STEPPE GENEROSITY: COOPERATION, LABOR SHARING, AND GENEROUS
GIVING AMONG MONGOLIAN PASTORAL NOMADS

By

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ABSTRACT OF THE DISSERTATION

Steppe Generosity: Cooperation, Labor Sharing, and Generous Giving among Mongolian
Pastoral Nomads

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Cooperation abounds in human communities and enables humans to gain access
to resources, form coalitions with others, mitigate economic and ecological risks, and
signal personal qualities to others. Cooperation has been documented in all human
subsistence patterns, including pastoralist societies. However, cooperation in Inner Asian
pastoral nomad cultures remains understudied and poorly understood from a behavioral
perspective. In this dissertation, I use a human behavioral ecology approach to understand
1) the dynamics of labor sharing in a remote community of Mongolian pastoralists, 2) the
major drivers of generous giving in rural Mongolia, and 3) how natural disasters, like
severe winter storms, affect Mongolian pastoralists' willingness and ability to engage in
cooperative behavior. Mongolian nomadic pastoralists were chosen as the community of
focus because they engage in a variety of labor sharing practices and are affected by
ecological risks such as droughts and severe winter conditions.

In Chapter 2, recipient identity conditioned heuristic (RICH) allocation games are
used to explore generous giving among both men and women in a Mongolian herding
community and show that generous giving is driven primarily by a kinship, social
reputations, and a person's perceived neediness. In Chapter 3, social network analyses are

used to explore labor sharing ties for 6 commonly cooperative labor types in a sample of 47 pastoral nomad households and show that labor sharing ties are largely explained by blood and marital kinship and social reputations. In Chapter 4, common pool resource experimental economic games are used to explore the effects of natural disasters on cooperation in Mongolia. While the results are inconclusive, the study represents the first-ever application of this type of experimental game in Mongolia and show that Mongolian pastoralists can effectively manage common pool resources in an experimental setting. The dissertation concludes in Chapter 5 with a synopsis of the results of each chapter and suggestions for future research on cooperation in both Mongolia and pastoralist societies more generally.

First and foremost, I am extremely grateful to my academic advisor, Dr. Lee Cronk, for his support and guidance during the last five years. He has provided countless instances of academic support, methodological expertise, and encouragement, and has kept me on track to finish my doctoral degree with something meaningful to contribute to the study of human behavior. However, he was never so academic as to deny lengthy discussions of Star Trek or some Lord of the Rings impersonations. Being a part of the Cronk Lab has been a fantastic part of my academic career and I am a better student and scholar for it.

I am also grateful to my graduate committee, Drs. Dorothy Hodgson, Ryne Palombit, and Simon Wickhamsmith for serving as committee members and mentors. Their collective advice and input helped me to take a more holistic approach to my research that accounts for broader perspectives on human evolutionary studies, ethnography of pastoralist cultures, and the rich cultural and literary traditions of Mongolia itself.

The Human Generosity Project has been instrumental in the development of my research aims and I am grateful to Drs. Athena Aktipis, Daniel Sznycer, Cathryn Townsend, and Matthew Gervais for their advice on methods and data collection since the beginning of my doctoral program. Their advice, and the advice of all HGP team members has been extremely helpful in my study design and funding applications. It is also great to be able to contribute my research data to a broader team-effort to explore human generosity and cooperation.

I would have never began this long journey if it had not been for the generosity of Dr. Clifford Montagne and the BioRegions International program at Montana State

Finally, I thank my family and close friends for their endless support during the thick and thin of my academic career. My mother taught me how to be curious about the world around me, and that that could be a life's pursuit. My father, much more practical, still supported me even when my decisions seemed brainless, and my brother and sister have always been supportive of their crazy brother who always seems to have disappeared in some far-off corner of the planet. Lastly, I owe everything to my wife, Robyn, for putting up with more research and travel than I could have asked. Thank you for not divorcing me and for being a person I can always be myself around.

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Chapter 1:

Introduction

1.1 Dissertation Synopsis

Cooperation and coordination through mutual defense, group foraging, cooperative breeding, and risk management are widely recognized by biologists and behavioral ecologists in social species (Dugatkin 2013). Cooperative behavior has been documented in diverse socially living species including insects (Borsuk et al. 2011; Nowak et al. 2010; Pierce et al. 1987), birds (McDonald 1989), wolves and other canids (Marino et al. 2012; Moehlman and Hofer 1997), nonhuman primates (Grueter 2013; Yamamoto and Tanaka 2009), and humans (Cronk and Leech 2013). In human social groups, cooperation serves as a means for individuals and groups to mitigate risk (Cronk et al. In Press; Aktipis et al. 2018), access scarce resources (Kaplan et al. 2009), engage in defense or aggressive action towards other groups (Mathew and Boyd 2014; Bowles 2009), and maintain social norms of reciprocity (Boyd and Richerson 1988; Trivers 1971). Cooperative behavior has been documented in many forms throughout human social groups and may be one of the reasons humans have been able to expand into and exploit every major biome on Earth (Moran 2008).

Within human subsistence patterns, pastoralists have been shown to exhibit a great deal of coordination and cooperative behavior (Thomas et al. 2015; Lyle and Smith 2014; Aktipis et al. 2011; McCabe 2010). Pastoralist cultures tend to live in marginal ecosystems that are less ecologically suited for horticulture or agriculture (Khazanov 1994), and cooperation often allows pastoralists to access labor (McCabe 2010; Upton 2008, Fernandez-Gimenez 2002), engage in warfare or defense (Mathew and Boyd 2014;

Hendrickson et al. 1994), and mitigate ecological and economic risks (Aktipis et al. 2016; Hao et al. 2015).

Inner Asian pastoralists, especially those living in the Republic of Mongolia are an ideal population to study cooperation in pastoral societies because they live in highly variable climatological conditions and temperature extremes (D'Arrigo et al. 2001). They are also frequently affected by ecological risks such as severe winter weather conditions and droughts (Fernandez-Gimenez et al. 2012; UNDP 2010). Furthermore, unlike pastoralists living in the former Soviet Union, China, and East Africa, which have largely been subject to policies to privatize grassland and settle pastoral nomads according to western ranching models (Conte and Tilt 2014, Fratkin 2001; Humphrey and Sneath 1999), pastoralists in the Republic of Mongolia have retained nomadic pastoralism and continue to manage grasslands as common pool resources.

Mongolian pastoralists have been shown to depend on social ties and kinship to manage labor and resources, especially as the Republic of Mongolia has transitioned from a socialist planned economy to a market economy (Murphy 2014; Sneath 2002; Bold 1996; Cooper 1993). However, from a behavioral ecological perspective, comparatively little attention has been given to understanding cooperation among Mongolian pastoralists, and to date, few behavioral ecology studies have been conducted in Mongolia (see Gil-White 2004 for a notable exception).

In this dissertation, I use the human behavioral ecology approach to investigate cooperation and labor sharing among Mongolian nomadic pastoralists. I focus on three major areas: 1) Understanding the demographic, economic, and reputational characteristics that drive labor exchange in rural Mongolia, 2) Understanding how

socioeconomic, kinship, and reputational factors drive generosity among Mongolian nomadic herders, and 3) Investigating how ecological risks (most notably, severe winter storms) affect Mongolian herders' decisions on how to manage common pool resources.

1.2 Dissertation Organization

In this chapter, I introduce the main background theory and literature for the dissertation. I then provide background information on the field study location in Tosontsengel, Mongolia and the community of nomadic pastoralists I spent the academic years 2016 – 2017 living among. Each subsequent chapter (chapters 2, 3, and 4) was written as a manuscript for publication and has separate methods sections. There is significant theoretical overlap in the background and methods sections of each of these chapters. In chapter 2, I present the results of a recipient identity conditioned heuristic (RICH) allocation game and its implications for understanding generosity in rural Mongolia (Gervais 2017). In chapter 3, I discuss the results of social network analyses of six types of labor in a community of 47 nomadic pastoralist families living in Tosontsengel, western Mongolia. In chapter 4, I discuss the results of two common pool resource experimental economic games conducted in Tosontsengel and Orkhon, Mongolia, and how the results of these experimental games can be used to understand the effects of ecological risks on common pool resource management in Mongolia. Chapter 5 presents a synopsis of the results of each of the studies mentioned above and a discussion of the dissertation's broader implications for both Mongolian Studies and human behavioral ecology. I conclude with suggestions on potential future research directions for understanding cooperation in both Mongolia and in pastoralist societies more generally.

1.3 Introductory Theory

1.3.1 *The Human Behavioral Ecology Approach*

The overall aim of this dissertation is to explore how social reputations, kinship, and other demographic characteristics drive generosity and cooperation among pastoral nomads in the remote Mongolian countryside and how Mongolian common pool resource management is affected by climatological risks. In this introductory chapter, I begin with a brief description of the human behavioral ecology approach that informs each of the studies presented in chapters 2, 3, and 4. I then move on to a discussion of the current human behavioral ecological literature on human cooperation.

Human behavioral ecology (HBE, hereafter) is particularly useful for analyzing the diverse means by which human communities coordinate and cooperate to overcome group-level challenges and times of resource scarcity. HBE uses a variety of quantitative social science and biological methods that are grounded in Darwinian evolutionary theory to test hypotheses related to the origins and contemporary dynamics of human behavior (Smith and Winterhalder 1992). Because HBE relies on quantitative data and hypothesis testing, the approach provides a framework with which to compare behavior across populations. Furthermore, the broad applicability and uniform assumptions of HBE theory and methods allow practitioners to look for evolutionary parallels among cultural groups' responses to socioeconomic and ecological constraints.

1.3.2 *The Behavioral Ecology of Cooperation*

The cross-cultural ethnographic and behavioral ecology record has noted the widespread prevalence of generosity, sharing, coordination, and cooperation in human societies (Cronk and Leech 2013). Evolutionary psychologists and behavioral ecologists

have posited several hypotheses to explain the evolution of cooperation and altruism as components of the human behavioral repertoire. These hypotheses include the maintenance of reciprocity and reciprocal altruism, the honest signaling of partner quality and willingness to adhere to social norms, kinship and inclusive fitness, risk management, and reinforcing social connectivity through social reputations and cheater detection.

Researchers studying cooperation and sharing in humans have noted the prevalence of reciprocity in resource sharing, altruism, and even violence (Bowles and Gintis 2000; Trivers 1971; Sahlins 1965). Reciprocity and reciprocal altruism can reinforce social ties and minimize the risks of selecting partnerships with non-cooperative people or people who desire to free-ride on the generosity of others (Axelrod 1997; 1984). In addition, some researchers note the prevalence of what they term "strong reciprocity" (e.g. generosity) in human social groups and argue that generous acts enable individuals to signal their quality as cooperative partners and reinforce cooperative connectivity in groups (West et al. 2006; Bowles and Gintis 2004; Fehr et al. 2002). Thus, reciprocal ties in social groups not only signal a person's quality as a potential cooperative partner, but also may enable sharing norms to develop and diminish the risk of free-riding behavior (West et al. 2006). Violations of social norms regarding sharing, reciprocity, and generosity (e.g. prohibitions against stinginess) can be diminished through social ostracism and punishment of individuals who free-ride on the generosity of others or display non-cooperative behavior (Berbesque et al. 2016; Gintis 2000, Boyd and Richerson 1989; Boyd and Richerson 1988). Through this mechanism, reciprocal ties

between people and within larger networks may both drive and reinforce cooperation by providing selective benefits to cooperative individuals.

