularly rapid in the past fifteen to twenty years (Solomon et al. 2006). Pastoralists are dependent on herbaceous species for their livestock to thrive, particularly sheep and cattle; however, recently there has been large amount of bush encroachment specifically that of woody species that only goats and camels can survive on (Solomon et al. 2006).

As a way to attempt to provide aid, organizations have paid or provided food-for-work to Borona pastoralists for the removal of woody species. When Borona pastoralists were asked about this method of aid they showed little interest in engaging in it (Solomon et al. 2006). Invasive species encroachment is a serious issue; however, removal of woody species is a laborious process. Due to pastoralists’ mobile lifestyle the Boronas stated that they could just move to a different location if it became too deprived of herbaceous species. In addition, Boronas may not want to exert the effort of removing the woody species only to have to move a few months later because of climatic changes. Figure 9 demonstrates the six main constraints on livestock production where recurrent drought is considered the greatest issue and communal land tenure is the lowest constraint.

Attributing constraint factors (mean rank) to livestock production as ranked by Borona elders in the five peasant association¹ (respondents, $n = 128$)

Number	Mean rank ²	Attribute
1	1.90 ^a	Recurrent drought
2	2.25 ^b	Grazing and feed shortage
3	2.92 ^b	Water scarcity
4	4.30 ^c	Animal diseases
5	4.79 ^c	Predators
6	4.84 ^c	Communal land tenure

¹Attributes were listed and ranked from most important (1) to least important (6).

²Entries accompanied by the same letter were not ranked differently ($P > 0.05$) according to Friedman’s test (Steel and Torrie, 1980).

Figure 9: (Solomon et al. 2006)

The Borona pastoralists also displayed a lack of trust of the government and a fear of being reprimanded by their local administration (Solomon et al. 2006). The Borona pastoralists stated that bush burning is an effective rangeland management technique, especially for the removal/preventing of woody species. When asked why they weren’t practicing this anymore, 95% of the respondents said it was because the Ethiopian government put a ban on bush burning. Moreover, the other 5% said the ban was removed a few years ago but they were still afraid of practicing this technique because fear of prosecution (Solomon et al. 2006). This demonstrates that even though pastoralists have found a form

of technology that works effectively for them, fear of government prevents them from utilizing it. Instead they attempt to build enclosures or create new camp sites for their seasonal migrations.

Borona pastoralists continue to face rangeland deterioration. Figure 10 demonstrates what Borona pastoralists considered to be of biggest threat. Number one being recurrent drought and the least concerning being the development of water ponds.

Attributing factors (mean rank) to rangeland deterioration as ranked by Borana elders in the five peasant association¹ (respondents, $n = 128$)

Number	Mean rank ²	Attribute
1	1.33 ^a	Recurrent drought
2	2.56 ^b	Increased human and livestock population
3	2.78 ^b	Increased use of land for cultivation
4	3.72 ^b	Ban on the use of fire
5	4.61 ^c	Development of water ponds

¹Attributes were listed and ranked from most important (1) to least important (5).

²Entries accompanied by the same letter were not ranked differently ($P > 0.05$) according to Friedman's test (Steel and Torrie, 1980).

Figure 10: (Solomon et al. 2006)

Bottom of Hourglass

Pastoralists contribute very little towards the creation of climate change; yet, they feel the impacts of it daily. Humanitarian groups and governments attempt to help pastoralists adapt to climate change through the development of technologies or institutions. The question is whether or not these technologies are actually helping the pastoralists and if these groups have an agenda. Pastoralists live off of common land and resources. Outsiders interpret pastoralists as not using the land efficiently or effectively; yet, pastoralist's lifestyle has been adapted as a way to live off of harsh environments where cultivation may not be possible. Individuals assume that because they come from a place of privilege in either lifestyle or education that they have the knowledge to help pastoralists deal with climate change.