Because humans can infer the mental states of others and display high degrees of social intelligence, we are often able to both infer and predict the desires and intentions of others (Byrne and Whiten 1989). Based on these abilities, humans can detect signals of others' willingness to engage in cooperative behavior. Some theorists argue that selection favors individuals who can choose partnerships with cooperative people and avoid forming close relationships with people who intend to free-ride on the cooperativeness of others (Cosmides and Tooby 2005). Thus, it may also be in an individual's best interest to signal his or her quality as a cooperative partner to others, even if these signals are costly in energy or resources (Gintis et al. 2001). Cooperative behavior can serve as a hard-to-fake and honest signal of partner quality and eliminate the risks of cooperating with cheaters (Bliege-Bird et al. 2001; Irons 2001). Thus, costly signaling can lead to the long-term maintenance of cooperative behavior in social groups because it helps eliminate the free-rider problem (Sosis and Bressler 2003; McAndrew 2002). For example, previous studies indicate that participation in communal religious rituals that are physically or emotionally taxing (Soler 2012; Sosis and Ruffle 2003), membership in community cooperative organizations (Gerkey 2013, Gelcich et al. 2015), and public displays of resource provisioning (Alvard 2009; Smith and Bliege-Bird 2000) can all promote cooperation in human societies.

Costly signaling models of cooperation predict that hard-to-fake signals of cooperation can help people navigate social networks and select for partnerships with cooperative individuals while avoiding less cooperative members of the community

(Cosmides et al. 2005). As a result, social prestige and reputations for prosociality may serve as valuable currency that humans use to both signal their quality as cooperative partners and to avoid forming relationships with norm-violators or non-cooperative individuals (von Rueden and van Vugt 2015; Iniguez et al. 2014). Agent-based models of the effects of prestige and social reputations on cooperative behavior find that reputations can help reinforce reciprocity in social networks, strengthen cooperative relationships, and eliminate the risks of cooperating with free-riders (Fu et. al 2008; Nowak and Sigmund 1998). Similarly, empirical and ethnographic investigations of the effects of social reputations on cooperation also indicate that individuals are acutely aware of being observed and assessed by others and that reputation-based partner choice can reinforce cooperation and help communities solve collective action dilemmas (Sylwester and Robert 2013; Ahn et al. 2009; Iredale et al. 2008; Haley and Fessler 2005).

In cultural anthropology, the importance of status, prestige, and social reputations in economic and political life was first systematically studied by Sahlins who noted the significance of status and prestige in providing both individual and group-level benefits (Sahlins 1963). Since that time, there have been numerous ethnographic and behavioral ecological studies to test the hypothesis that social status and reputations are primary drivers for the evolution and maintenance of cooperation in human societies. For example, empirical studies in horticultural and foraging societies have shown that social status, prestige, and reputations both help reinforce cooperation in small-scale societies and provide fitness enhancing benefits to high-status individuals such as economic benefits and increased access to reproductive partners (Macfarlan et al. 2013; von Rueden et al. 2011). High status individuals have also been shown to have greater health benefits,

decreased morbidity, and increased offspring survivability relative to lower status individuals in small-scale societies (Lyle and Smith 2013; von Rueden et al. 2011). Social status and reputations also provide people with greater influence over others and greater decision-making power (von Rueden et al. 2008). Thus, it is possible that social reputations and prestige can be powerful signals that enable individuals to both signal their quality as cooperative partners and access partnerships with others (Macfarlan and Lyle 2015; Barclay 2011; Noe and Hammerstein 1994).

While social reputations and prestige may serve as a means for individuals to signal their quality as cooperative partnerships with others, inclusive fitness models predict that genetically related kin should also behave altruistically towards one another. This is because cooperation among genetically related individuals enhances the fitness of people sharing the same genetic lineage (Krupp et al. 2008; Richerson and Boyd 1999; Chagnon and Bugos 1979). By behaving altruistically towards genetically related kin, individuals can help increase relative gene frequency within the population, and thus, the long-term success of a lineage (Hamilton 1964). Affinal and fictive kin relationships may also serve as a mechanism for the formation of cooperative partnerships among individuals who are related by marriage or through mutual membership in organizations and social groups (Thomas et al. 2015; Alvard 2009). This may partially explain the widespread use of kin terms to describe relationships between non-genetically related members of social groups, religious institutions, mutual aid societies, and fraternal organizations (Cronk and Gerkey 2007). Thus, genetic relatedness, affinal kinship, and fictive kinship may serve the formation of cooperative relationships both within and between social groups.

While consanguineal, affinal, and fictive kinship may foster and reinforce cooperation in social groups, Aktipis et al. (2018) and Roberts (2005), among others, argue that cooperation and generosity allow individuals to selectively choose to cultivate relationships not only with kin, but also with any other individuals who can directly influence each other's ability to replicate genes (Akitpis et al. 2018; Roberts 2005; Kelley and Thibaut 1978). Thus, this fitness interdependence predicts that actors in a social network should actively pursue cooperative partnerships with other individuals with whom they share positive interdependence while minimizing interactions with actors with whom they are negatively interdependent.

Prosociality among people sharing positive fitness interdependence, kinship connections, or social bonds can help individuals mitigate the effects of ecological, economic, and social risks (Cronk et al. In Press; Aktipis et al. 2018). The benefits of cooperation in mitigating risk often come in the form of mutual assistance, the assurance of the cooperation of others in aggressive or defense actions, and the ability to draw on networks of exchange during times of scarcity (Macfarlan et al. 2012; Hao et al. 2015; Wiessner 2002). These systems of risk mitigation can differ depending on the nature and timing of the risk (e.g. if the risk is synchronous or asynchronous) and depending on the nature of the relationship between two individuals (Cronk et al. 2015; Aktipis et al. 2011). However, cooperation in various forms can serve as a means for individuals to manage risk and promote long-term survival through assurances of mutual aid.

1.3.3 Cooperation in Mongolian Pastoral Societies

From the perspective of HBE, and relative to pastoralist societies in other regions of the world, Mongolian nomadic herders are an understudied and less well understood

pastoralist culture. While domesticated livestock herding has been present on the Mongolian Plateau and in Inner Asia for at least 3 millennia, Mongolia has only recently come to the attention of Western social scientists (Lattimore 1941). This is due in part to the remoteness of rural Mongolian populations and because Mongolia's 20th Century history as a communist state made the nation effectively closed to Westerners until the early 1990s (Humphrey and Sneath 1999). Since the 1990s, Mongolia's transition from a socialist command economy to a market economy has effectively opened the nation and the pastoral economy to international travel and international markets. Furthermore, it has also brought Mongolia to the attention of a growing number of both Western and East Asian social scientists.

The body of ethnographic research on both Mongolian pastoralists and the Republic of Mongolia has most closely focused on Mongolia's transition from socialism and the effects of new policies and new industries (most notably, mineral extraction) on the Mongolian state, society, and pastoral economy (Dierkes 2012; Endicott 2012; Humphrey and Sneath 1999, 1996). As the body of historical, ethnographic, and economic literature on Mongolia grows, anthropologists have also begun to look more closely at Mongolian pastoralists' social behavior, economic decision making, and the effects of ecological changes on Mongolian grasslands (Murphy 2014; Ericksen 2014; Fernandez-Gimenez et al. 2012; Gil-White 2004). Thus, Mongolia presents an ideal location to conduct both ethnographic and behavioral ecology research for several reasons. First, unlike pastoralists living in other parts of the world and herding populations in China and Russia, Mongolian pastoralists maintain the seasonal nomadic migration (albeit in reduced form) that has categorized Inner Asian pastoralism at least

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since the Bronze Age (Fratkin 2001; Humphrey and Sneath 1999; Lattimore 1941).

Second, because of land laws that were first codified in the 12th Century during the

Mongol Empire, and are still in use today, the Mongolian steppes largely remain common

pool resources rather than fragmented privatized rangeland (Endicott 2012). Finally, as a

result of Mongolia's transition to a market economy, and the absence of state-level social

support that existed under socialism, Mongolian herders are now relying more heavily on

labor sharing among groups of extended kin to manage labor and resources (Upton 2008;

Sneath 2002). Thus, they are an ideal population to study cooperation and labor sharing.

To understand how cooperation and labor sharing function on the contemporary

Mongolian steppes, it is necessary to briefly explore the history of land use, social

organization, and the pastoral economy of the Republic of Mongolia. Mongolian nomadic

pastoralists rely primarily on natural grassland and seasonal mobility to sustain herds of

sheep, goats, horses, camels, cattle, and yaks (Humphrey and Sneath 1999). Patterns of

seasonal mobility and herd species compositions differ depending on the region of

Mongolia pastoralists are living in and can be regular or change from year-to-year

depending on the predictability of annual weather and precipitation in a given region

(Humphrey and Sneath 1999; Sheehy 1993). Herders are keenly aware of livestock

species' nutritional and water needs and choose seasonal pastures based on traditional

ecological knowledge and ideal microclimates for each season (Fernandez-Gimenez

2000). Thus, seasonal nomadism allows herders to both seek the ideal conditions for each

season and allow seasonal pastures to regenerate after a season of grazing pressure.

During the last 1,500 years of Mongolian history, the sociopolitical structure of

the pastoral economy has transitioned considerably. Prior to the formation of the Mongol

Empire, the Mongolian Plateau was populated by loose tribal and clan confederations which were unified by Chinggis Khan to form a land empire that extended from Korea to Eastern Europe (Pedersen et al. 2014; Weatherford 2004). Following the collapse of the Mongol Empire and the waning of Mongol political dominance in East Asia, the Mongolian Plateau become a territorial component of Imperial China and remained under the authority of the Manchu Qing Dynasty (1644 – 1912) until the early 20th Century. After the Xinhai Revolution ended Manchu rule in China, Mongolia declared independence from China and formed an independent kingdom under the leadership of the Bogd Khan, who served as both the political and Tibetan Buddhist leader of the Mongol Kingdom (Batsaikhan 2014; Endicott 2012).

In the 1920s, the Bogd Khan was deposed by communist revolutionaries and Mongolia became a socialist republic that was heavily influenced and subsidized by the Soviet Union (Batsaikhan 2014; Kuzmin and Oyunchimeg 2009; Humphrey and Sneath 1996a; 1996b). The Mongolian People's Republic lasted until the early 1990s when the command economy could not be sustained because Soviet economic aid was no longer available (Humphrey and Sneath 1999). After the end of socialism in the early 1990s, Mongolia became a market economy, and the pastoral economy has become increasingly integrated with global markets for livestock products since that time (Dierkes 2012; Potkanski 1993).

During the pre-socialist period (prior to the 1920s), Mongolian land, society, and economic life were controlled and regulated by feudal princes and clan patriarchs who nominally represented the ruling emperor in Beijing. In addition, much of Mongolian political, economic, and social life was controlled by Tibetan Buddhist monasteries that

owned large herds of livestock and maintained labor forces of herders (Endicott 2012).

Land and grazing territory that wasn't under the direct control of monasteries was

organized according to clans based on extended patrilines that were governed by a ruling

prince or clan patriarch (Batsaikhan 2014; Humphrey and Sneath 1999). However, during

this period, Mongolian land law enforced the management of grazing territory as a

commons, and while clans and tribal groups restricted access to grazing territory by

neighboring groups, no one family could claim ownership of grazing territory.

During the pre-socialist period, pastoral labor and seasonal nomadic migration

were managed by groups of extended kin that formed circular encampments known as

khuree. *Khuree* served as basic mutual defense groups during a time in which raiding and

military operations by neighboring clans, tribal groups, and feudal leaders were more

regular (Bold 1996). *Khuree* were further subdivided into smaller groups of herding

families known as *khot ail* which usually consisted of groups of two to ten usually

interrelated families who would co-manage livestock, share seasonal labor, and occupy

pastoral territory based on customary use rights (Sneath 2003; Fernandez-Gimenez 1999;

Bold 1996; Cooper 1993; Mearns 1993). *Khot ail* served as herding families' main source

of labor for herding tasks.

After the formation of the Mongolian People's Republic (1924 – 1992), Buddhist

monasteries, feudal leaders, and clan leaders were actively purged by the communist

government, and herders were often forced to "forget" their clan identity (Batsaikhan

2014). During the 1930s, private ownership of livestock herds was ended, and the

national government collectivized land, labor, and livestock into socialist collectives

known as *negdel* (Humphrey and Sneath 1999). *Negdel* organized herding labor, seasonal

migrations, and set annual production quotas for livestock products. State-owned animals were divided among herding families, and the customary *khot ail* social structure was disrupted as collectives grouped families according to specific labor tasks or livestock species (Endicott 2012; Upton 2008). The collectives also became herding families' source of basic social support as they provided veterinary assistance, emergency livestock fodder, transportation for nomadic migrations, and annual salaries to each herding family (Batsaikhan 2014; Humphrey and Sneath 1999). Therefore, during the socialist period, customary systems of cooperation and labor sharing among extended families were diminished as the local and national governments regulated the pastoral economy and organized seasonal labor.

Following the end of socialism in Mongolia in the early 1990s, *negdel* were dissolved and collective livestock were privatized and distributed to individual households (Endicott 2012). For the first time in nearly a century, herding families were now responsible for managing their own livestock and making decisions on what types of livestock products to produce. In addition, the services and technical support formerly provided by the collectives were discontinued and families were now required to secure their own sources of emergency fodder, seasonal transportation, and veterinary services (Humphrey and Sneath 1996a). While grassland remained a common pool resource, pastoral communities became responsible for regulating seasonal access to land and limited winter camp sites. This proved extremely difficult for pastoral communities since after the end of socialism, there was a sharp increase in the number of rural families as families moved from cities to rural areas to take advantage of the division of collective livestock to private families. This increase in livestock numbers and rural families has

been shown to have contributed to an increase in overgrazing and pasture degradation in Mongolia since the 1990s (Hilker et al. 2013; Fernandez-Gimenez and Allen-Diaz 2001).

In the present, as the state's role in regulating land use and pastoral production has diminished, ethnographers working in post-socialist Mongolia have found that in the absence of state-level social support, traditional kin-based labor sharing and land use strategies have re-emerged (Sneath 1993). Pastoral communities are once again relying on membership in extended patrilines to determine access to land resources and *khot ail* groupings to access labor (Murphy 2014; Upton 2008; Sneath 2004). Thus, herders are relying more heavily on kinship ties and dyadic relationships to manage livestock, develop social networks, choose cooperative partners, hire seasonal labor, and gain access to economic opportunities (Thrift and Byambaatar 2015; Murphy 2014; Humphrey and Sneath 1999; Sneath 1993). Notably, current ethnographic research in rural Mongolia suggests that herders value reputations for hard work, herding skill, and herding knowledge and use these characteristics to evaluate other individuals. They often cite "laziness" as the mark of a poor-quality herder or a person who experience misfortune (Ericksen 2014). Murphy (2014) also finds that kinship ties are an important factor in determining both labor sharing relationships among herders and access to land in rural Mongolia.

The study of cooperative connectivity in Mongolia is also interesting from the perspective of how herding families mitigate the risks of climatic variability that exist in Mongolia. The Mongolian Plateau is characterized by a continental climate that experiences frequent temperature extremes and climatic variability. At a time in which the United Nations has identified Mongolia as one of the epicenters of global climate

change, the Mongolian Plateau has experienced a rise in unpredictable weather conditions, severe droughts, and winter weather disasters (SDC 2011; UNPD 2010). Key among these severe weather events is a natural disaster known as *dzud*. *Dzud* often occur when snowstorms are followed by severely cold temperatures that cause an impenetrable layer of ice to form over grassland that prevents livestock from grazing (Begzsuren et al. 2004). These conditions are particularly hazardous for nomadic pastoralists because they often lead to livestock mortality from starvation and exposure.

As climate change makes annual precipitation and weather more unpredictable on the Mongolian steppes, *dzud* are becoming increasingly more common and severe. National censuses of livestock numbers in Mongolia conducted between 2012 and 2015 indicate that the Mongolian national livestock herd fluctuated between 40 and 55 million total animals in these years (Eldevochir 2016). However, current estimates indicate that the Mongolian economy suffered the loss of over 21 million livestock because of *dzud* between 1990 and 2010 (UNPD 2010). The most recent nationwide *dzud* in the winter of 2009-2010 resulted in the death of over 8.5 million livestock (roughly 20% of livestock in Mongolia) (Vernooy 2011). *Dzud* have been identified as a major driver of rural poverty in Mongolia and have forced many of the nation's pastoral nomads to abandon herding after losing most, or all, of their livestock to winter weather disasters (Templer et al. 1993). While these statistics are alarming, it is currently unclear how risks such as *dzud* affect herders' ability to cooperatively manage common pool grassland resources and whether *dzud* make herding families more or less cooperative.

The growing body of ethnographic literature related to post-socialist Mongolian herding communities indicates that social reputations and kinship may be important

factors that herders use to evaluate others and choose cooperative partners in a pastoral

economy that now functions largely through inter-family labor sharing. Given these

findings, this dissertation aims to explore labor sharing ties in rural Mongolia empirically

using both experimental economic games and social network analyses of labor sharing

ties among herders. The three studies described in Chapters 2, 3, and 4 explore labor

sharing ties, generous giving, and the effects of climatological risk, social reputations,

and kinship on cooperation in Tosontsengel, a climatologically harsh region of western

Mongolia.

1.4 Site Description: Tosontsengel, Mongolia

Figure 1.1: Study Site Location within Mongolia
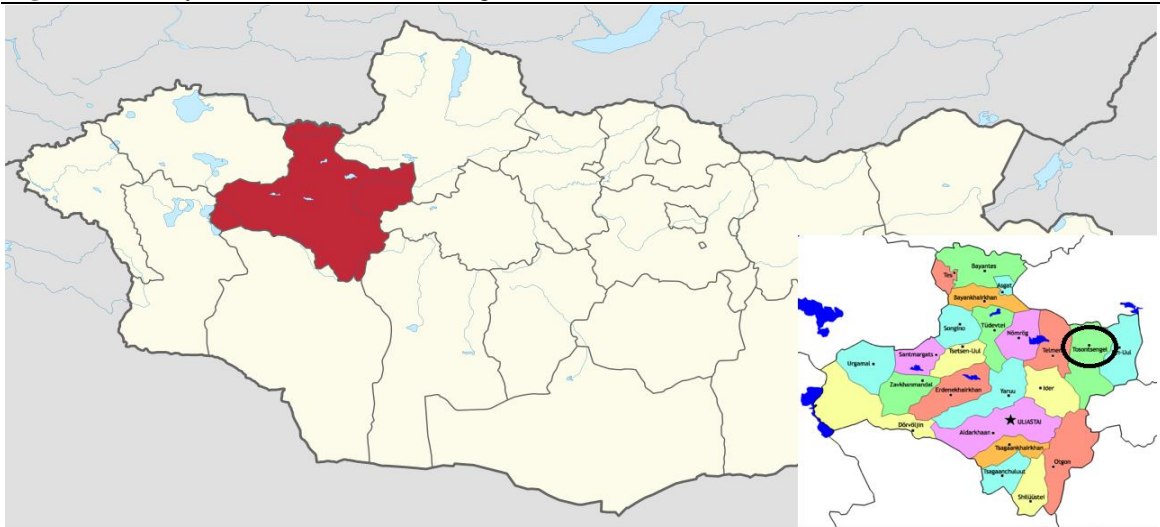
The three studies included in this dissertation were conducted in Tosontsengel,

western Mongolia (see map in Figure 1.1 for the region's location in Mongolia).

Tosontsengel is an administrative subdivision (*sum*) of Zavkhan Province, the

easternmost of Mongolia's 5 western provinces. The *sum* is known for being one of the

most climatologically harsh in Mongolia and holds the record for the coldest temperature

in Mongolia (-52.9ºC) and the highest barometric pressure ever recorded globally (Purevjaw et al. 2014). The landscape is comprised mainly of the mountainous forest-steppe that categorizes most of Mongolia's central Khangai mountain range. The Ider River runs east-west through the *sum* and is joined by numerous tributary rivers that flow into the Ider from the slopes of the Tarvagatai Range on the southern bank of the river and the Bulnai Range on the northern bank of the river. The population of Tosontsengel is just over 9,000 residents and it is the largest *sum* by population in Zavkhan Province after the provincial capital, Uliastai.

Most of the population of Tosontsengel are Khalkha Mongols which is the most populous and culturally dominant of Mongolia's tribal and ethnic groups. The Khalkha are indigenous to eastern and central Mongolia and the eastern portion of Zavkhan Province represents the traditional western boundary of Khalkha territory. Most of the population practice Tibetan Buddhism and the eastern portion of Zavkhan and neighboring Khovsgol and Arkhangai Provinces were central in a Buddhist uprising against collectivization in the early period of the Mongolian People's Republic (Batsaikhan 2014). In addition to Tibetan Buddhism, there is also a small Christian community of less than 50 individuals in the *sum*'s administrative village. Most residents also practice syncretic elements of traditional Mongolian shamanism and will regularly observe prohibitions and practices designed to pay homage to natural and ancestral spirits. To date, however, there are no known practicing shamans in the region.

During the socialist period, Tosontsengel was home to a the Sukhbaatarish *negdel* and collectivized pastoral production was maintained until the collapse of the Mongolian People's Republic in the early 1990s. In addition, because Tosontsengel is surrounded by

heavily forested ecosystems and by virtue of its central location on the border of two other provinces, the national government also constructed a large wood processing factory in the *sum*'s administrative village. This factory produced both raw construction materials and finished carpentry goods. Because of this factory, Tosontsengel's population swelled during the 20th Century when families from surrounding regions moved to the administrative village to take advantage of labor opportunities in the wood processing factory. Following the end of socialism, the wood factory was closed, but small numbers of independent carpenters still operate small workshops in the former facility today.

In the present, the chief source of income for the majority of Tosontsengel's rural families is animal husbandry, and pastoralists typically specialize in mixed-species herds of sheep, goats, horses, and cattle. Herders report that the region's climatological harshness makes it poorly suited for horses and cattle and more ideally suited for sheep and goats. As a result, wool and cashmere are the main sources of income for pastoral families, and these are seasonal sources of income that are typically sold in the spring and summer months. Some herding families also make supplementary income from cutting timber, driving trucks, producing handicrafts, and operating small shops in the administrative village. These supplementary income sources are usually viewed as secondary to animal husbandry, and rural families generally hold pastoral income and wealth in animals in higher esteem than other income sources (Empson 2012).

Rural families assert that herding is a difficult way to make a living in Tosontsengel and often express frustration with their inability to sell livestock products directly in markets for these products. Because herding families often do not have the

financial capital to transport livestock products to markets themselves, nor a large enough supply of products to justify transporting products long distances, they often sell wool and cashmere to traders in the administrative village who transport them to Ulaanbaatar, the national capital. Once in Ulaanbaatar, these middlemen sell the products to buyers (usually from China) for a higher price. Tosontsengel's pastoral families are involved in what Murphy (2018) refers to as the "cashmere debt cycle" in which herding families are generally cash poor and finance their annual expenses by taking out bank loans at high interest rates which they repay with the proceeds from wool and cashmere sales. This debt cycle often contributes to herding families' inability to invest in alternate sources of income or to effectively purchase supplies and emergency fodder.

Pastoral families in Tosontsengel rarely sell meat and dairy products because of a reluctance to slaughter animals for sale. A great deal of prestige is conferred upon a family that becomes "1,000 animal herders" (*myangat malchiin* in Mongolian), so herding families would often rather have larger herds than more cash from livestock sales. In addition, many Tosontsengel herders express the fact that they simply cannot sell meat and dairy products because there is no market for them in town. This is because town residents, shop keepers, and restaurant owners possess their own livestock (often herded by family in the countryside) which they use for sale and consumption. Therefore, the market for meat and dairy products in the administrative village is negligible.

Tosontsengel pastoralists are nomadic and make between four and six seasonal movements for a total annual migration of 40-80 kilometers. Families typically live in river valleys that run north-south and drain into the Ider River floodplain. They spend the winter in sheltered mountain valleys and move along the banks of tributary rivers in the

spring. During the summer, families move into the Ider River floodplain where land and

water resources are abundant before moving back into the tributary river valleys in the

autumn. Tributary valleys tend to be exogamous with men spending their lives living in

the tributary valley of their birth and women marrying in from adjacent valleys, with

some exceptions. During the winter, small groups of 2-5 families who are usually

extended kin form *khot ail* and co-manage livestock in the limited winter campsites. The

household heads of these families sometimes take turns herding all families' combined

livestock while other household heads remain in camp. These groups then fission in the

spring and summer when grassland resources are more available. Figure 1.2 illustrates the

distribution of seasonal pastures in a tributary valley known as Shumultei. This valley

was the area of focus for the studies described in chapters 2 and 3.