The cement markers were built as a way to make the pastoralists migration route permanent; stopping pastoralists from grazing on other actors land and to prevent the usurpation of pastoralists grazing land for the agricultural purposes or to remove it from the commons. Although this idea was created through a process of consensus amongst the actors, it's a short term fix. The purpose of pastoralists mobile lifestyle is to move to where the resources are. By making their path sedentary, pastoralists become more vulnerable to irregular rainfalls and lack of consistent resources. The cement markers decrease available commons. It builds a place for pastoralists to roam and makes that region only available to pastoralists. It may decrease tension; however, if a season is particularly dry then pastoralists will have to travel further to find resources; making it more challenging for livestock to survive the journey.

Access agreements through grazing committees allows for connections to be made that might not be made otherwise. It also decreases the risk on both parties because, in theory, the grazing committee removes that risk by becoming the middleman. It also decreases tension because if there is

an issue felt by either party they can go to the grazing committee that will then address the problem. The pastoralists are charged a fixed rate per livestock head and are guaranteed access to ranchers land if they pay. If pastoralists break the contract or don't pay then the grazing committee can go to local leaders to ensure punishment. In addition, this process is a decentralized way to manage land and escape the tragedy of the commons. This solution doesn't involve any outside sources meaning there is no dependence on an Non Governmental Organization (NGO) or government to continue the program.

Index Based Livestock Insurance is a way to reduce levels of drought felt by the pastoralist. Although pastoralists may still go for long periods between resources, the anxiety of becoming impoverished is decreased. This form of insurance is financially efficient because the drought levels are measured through satellite images. Regardless of the number of livestock lost during the season, as long as the strike point has occurred, pastoralists will be reimbursed accordingly. The challenge is that each pastoralist has different migration routes; thus, drought levels are felt differently amongst pastoralists. The dilemma with this technology is that the pastoralists are entirely dependent on the individuals running the program. It isn't a community driven program, although helpful, it creates dependence on outside individuals. In addition, this form of technology is only for drought levels. If it were to be a wet season and a disease were to break out then the pastoralists wouldn't be compensated.

Another form of rangeland management is through building enclosures at the pastoralists' seasonal base camps. By using invasive species as material to build their fence there's no production cost. By rotating which enclosures the livestock roam in, it allows time for the other fenced off areas to grow. This method isn't new to pastoralists; however, to encourage pastoralists to continue to build the fences, NGOs have been paying pastoralists based on per hectare built. By paying the pastoralists for their labor, NGOs hope that the pastoralists will see the benefit of their work and once the NGOs program is phased out, pastoralists will continue this process. The issue is that once the program is phased out, the pastoralists lose a source of income that they'd become dependent on. Although the pastoralists might be gaining money through this rangeland management technique, the initial shock of losing that source of income can be extreme, especially if it occurs during a particularly dry season.

The attempt to help decrease the effect of climate change felt by pastoralists is a fairly new concept. Little research has been done to understand the cost and benefits of the previously mentioned technologies. In addition, whether the pastoralists themselves understand and like the technologies is another dilemma. As humanitarian aid has been used as a mask for political agenda, first a level of trust has to be established. Hardin predicted that those who get their resources from commons will use it egotistically, that the commons would become depleted and over-used rather quickly; however, pastoralists have survived for centuries and the decrease of resources has nothing to do with how they use the commons. In fact, their lifestyle is an efficient use of land. As climate change has become a reality for pastoralists they have new techniques that allow them to continue this lifestyle. Pastoralists and outside groups have created institutions that correlate with Ostrom's research; however, the reason why outside groups get involved with pastoralists' lives is because of an assumed tragedy of the commons and with the added challenge of climate change.

So can we trust people to take care of resources? It ultimately depends on why individuals need this resource and what their relationship is with it. If the resource is needed for an individual's livelihood then said individual is more likely to use the resources responsibly. Once multiple actors become dependent on the resource then the level of trust decreases because each actor has their individual gain. Relations between actors become strained and a social hierarchy becomes established. Once this occurs, outside individuals attempt to step in and come up with a solution; however, these outsiders

have limited knowledge on what it means to depend on that resource. So then the question becomes, can we trust the outsiders to help the resource users?