Figure 1.2: Distribution of Seasonal Pastures in Shumultei
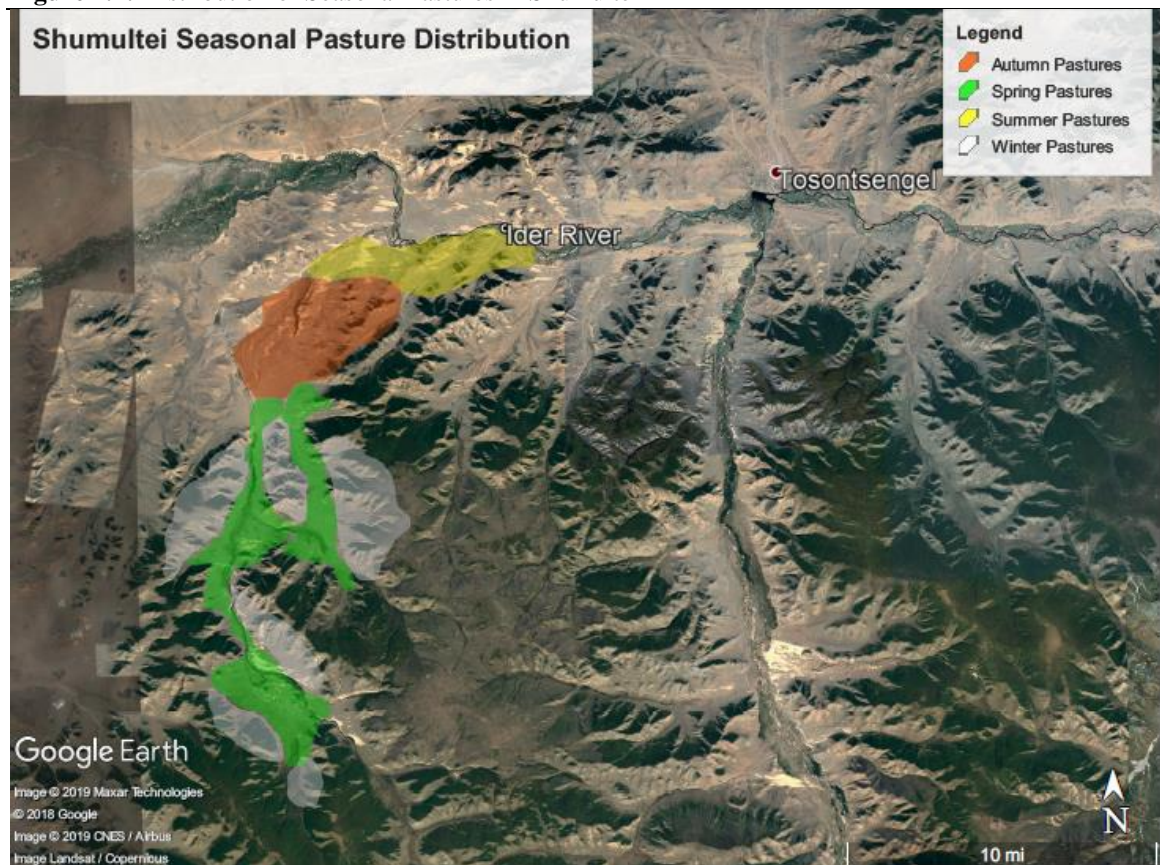
Most of Tosontsengel's full-time pastoral families also maintain a secondary residence in the administrative village where a portion of the family will remain during the winter months. Local children all attend regional boarding schools during the school year (September – June) and these secondary residences often serve as a place for children to live during the school year so that they do not have to live in school dormitories. They will often be joined by elderly grandparents or sometimes the wife of the household while the household head remains in the countryside managing the family's livestock. Following the completion of the school year in the late spring, these families will leave their village residences and spend the late spring and summer months in the countryside. Because of this, it is often difficult to find the exact whereabouts of family members when visiting a family in the countryside.

Herding families are most often economically limited by their access to winter camping sites. While spring and autumn pastures are less restricted in terms of which families can access them and summer pastures are essentially open access, access to winter pastures is highly regulated both by herding communities themselves and by law. Herding families possess a variety of use rights and reasons for why they have access to winter camp sites. Some families can produce verifiable historical kinship ties to a winter site (e.g. a person's ancestors are known to have occupied a winter site). Other families are welcomed into a site by kin who allow them to join winter *khot ail*. Other families were granted 60-year renewable use contracts by the local government after the end of socialism in the 1990s. Access to winter grassland and camping sites is a major source of contention and conflict among herding families and many individuals I interviewed report being concerned about what will happen in the future as the number of herding

families in the region grows. Figure 1.3 illustrates the distribution of *khot ail* and winter

camping sites on the Shumultei Valley's winter rangeland.

To select an appropriate sample for the RICH allocation games and social

network analyses I discuss in Chapters 2 and 3, I focused my dissertation fieldwork on a

community of herders living in a tributary valley in Tosontsengel known as Shumultei (a

pseudonym derived from a nickname for Tosontsengel which translates to "great

numbers of mosquitoes"). Tributary valleys on the northern flanks of the Khangai

Mountains tend to consist of between 25 and 60 families. While kinship and social ties

extend beyond a herding family's home valley, the bulk of labor sharing, seasonal

migration, and social interaction occur within the home valley itself. Therefore, a

tributary valley presents not only a logistically feasible area of study but also a culturally

appropriate area to explore inter-family labor exchange, generosity, and social ties.

Figure 1.3: Shumultei Winter *Khot Ail*
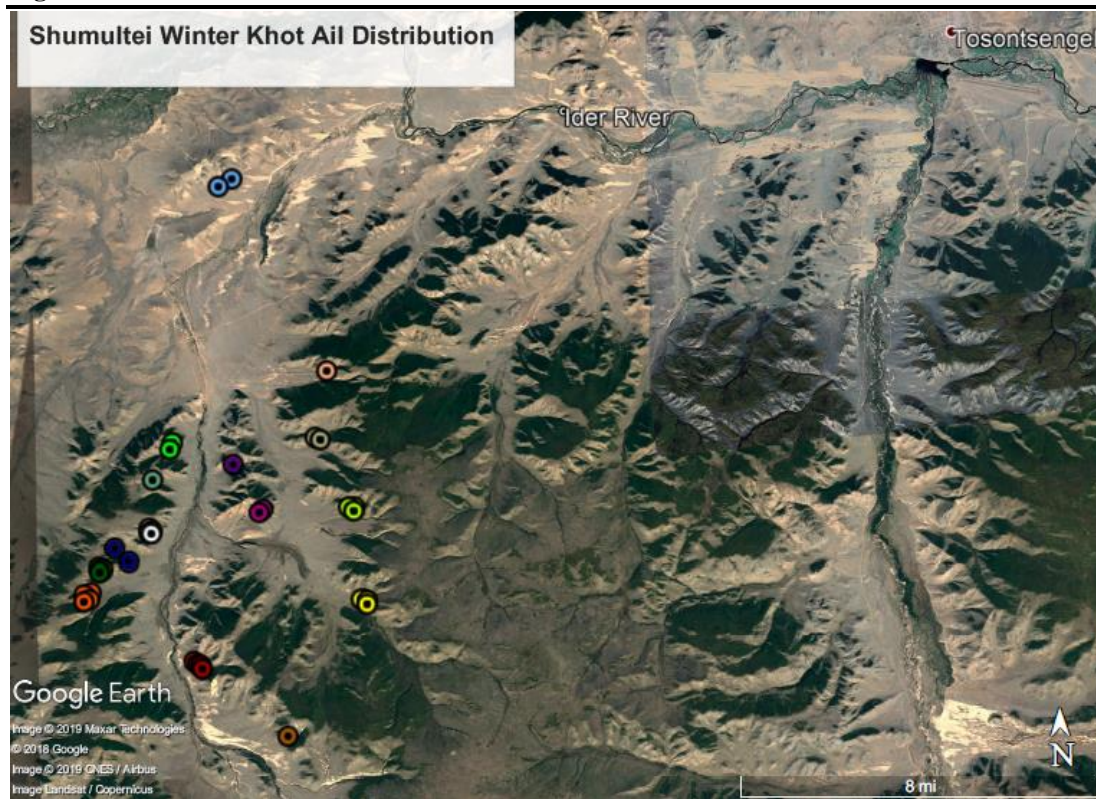
The Shumultei Valley is one of the largest of Tosontsengel's tributary valleys and is also the most distant from the *sum*'s administrative village. It is located adjacent to the border of Tosontsengel and neighboring Telmen *sum*. It consists of 47 full-time pastoral households who spend the year living and herding close to one another. I spent the winter, spring, and summer (November 2016 – July 2017) collecting data, conducting participant observation, and living among these families. While in the area, I lived in two winter and spring *khot ail* in a traditional Mongolian felt *ger*. In addition to collecting the data for the studies I describe in subsequent chapters, I spent a considerable amount of time in the local community assisting families with herding labor and participating in community activities including the lunar new year festival, wolf hunting expeditions, daily life in herding camps, and even fighting brush fires in the spring. I completed data collection for my dissertation project in July 2017.

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Chapter 2:

Results from a non-anonymous allocation game in a Mongolian pastoral nomad community

In this study, I explore generosity among Mongolian nomadic pastoralists using a non-anonymous recipient identity-conditioned heuristic (RICH) allocation game (Gervais 2017). Unlike dictator games, in RICH allocation games, players are aware of the identities of other participants in the game and can make allocations of experimental funds based on their relationships with and knowledge of other players. This study represents the first application of RICH allocation games among Inner Asian pastoralists, and the first ever to include an all-female sample. The results of these experimental games provide valuable insights regarding the major drivers of generosity in the Mongolian countryside and in small-scale pastoralist societies more generally.

2.1 Introduction: The Behavioral Ecology of Cooperation

The cross-cultural ethnographic record indicates that generosity, sharing, and cooperation are extremely common human behaviors (Cronk and Leech 2013). Evolutionary psychologists and behavioral ecologists have posited several potential hypotheses to explain the evolution and maintenance of generosity and cooperation in anatomically modern *Homo sapiens*. These hypotheses include the honest signaling of partner quality and willingness to adhere to prescribed social norms, the maintenance of reciprocity, the management of risk, cheater detection, kinship and inclusive fitness, and reinforcing social reputations by displaying overtly altruistic behavior.

Researchers studying cooperation in human societies have presented reciprocity as a means by which human societies maintain cooperation and sharing (Trivers 1971;

Sahlins 1965). Reciprocity and generosity can serve to reinforce cooperation and minimize the tendency for individuals to free-ride on the generosity of others (Axelrod 1997; 1984). Within a social framework, individuals and communities can punish free-riding through social ostracism and the punishment of persons who display cheating or non-cooperative behavior (West et al. 2007; Gintis 2000; Boyd and Richerson 1989), and this may be especially the case for small-scale societies that are dependent on locally available resources (Boyd and Richerson 1988). Thus, the desire to maintain reciprocal ties in both dyadic relationships and within larger networks may at least partially drive cooperation and provide selective benefits to individuals who engage in cooperative behavior.

Cosmides and Tooby (2005) argue that selection favors an individual's ability to detect signals of willingness to cooperate in others while avoiding individuals who display a tendency to cheat. Thus, cooperative behavior can serve as an honest and hard-to-fake signal of partner quality and eliminate potential free-rider problems (Bliege-Bird et al. 2001; Irons 2001). Empirical tests of costly signaling in human cooperative behavior indicate that participation in communal religious rituals (Soler 2012; Sosis and Ruffle 2003), membership in community cooperative organizations (Gerkey 2013), and provisioning by big game hunters (Alvard 2009) can all be honest signals of partner quality and promote the expression of prosociality in humans.

Based on costly-signaling models of cooperation, it is reasonable to expect that if people can signal their willingness and ability to engage in cooperative partnerships, then they should be acutely aware of observation by others and their reputations for being quality partners. Fu et al. (2008) find that reputations can help reinforce cooperation and

sharing in networked relationships and help eliminate the risks of cooperating with free-riders. Experimental tests indicate that individuals are inclined to display more generous behavior when observed by an audience (Iredale et al. 2008; Haley and Fessler 2005), and agent-based models show that reciprocity can be strengthened in a network if agents select for dyadic ties with those with high reputational scores (Nowak and Sigmund 1998). Tests of the effects of social reputations on cooperation also indicate that high status individuals often enjoy greater degrees of social, economic, and health benefits than those with lower status (Lyle and Smith 2014) and partner selection may create biological markets for high status partnerships in social groups (Barclay 2013; Macfarlan et al. 2013).

Inclusive fitness models predict that altruistic behavior among genetically related kin can increase gene replication and thereby promote long-term fitness (Richerson and Boyd 1999; Chagnon and Bugos 1979; Hamilton 1964). Furthermore, in human societies, affinal and fictive kinship may also be an important way for people to forge and maintain cooperative partnerships in social groups (Alvard 2009). Tests of the effects of kinship on cooperation have shown that cues of kinship increase cooperation in public goods experiments (Krupp et al. 2008). This suggests that kinship may help humans develop sharing networks and dyadic ties in social groups.

Aktipis et al. (2018) and Roberts (2005), among others, argue that cooperation and generosity allow individuals to selectively choose to cultivate relationships with other individuals who can directly influence each other's long-term economic or reproductive success (Kelley and Thibaut 1978). Individuals sharing positive fitness interdependence positively influence each other's economic, reproductive, or social

success. Thus, individual actors in a social network should actively pursue cooperation with other actors with whom they share positive interdependence while minimizing negative interactions with actors with whom they are negatively interdependent. Prosociality among people sharing positive fitness interdependence can help individuals mitigate the effects of ecological, economic, and social risks and positively enhance each other's fitness (Cronk et al. In Press; Aktipis et al. 2018).

2.1.1 Cooperation in Mongolian Pastoral Societies

In the ethnographic record, cooperation has been shown to exist in every major human subsistence practice and ecosystem (Cronk and Leech 2013). Pastoralist societies are known to cooperate to accomplish labor intensive tasks, mitigate environmental risks, and access natural resources (Conte and Tilt 2015; Aktipis et al. 2011; Naess et al. 2009; McCabe 1990). On the Inner Asian steppes, and on the Mongolian Plateau, cooperation among nomadic pastoralists has allowed pastoral communities to ensure mutual defense of territories, access seasonal pastures, and meet labor demands for herding tasks (Murphy 2014; Humphrey and Sneath 1999; Bold 1996; Cooper 1993). To understand how cooperation and sharing behavior function on the contemporary Mongolia steppes, it is essential to understand the history of land use, social organization, and the pastoral economy of the Mongolian Plateau, especially in the context of 20th and 21st Century Republic of Mongolia.

Nomadic pastoralism has existed as the main mode of subsistence on the steppes of Inner Asia for at least three millennia (Lattimore 1941), and on the Mongolian Plateau, pastoral nomads rely on naturally occurring grassland and seasonal mobility to sustain herds of sheep, goats, horses, camels, cattle, and yaks (Humphrey and Sneath 1999).

Throughout the history of the Mongols, the sociopolitical structure of the pastoral economy has transitioned from loose tribal and clan confederations, the unified Mongol Empire, territorial components of imperial China, and an independent Mongol Khanate (Endicott 2012). During the 20th Century, Mongolia became a socialist republic that was heavily influenced and subsidized by the Soviet Union (Humphrey and Sneath 1996a; 1996b). After the collapse of socialism in the early 1990s, Mongolia became a market economy, and the pastoral economy has become increasingly more integrated with global markets for livestock products since 1992 (Potkanski 1993).

Prior to the founding of the Mongolian People's Republic in the 1920s, land, society, and economic life were mandated by Tibetan Buddhist monasteries or by feudal princes that represented the reigning emperor in Beijing (Endicott 2012). Land and territory were organized according to clans based on extended patrilines and governed by a ruling prince or clan patriarch (Batsaikhan 2014; Humphrey and Sneath 1999). During this period, pastoral labor and seasonal migration were managed by groups of extended kin, and individual herding camps were maintained by small groups of families known as *khot ail*. *Khot ail* consisted of groups of two to ten usually interrelated families who would co-manage livestock, share seasonal labor, and occupy pastoral territory based on customary use rights (Sneath 2003; Fernandez-Gimenez 1999; Bold 1995; Cooper 1993; Mearns 1993).

During the Mongolian People's Republic (1924 – 1992), clan identity and *khot ail*'s role in land management and herding life were suppressed in favor of the formation of socialist herding collectives. Collectives enforced government-mandated quotas for livestock products, organized herding labor, and divided state-owned animals among

herding families (Endicott 2012; Upton 2008). The collectives also provided herders with veterinary assistance, emergency livestock fodder, transportation for nomadic migrations, and annual salaries (Batsaikhan 2014; Humphrey and Sneath 1999). Therefore, during the socialist period, customary systems of cooperation among extended kin were diminished as the local and national governments regulated the pastoral economy and the flow of goods and services.

Following the collapse of the Mongolian People's Republic in the early 1990s, pastoral collectives were dissolved, and formerly collective livestock were privatized and distributed to individual households for private management (Endicott 2012). Herding families now became responsible for managing their own herds and making decisions on what types of livestock products to produce. In addition, the services formerly provided to herding families by the state were discontinued and herders were now required to secure their own sources of emergency fodder, transportation, and veterinary services (Humphrey and Sneath 1996a). Pastoral communities also became responsible for regulating access to grassland resources and winter camping sites and this has contributed to an increase in overstocking and pasture degradation in Mongolia since the 1990s (Hilker et al. 2013; Fernandez-Gimenez and Allen-Diaz 2001).

As the role of the state in regulating land use and pastoral production has diminished, ethnographic research has found a resurgence of traditional kin-based ties and land use strategies that were common prior to socialism (Sneath 1993). Pastoral communities are once again relying on membership in extended patrilines to determine access to land resources (Murphy 2014, Sneath 2004). In the absence of state-provided services, herders are also relying more heavily on kinship ties, *khot ail* groupings, and

dyadic relationships with other herding households to manage livestock, develop social support networks, choose cooperative partners, and sometimes hire seasonal labor (Thrift and Byambaatar 2015; Murphy 2014; Humphrey and Sneath 1999; Sneath 1993). Ericksen (2014) has found that herders value reputations for hard work, herding skill, and herding knowledge when evaluating others and choosing cooperative partners. Murphy (2014) also argues that kinship ties are an important factor in determining both labor sharing relationships and access to land in rural Mongolia.

While cooperation and labor sharing help Mongolian herders mitigate risk, secure labor for herding tasks, and gain access to land resources, the precise dynamics of labor and resource sharing among Mongolian nomadic herders are still poorly understood. Empirical tests are needed to assess the main drivers of sharing and generosity in Mongolian herding communities. To do this, I used a non-anonymous allocation game to assess how social, economic, and kinship factors influence generous giving in a Mongolian pastoralist society. These experimental games, conducted with both male and female Mongolian nomadic herders, were used to test two main hypotheses: 1) kinship is a major driver of cooperative connectivity and generous giving in Mongolian pastoralist communities and 2) individuals possessing positive social reputations will enjoy more social connectivity and resource exchange than individuals with less positive social reputations. These hypotheses lead to two main predictions in the allocation games: 1) Individual players will allocate more money to kin than non-kin and 2) An individual's reputations for work ethic, generosity, and herding skill will be positively correlated with the amount of received from others. I also make a third prediction based on the findings

of Gervais (2017): 3) An individual's perceived need will be a main driver of individuals' decisions to allocate money to others.

2.2 Materials and Methods: Recipient Identity Conditioned Heuristic (RICH) Economic Games

Experimental economic games afford social scientists the ability to empirically test hypotheses regarding sharing, altruism, and perceptions of fairness in a controlled and repeatable way. In their various forms, experimental economic games have been successfully used to compare economic decision making and cooperation cross-culturally (Henrich et al. 2008), to test the effects of culturally-salient frames (Cronk 2007; Cronk and Wasielewski 2008), in computer-based simulations (Fu et al. 2008; Dreber et al. 2008; Aktipis 2004; Nowak and Sigmund 1993), in developmental psychology (Yu et al. 2016; Benenson et al. 2007), in hormonal and brain analyses (Israel et al. 2009; Tabibnia and Lieberman 2007), and to assess cooperative behavior in non-human primates (McAuliffe et al. 2015; Leimgruber et al. 2014; Laksminarayanan and Santos 2008). These experimental methods allow for the simplification of complex economic and social scenarios and build the potential for modeling behavior in broad sociocultural contexts.

One of the most common and extensively used experimental economic games is the dictator game (Engel 2010). In this two-player scenario, a proposer is given an allocation of money which he or she can keep any portion or give any portion to a usually anonymous recipient who was not allocated any money (Forsythe et al. 1994). This game has been tested worldwide in both Western and non-Western populations (Henrich et al. 2005) and is often used as a baseline assessment of an individual or social group's generosity and perceptions of fairness (Cronk and Leech 2013; Engel 2010; Cason and Mui 1997).

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While the dictator game has long served as a means of assessing generosity cross-culturally, recent research has challenged the scientific validity of dictator games by arguing that the typically high levels of generosity observed in dictator games may be at least partially an artefact of experimental design (Galizzi and Navarro-Martinez 2015). For example, Winking and Mizer (2013) found no evidence of generous giving in a natural field experiment dictator game in which players were given an allocation of real money in the presence of another individual but the experimenters did not suggest they could give money to the other person (Winking and Mizer 2013). Thus, the high rates of generous giving typically observed in dictator games may be a result of researchers priming players to give to others or to believe that the purpose of the game is to give to others. Similarly, Bardsley (2008) argues that generous giving in dictator games may simply be a result of players being primed to give to others by experimental protocols. Bardsley (2008) and Wiessner (2009) also suggest that the anonymous and often contrived nature of dictator games fails to capture the highly-contextualized nature of sharing in real world economic decisions.

Currently, there have been efforts in the social sciences to design experimental economic games that provide more culturally-specific context and real-world decision making (e.g. allocating resources or money to real community members) (Thomas et al. 2015). Recipient identity conditioned heuristic (RICH, hereafter) games have been proposed by Gervais (2017) to increase the external validity of experimental economic games and provide additional dimensions of real-world social context to experimental methods. RICH games are N-player economic games in which players are presented with matrices of facial photographs individuals from their local community with which to

make decisions to allocate, or in some cases, take money from other players in the game. Individual decisions are kept confidential as part of the experimental protocol, but players are aware of the identities of other players in the game (Gervais 2017). This enables researchers to collect a greater amount of context-specific information regarding game decisions and player reasoning than in other commonly used experimental games.

One RICH economic game that closely resembles the dictator game is the allocation game. In RICH allocation games, each player is given an allocation of money and an array of photographs that includes both his or her photo and photos of all other players in the game. Players are given the opportunity to allocate experimental funds as they see fit amongst themselves and other players with the assurance that decisions will be kept confidential and that the players they allocate funds to will receive the money after completion of the game (Gervais 2017). After making allocations, each player is interviewed regarding his or her decision making and allocation choices. Thus, unlike more traditional applications of the dictator game which usually involve a decision on how much money to allocate to a single unknown individual, RICH allocation games provide not only numerical data, but also rich qualitative information regarding decision making.

As of 2018, RICH allocation games have been successfully employed in one all-male sample of fishermen in Yasawa, Fiji by Gervais, who found that allocation decisions were driven primarily by participants' perceptions of other players' need (Gervais 2017). Building on this previous successful application of RICH games, this study presents the results of RICH allocation games in a community of nomadic pastoralists living in Tosontsengel, Republic of Mongolia. I conducted two separate

RICH allocation games: one with a sample of forty-six mixed male and female (40 males, 6 females) pastoral household heads and a second, separate game, with a sample of forty-two adult females from the same group of households.

2.3 Site Description: Tosontsengel, Zavkhan, Mongolia

Tosontsengel is an administrative subdivision (*sum*) of Zavkhan Province in western Mongolia. The region is known for being one of the most climatologically harsh in Mongolia and holds the record for the coldest temperature in Mongolia (-52.9ºC) and the highest barometric pressure ever recorded globally (Purevjaw et al. 2014). The region consists mainly of mountainous forest-steppe and is largely within the central Mongolian Khangai mountain range. The Ider River runs east-west through the *sum* and is joined by numerous tributary rivers that flow into the Ider from the slopes of the Khangai Range. The population of Tosontsengel is just over 9,000 residents and it is the largest *sum* by population in Zavkhan Province after the provincial capital, Uliastai. Most of the population are Khalkha Mongols (Mongolia's largest ethnic group) who practice Tibetan Buddhism with syncretic elements of traditional Mongolian shamanism (Batsaikhan 2014). Figure 2.1 shows the location of Tosontsengel within Mongolia.

The chief source of income for the majority of Tosontsengel's rural families is animal husbandry, and pastoralists typically specialize in mixed-species herds of sheep, goats, horses, and cattle. Wool and cashmere are the main sources of income for pastoral families, and these are sold to traders in Tosontsengel's administrative village who transport them to Ulaanbaatar, the national capital, where they enter global markets for livestock products. Some herding families also make supplementary income from cutting

timber, driving trucks, producing handicrafts, and operating small shops in the

administrative village. These supplementary income sources are usually viewed as

Figure 2.1: Study Location in Mongolia
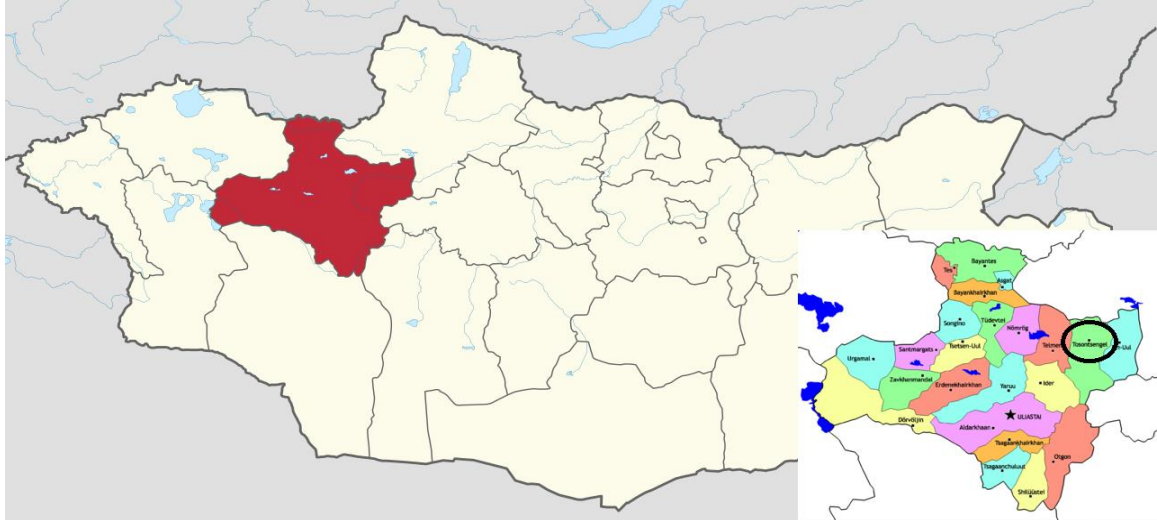
secondary to animal husbandry, and rural families generally hold pastoral income and

wealth in animals in higher regard than other income sources (Empson 2012).

Tosontsengel's pastoralists are nomadic and make between four and six seasonal

movements for a total annual migration of 40-80 kilometers. Families typically live in

river valleys that run north-south and drain into the Ider River floodplain. They spend the

winter in sheltered mountain valleys and move along the banks of tributary rivers in the

spring. During the summer, families move into the Ider River floodplain where land and

water resources are abundant before moving back into the tributary river valleys in the

autumn. Tributary valleys tend to be exogamous with men spending their lives living in

the tributary valley of their birth and women marrying in from adjacent valleys, with

some exceptions. During the winter, small groups of 2-5 families who are usually

extended kin form *khot ail* and co-manage livestock in the limited winter campsites.

These groups then fission in the spring and summer when grassland resources are more available.

To select an appropriate sample for allocation games, I focused this analysis on a tributary valley in Tosontsengel known as Shumultei. While kinship and social ties tend to extend beyond an individual herding family's home tributary valley, the bulk of labor sharing, seasonal migration, and social interaction occur within the home valley. The Shumultei Valley is the largest of Tosontsengel's tributary valleys and is also the most distant from the *sum*'s administrative village. It consists of forty-seven full-time pastoral households who spend the year living and herding close to one another. Figure 2.2. illustrates the distribution of winter *khot ail* on the Shumultei Valley's winter pastures. In

Figure 2.2: Winter *Khot-Ail* Distribution in Shumultei
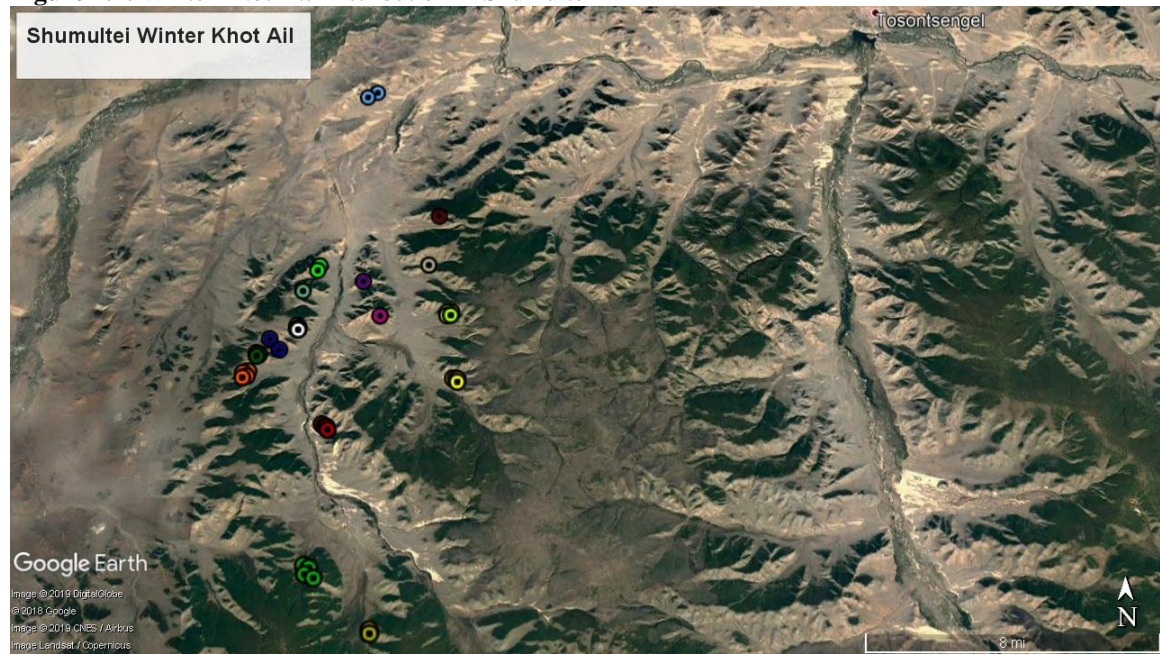
this study, I conducted two separate allocation games. One of these games was limited to the household heads of forty-six families that spend at least three of four seasons living in the countryside. Household heads were determined by consulting official government

records which list particular individuals as the head of household for each family in the

study sample. Household heads are mostly the eldest men in each nuclear family, but the

valley is also occupied by seven female-led households. In a second, separate game, I

conducted allocation games with a sample of forty-two adult females who are represented

by wives, female household heads, or the eldest females in each family that was included

in the analysis. Because there are seven female household heads, these women played

both the household heads' game and the women's game at different times. One family

was omitted from the study due to not being present in the valley at the time of data

collection. Table 2.1 illustrates the demographic characteristics of the household heads

and female samples.

Table 2.1: Descriptive Statistics of Study Population

	N	**Age** *Mean/St.* *Deviation*	**Animals** *Mean/St.* *Deviation*	**Children** *Mean/St.* *Deviation*	**Dependent** **Children** *Mean/St.* *Deviation*
Household Heads' Game	46	46.41 (13.14)	190.30 (152.40)	3.31 (1.88)	2.07 (1.48)
Women's Game	42	42 (12.61)	199.41 (157.18)	3.50 (1.74)	2.27 (1.41)

2.4 Procedure

I conducted allocations games with one field assistant between March and May

2017. Games instructions were given in the Khalkha dialect of Mongolian and procedures

were carried out according to the protocol developed by Gervais (Gervais 2017). Prior to

beginning data collection, I consulted local government officials to determine the number

of families registered as full-time herding families in the Shumultei Valley. During this

time, we obtained facial photographs of each adult male and adult female living in the

study population. These photographs were standardized to have the same size and white background and were printed as 1x2 inch rectangles. Each player's name and surname initial were added to the bottom of his or her photograph. Photos were then randomly organized into a matrix in plastic craft boxes with locking lids. Photographs were re-randomized after each participant played the game by shuffling the photos and reorganizing them in the craft boxes.

Participants played the allocation games in their primary residences, usually a one room felt yurt (*ger* in Mongolian) or a one room cabin located on the family's winter or spring pastures. Alternatively, because some families maintain secondary residences in the Tosontsengel administrative village, some games were also conducted at these alternate residences. When possible, both household heads' and women's games were given simultaneously, but communication between individuals living in the same household was not permitted. Female household heads played both the household head and women's games and were given the games during the same session, but not simultaneously.

Allocation games are best played when participants are alone to minimize potential observer effects. However, due to the nature of Mongolian herders' seasonal encampments, where all family members reside within the same small, one-room dwelling, it was sometimes not possible to isolate players from other family members present in the household. Traditional norms of hospitality, and harsh winter weather conditions, made it impossible to ask residents to leave their homes, but if other family members were present at the time of data collection, they were not permitted to comment on players' decisions or coach players while they made allocations. Because games were

conducted on a household-to-household basis, players were instructed that they were not permitted to share their decision making or thoughts about the game with other members of the community while the game was still being given in other households. Players were not timed during the decision-making process and were given as much time as they needed to complete the allocation game.

During the data collection phase, each participant was presented with 20 black buttons representing 20,000 Mongolian *tugriks* (MNT) (~$8 at the time of data collection and enough to purchase a liter of vodka or 10 kilograms of wheat flour). Buttons were used in lieu of cash because MNT are available only as paper currency that would not fit into cells in the photo matrix. Players were assured that the experimenters were using buttons as a matter of convenience, that each button represented 1,000 MNT, and that they were playing with real money that would be paid in cash following the completion of the game.

Each player was then presented with two boxes of photo matrices containing 46 photographs for the household heads game or 42 photographs in the women's game. Players were asked if they knew the individuals in the photo matrices and if they could recognize their own photograph among the others. They were then instructed that the 20,000 MNT was theirs and that they could divide it in 1,000 MNT increments amongst themselves and/or other players in the photo matrix for whatever reason they wished by placing buttons on the photographs of individuals to whom they wanted to allocate money. They were then told that these amounts would be recorded, and that the people they allocated money to would be paid this money at the completion of the game. However, they were also instructed that the decisions they made would be kept

confidential, and the individuals they allocated money to would not know the identities of other players they received money from.

Before allowing players to begin allocating experimental funds, we presented each participant with an example game using facial photographs of non-participants. The author randomly placed buttons on these photographs while the field assistant explained that the people receiving buttons would receive the money in cash after the allocation game. No example reasons for allocation were given in the examples to minimize potential priming effects. Following the completion of the example, each participant was asked five true or false questions regarding the rules of the game. If he or she answered any of the questions incorrectly, the field assistant provided the correct answer and a repeated explanation of the rules. Once verbal cues of understanding and informed consent were obtained, participants could begin allocating money.

While each player was making allocations, the research team moved to a different area of the room or turned in a different direction from the players to avoid potential observation effects. If participants had questions about the rules of the game as they played, these were answered, but no suggestions were given as to potential reasons a player might allocate money to another player. When players were finished making allocations, the research team took possession of the photo matrices, and began post-game interviews. The amount of money players allocated to each player was recorded and players were asked to provide their reasons for giving to each person they decided to allocated funds to. These reasons were recorded and compiled into a Microsoft Excel database and coded according to their categorical description. A total of eight categories were created based on player's reasoning: kinship (statements regarding blood or affinal

kinship), perceived need (statements about a person's perceived neediness), friendship (statements about long-term friendship with an individual), gratitude for service (statements about receiving help from a person in the past), proximity (statements about living in close proximity to an individual), age (statements about perceived youth or old age), reputations (statements about a person's perceived reputation), and other (e.g. non-articulated reasoning or statements about simply liking a person).

Following the completion of both the household heads and women's games, the research team conducted a structured household demographic and economic survey which included questions regarding a household's number of children, average annual expenditure, number and type of livestock, and additional sources of annual income. Then, household heads were asked to complete a pile sort activity aimed at assessing kinship relationships and reputational characteristics for all players in the household heads' allocation games. Each household head was presented with the same photographs and names used in the allocation game photo matrices pasted onto index cards and was asked to sort these cards according to individuals he or she shared blood and marital kinship relationships with.

After completing the kinship sort, each participant was asked to describe the kinship relationship he or she shared with each of the other players. Then, household heads completed three additional photo sorts in which they were asked to sort other individuals according to the following reputational characteristics: work ethic, herding skill, and generosity. They were asked to place the individuals they felt possessed each of these qualities in a pile and exclude the individuals they felt did not possess each characteristic. Reputational scores were determined by adding the number of times an

individual was cited as having a reputational characteristic. Composite reputational scores were calculated by adding the total number of times each individual was cited by others as having the reputational characteristics included in the analysis. Due to the length of the activities listed above, and the busy nature of daily pastoral labor for both men and women, the research team was not able to collect kinship or reputational data for the women's allocation game.

Data collection continued until the completion of the last household's allocation game. One household was omitted from the study because it was not present at the study site during the time of data collection. In addition, allocation decisions were not available from three individuals in the female sample due to one player no longer living in the study site, another being recently divorced and no longer in the test population, and another mourning a death in the family that made conducting the game in her household culturally inappropriate. However, all three of these women were included in the photo matrices with which other women could make decisions to allocate funds.

To determine kinship ties among game players and to calculate the number of blood and marital kin each player had, I cross-examined players' kinship pile sorts to determine the number of blood and marital kin each player had in the community. These kin relationships were then categorized as close blood kin (e.g. mother, father, sibling, half-sibling), distant blood kin (e.g. uncle, aunt, first cousin, second cousin), close marital kin (e.g. father-in-law, mother-in-law, brother-in-law, sister-in-law), or distant marital kin (e.g. uncle-by marriage, aunt-by-marriage). Only relationships that were mutually agreed upon by both individuals claiming a blood or marital tie in cross-examination were included in the analysis.

To analyze the potential effects of kinship, wealth in animals, and social reputations on the amount of money players received, allocated, and kept for themselves, I used Pearson correlation analyses and linear regressions. Because Shapiro-Wilks Tests for normality indicate that the data are not normally distributed, I used nonparametric Wilcoxon Rank Sum Tests to compare the amount of money players allocated to blood kin, marital kin, and non-kin and Mann-Whitney Tests to compare the decisions of male and female players. Finally, I performed qualitative analyses to code player's reasons for giving to others into categories. It should be noted here that if a player gave more than one reason for giving to another player, both reasons were included in the appropriate categories (thus, percentages listed in the player reasoning table below will not equal 100% when summed). The data were analyzed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.

2.5 Results

2.5.1 *Descriptive statistics and comparison of men and women's decisions*

In the household head's allocation game, participants kept 4,288.89 MNT (21.44%, St. Deviation = 3,468.18) on average for themselves, allocated 15,711 MNT (78.56%, St. Deviation = 3,468.18) to other players, and received 14,565.22 MNT (St. Deviation = 10,510.63) from other players. Household heads allocated funds to 6.07 (St. Deviation = 3.49) other players on average and receive allocations from an average of 5.91 (St. Deviation = 3.79) individuals. The earnings of each player ranged from zero MNT for two players to as much as 41,000 MNT. No household heads kept all 20,000 MNT for him or herself, and 10 players allocated all 20,000 MNT of the experimental funds to other household heads. Table 2.2 illustrates the descriptive statistics for the

household heads and women's games and combined averages and standard deviations for

the entire study sample.

Table 2.2: Description of average allocations in household heads' and women's games

	Household Heads (Mean/St. Deviation)	**Women** (Mean/St. Deviation)	**Combined** (Mean/St/ Deviation)
Allocation to Others	15,711.11 (3,468.18)	14,587.18 (3,972.75)	15,142.86 (3,738.90)
Allocation to Self	4,288.89 (3,368.18)	5,512.82 (3,933.75)	4,857.14 (3,738.90)
Received from Others	14,565.22 (10,510.63)	12,619.05 (8,467.88)	13,636.36 (9,585.89)

Results of the women's allocation game indicate that participants kept

5,512.82MNT (27.56%, St. Deviation = 3,972.75) on average for themselves, allocated

14,587.18 MNT (72.44% St. Deviation = 3,972.75) to other players, and received

12,619.05 MNT (St. Deviation = 8,467.88) from others. Participants in the women's

allocation game allocated funds to an average of 5.21 (St. Deviation = 2.98) other players

and received allocations from 4.86 (St. Deviation = 3.05) players. Total allocations to

each female participant ranged from zero MNT for two players to a maximum of 37,000

MNT. One participant kept all 20,000 MNT for herself, and four players allocated all

20,000 MNT to other women in the photo matrix.

To compare the results of the household heads' and women's allocation games, I

omitted female household heads from the household heads' game to compare an all-male

sample to an all-female sample. Results of Mann-Whitney U Tests revealed no

significant differences in the amount of money men and women kept for themselves,

allocated to others, or received from others. The results of these analyses are summarized

in Table 2.3 which illustrates the percentages of experimental funds players allocated to

others, kept for themselves, and received from others.

Figure 2.3: Visual Representation of Game Descriptive Statistics
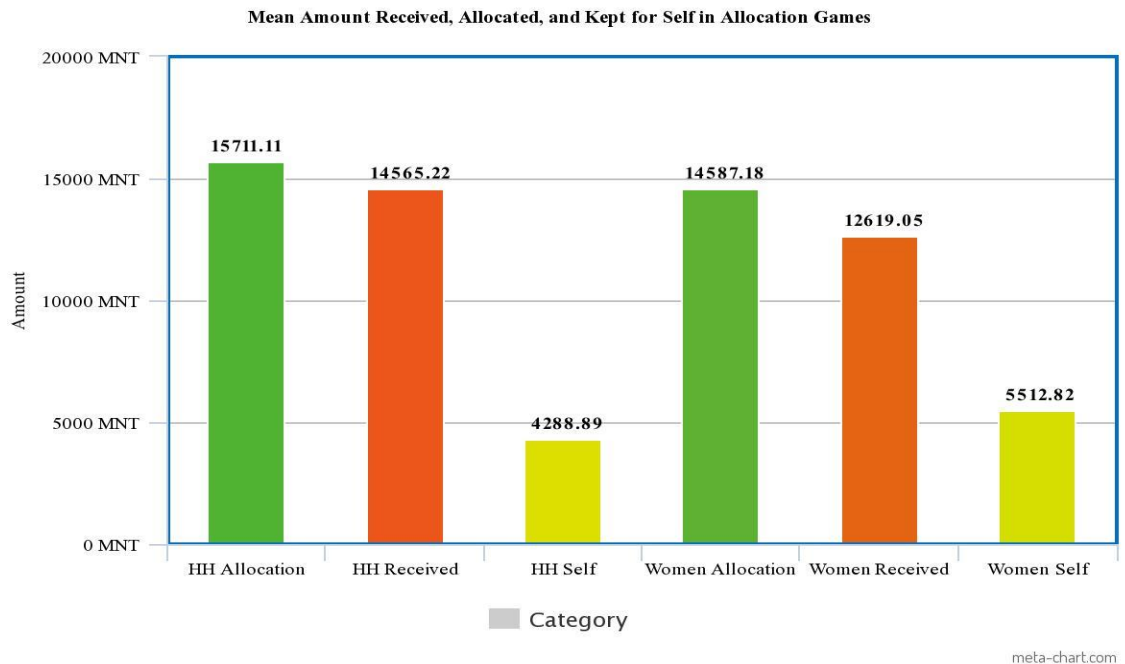
Table 2.3: Comparison of men and women's game behavior

Variable	Male Mean	Male Mean Rank	Female Mean	Female Mean Rank	z – value	St. Error	p - value
Amt. Kept for Self	4,078.95	35.08	5,512.82	42.82	1.54	97.05	.125
Amt. Allocated to Others	15,921.05	42.92	14,487.18	35.18	-1.54	97.05	.125
Amt. Received from Others	14,000	42.07	12,619.05	40.06	-0.38	105.52	.701

2.5.2 Correlational analyses

Demographic Variables

Correlational analyses of game behavior and demographic variables revealed that no significant linear relationships existed between the amount given to others, the amount players kept for themselves, or the amount of money players received from others and the number of animals in a player's herd or a player's age. However, a significant positive

correlation existed between the number of children a player had and the amount of money

he or she received from other players. In addition, a significant positive correlation

existed between the number of animals in a player's herd and the number of players an

individual received allocations from. Table 2.4 illustrates the results of these analyses.

Table 2.4: Correlation Matrix for Demographic Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Amt. Kept for Self	1								
2. Amt. Allocated to Others	-1.00**	1							
3. Amt. Received from Others	.094	-.094	1						
4. # Allocations Given to Others	-.244	.244	.026	1					
5. # Allocations Received from Others	.113	-.113	.887**	.024	1				
6. Player Age	.018	-.018	.227	.223	.215	1			
7. Herd Size	-.184	.184	.278	-.044	.297*	-.166	1		
8. Number of Children	.014	.014	.324*	.250	.218	.584**	-.042	1	
9. Number of Dependant Children	-.150	.150	.081	.157	-.003	-.290	.165	.408*	1

*Correlation significant at $p \leq .05$

**Correlation significant at $p \leq .0001$

2.5.2 *Reputational Variables*

The number of times an individual was cited by other players for being hard

working, a skilled herder, or generous in photo sorts was counted and assessed for

potential correlations with other demographic information collected during household

economic surveys. A player's scores for being hard working, a skilled herder, or a

generous person were not significantly correlated with the number of kin he or she had in

the study population. However, these reputational scores were significantly positively

correlated with one another. An individual's absolute rating as having a strong work ethic

was strongly positively correlated with being rated as a skilled herder and his or her

rating for being both a hard worker and a skilled herder were moderately positively

correlated with being rated a generous person. In addition, the size of a player's herd was strongly positively correlated with his or her being rated as a skilled herder (r = .702, $p \le$ .001) and a hard worker (r = .683, , $p \le .001$)   and moderately positively correlated with being rated as a generous person (r = .439, p = .002). Table 2.5 illustrates the results of these analyses.

Table 2.5: Correlation Matrix for Reputational Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Amt. Kept Self	1								
2. Amt. Allocated to Others	-1.00**	1							
3. Amt. Received from Others	.094	-.094	1						
4. # Allocations Given to Others	-.244	.244	.026	1					
5. # Allocations Received from Others	.113	-.113	.887**	.024	1				
6. Reputation for Skill	-.183	.183	.395**	.100	.358*	1			
7. Reputation for Hard Work	-.067	.067	.438**	-.016	.496**	.819**	1		
8. Reputation for Generosity	-.170	.170	.555**	.138	.634**	.580**	.744**	1	
9. Reputation Composite	-.150	.150	.491**	.072	.518**	.922**	.957**	.808**	1

*Correlation significant at $p \le .05$

**Correlation significant at $p \le .0001$

When assessed for potential linear relationships between the amount players kept for themselves and allocated to others, correlational analyses revealed no significant linear relationships for any of the three reputational variables, nor a composite reputational score, and the amount of money an individual kept for him or herself, or the amount he or she allocated to others. However, there is a significant moderate positive correlation between the amount of money players received from others and their

reputations for herding skill and there were significant moderate positive correlations between the amount of money a player received from others and his or her reputation for strong work ethic and generosity. There was also a significant moderate positive correlation between an individual's composite reputational score and the amount of money he or she received from other players. The same pattern also emerges for the linear relationships between the number of players individuals received money from and their reputational scores.

Kinship Variables

Correlational analyses of game behavior and kinship variables indicated that the amount a player kept for him or herself was negatively correlated with the amount a player gave to non-relatives (r = -.373, p = .012) (e.g. people who kept more for themselves tended to give less to non-relatives) but no significant linear relationships existed between any kinship category and the amount players allocated to others or received from others, save for two. A player's total number of kin, and total number of marital kin were positively correlated with the number of individuals he or she received allocations from.

When assessing the amount of money players allocated to different types of kin relative to their number of reported kin ties, however, several significant relationships emerged. First, the amount players gave to marital kin was moderately positively correlated with their total number of reported marital kin (r = .593, $p \leq$ .01) and close marital kin (r = .514, $p \leq$ .01) and weakly positively correlated with their reported numbers of distant marital kin (r = .389, p = .008). Similarly, the amount players gave to blood kin was moderately positively correlated with their total number of reported blood

relatives and close blood relatives (r = .521, $p \leq .01$, r = .431, $p = .003$, respectively) while only weakly positively correlated with their reported number of distant blood relatives (r = .302, $p = .044$). Table 2.6 illustrates the results of these analyses.

Table 2.6: Correlation Matrix for Kinship Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Amt. Kept for Self	1							
2. Amt. Allocated to Others	-1.00**	1						
3. Amt. Received from Others	.094	-.094	1					
4. # Allocations Given to Others	-.244	.244	.026	1				
5. # Allocations Received from Others	.113	-.113	.887**	.024	1			
6. Total Kin	-.022	.022	.288	.230	.382**	1		
7. Total Blood Kin	-.085	.085	.181	.085	.194	.597**	1	
8. Total Affines	.065	-.065	.194	.220	.308*	.600**	-.283	1

*Correlation significant at $p \leq .05$

**Correlation significant at $p \leq .0001$

The amount players allocated to combined blood and marital kin was also significantly moderately positively correlated with total reported blood and marital kinship ties (r = .489, $p = .001$). Finally, the amount players allocated to non-kin was moderately negatively correlated with their total reported number of kin (r = -.451, $p = .002$), and weakly negatively correlated with their total number of reported blood kin (r = -.351, $p = .035$). The results of the analyses described above are illustrated in Table 2.7.

To assess the difference in players' allocation to different kin categories and non-kin, I compared the amount of money players allocated to kin vs. non-kin, marital vs. blood kin, marital kin vs. non-kin, and blood kin vs. non-kin. Results of Wilcoxon Rank Sum Tests indicated that players gave significantly more to kin (combined marital and

blood relatives) than to non-kin and more to blood kin than marital kin. Players also gave

statistically significantly more to marital kin than to non-kin, but not significantly more to

blood kin than to non-kin. The results of these analyses are summarized in Table 2.8.

Table 2.7: Correlation Matrix for Allocations to Kin Types

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Total Kin	1						
2. Total Blood Kin	.597**	1					
3. Total Affines	.600**	-.283	1				
4. Amt. Blood Kin	.240	.521**	-.248	1			
5. Amt. Affines	.321*	-.140	.593**	-.349*	1		
6. Amt. Total Kin	.489**	.352*	.278	.609**	.571**	1	
7. Amt. Non-relatives	-.451**	-.315*	-.268	-.480**	-.384*	-.759**	1

*Correlation significant at $p \le .05$

**Correlation significant at $p \le .0001$

Table 2.8: Comparison of amounts given to different kin categories

Comparison	Positive Ranks	Negative Ranks	Tied Ranks	*z* - value	St. Error	*p* – value
Marital vs. Blood Kin	33	8	4	3.043	77.07	.002*
Total Kin vs. Non-kin	12	33	0	-2.757	88.51	.006*
Non-kin vs. Blood Kin	26	17	2	1.148	82.74	.251
Non-kin vs. Marital Kin	12	25	8	-2.062	66.20	.039*

*Comparison significant at $p \le .05$

2.5.3 *Multiple Regression Results*

To determine the strength of the positive relationships between how much a

player received from others and the variables described above, I conducted a multiple

linear regression. This analysis included the following variables that were found to be

significantly positively correlated with the amount of money a player received from

others: the number of animals in a player's herd, the number of children a player had, a

player's composite reputational score, and the total number of kin a player had. The results of this analysis indicated that the model is significant ($F(4, 40) = 6.42$, $r^2 = .33$, $p \leq .01$) and explains 33% of the variance in the amount of money players received from others. However, only composite reputational scores ($\beta = .574$, $t = 3.32$, $p = .002$) and total number of children ($\beta = .284$, $t = 2.28$, $p = .03$) were significant predictors in the model. Table 2.9 illustrates the results of this analysis.

Table 2.9: Multiple Regression Analysis Results for Amount Received from Others

Variable	St. Error	β	t – value	p – value
Reputation	119.42	.574	3.32	.002**
Total Kin	362.12	.224	1.73	.09
Herd Size	12.32	-.172	-.97	.34
Total Children	703.81	.284	2.28	.03*

$r^2 = .330$
F – ratio $= 6.42$
SEE $= 8698.86$
N $= 44$

*Significant at $p \leq .05$
**Significant at $p \leq .01$

2.5.4 *Player Reasoning*

Qualitative analysis of players' categorical reasoning for allocating experimental funds to others indicated that although few significant positive correlations between a player's total number of kin and the amount players gave to others, in both the household heads' and women's games, kinship was the primary driving reason players elected to give money to other players. Of 273 transactions players gave to others in the household heads' game and 201 in the women's game, 47.25% and 59.40%, respectively, were attributed to blood or marital kinship, and women often cited marital kinship as their reason for giving to other players.

The next most common reason players gave for giving to others was a sense of another player's need, which could include the loss of livestock in a previous season, having many children to care for, having bank debts, being elderly, or having a medical condition. In the household heads' game, 26.73% of transactions, and in the women's game 13.36% of transactions were attributed to a player's perceived need. Friendship ranked third for both household heads and women at 14.65% and 18.81%, respectively.

Table 2.10: Players' Reasons for Allocating Money to Others[1]

Category	Household Heads (% of 273 Allocations)	Women (% of 201 Allocations)	Combined Total (% of 474 Allocations[2]
Kinship	47.25	59.40	52.40
Perceived Need	26.73	13.36	21.05
Friendship	14.65	18.81	16.42
Gratitude for Service	11.72	2.97	8.00
Proximity	5.86	6.93	6.31
Player Age	3.66	5.44	4.42
Social Reputation	2.56	2.97	2.73
Other	1.46	1.98	1.68

[1]Category percentages will equal ≥100% because some allocations were attributed to more than one category
[2]Does not include allocations players made to themselves

Less common reasons for giving for both household heads and women included acknowledgment of services given by others such as caring for livestock, sharing labor, or lending equipment, although this reason was more common for household heads (11.72%) than for women (2.97%). Smaller numbers of players cited reasons such as their seasonal camp's proximity to other players' camps, a player's age, or a player's perceived social reputation as reasons for giving to others. Finally, a small number of players gave other reasons for making allocations that did not fall into the categories mentioned above such as being childhood classmates, simply "wishing to give" to another player, or expecting that a player would reciprocate an allocation. Player reasoning is summarized in Table 2.10.

2.6 Discussion

The results of this study reveal several important findings relevant to the study of generosity and cooperation in humans and the Mongolian ethnographic record. The study began with three main predictions: 1) Individual players will allocate more money to kin than non-kin, 2) An individual's social reputation for work ethic, generosity, and herding skill will be positively correlated with the amount of money received from others, and 3) An recipient's perceived need will serve as a main driving reason for player's decisions to allocate money to others. The results of the allocation game indicate broad support for hypotheses 1 and 2, but more limited and problematic support for hypothesis 3.

The overall positive relationship between social reputations and the amount of money players received, although not how much they allocate to others, indicates support for the findings of Macfarlan et al. (2012), Fu et al. (2008), and Lyle and Smith (2014) who have found that social reputations are positively related to individuals' access to cooperative partnerships and other social benefits. The results also support the findings of Ericksen (2014) who found that Mongolian herders value and actively cultivate their reputations for being hard workers and skilled herders. Thus, social reputations may serve as a means by which actors target potential cooperative partners and reinforce social bonds in rural Mongolia.

Within Tosontsengel's Shumultei population, reputations for being a hard worker, a helpful person, and skilled at animal husbandry are often cited by pastoralists as desirable characteristics of a good herder, while, as suggested by Ericksen (2014), "laziness" is seen as a characteristic of a poor-quality livestock herder. Often, when asked in interviews why some families lose excessive numbers of livestock during the winter, fail to prepare adequately for seasonal labor, or fail to grow the sizes of their herds,

Tosontsengel pastoralists will cite an individual's laziness as the reason for his or her misfortune. This type of sentiment often does not hold for families who are affected by sickness, large financial debts, or the death of family members.

A positive social reputation is not significantly positively related to a player's wealth in animals in the study population, and this may be because the absolute numbers of animals in a family's herd are a poor predictor of net wealth. There are two reasons for this. First, the relative value of livestock products and the diversified nature of the species that families keep in their herds makes it difficult to predict a family's annual income from livestock products and sales. Second, Mongolian herders' general suspicion and reluctance to discuss income from sources other than animal husbandry makes it difficult to determine a family's overall financial wealth (Empson 2012). Another potential possibility for the lack of a positive relationship between wealth in animals and social reputation is that the number of animals in a person's herd does not predict social reputation. However, this is not likely given that the Mongolian ethnographic record suggests that the number of animals a herder possesses is a strong predictor of social reputation and economic opportunities (Murphy 2018).

The significant positive correlation between a player's herd size and reputational score for hard work indicates that there may be a potential connection between wealth and social relationships. It is interesting to note that three of the household heads with the highest reputational scores for hard work, generosity, and herding skill also received larger-than-average allocations from others, are among the wealthiest herders in the community, and are also the most well connected in labor sharing networks with other families. However, these assumptions are based on the research team's qualitative

assessment of household heads from three seasons of participant observation in the study site, and thus, I exercise caution in making this claim until more effective means of assessing Mongolian herders' net wealth are developed.

A forthcoming study from the same test population (social network analyses described in chapter 3) also indicates that the individuals in the study population with the highest reputational scores are also those who provide the most assistance to other families in the study population for a variety of seasonal labor types. This finding is consistent with the Mongolian ethnographic record which suggests that pastoral populations value work ethic and diligence in herding labor (Ericksen 2014). Murphy (2014) also suggests that wealthier herding families in eastern Mongolia are more able to secure access to land and labor resources, often at the expense of families with smaller herds. Thus, support for the hypothesis that players with higher social reputations for behavioral characteristics that are valued in Mongolian pastoral communities suggests that, as in other small-scale societies, social reputations are a powerful currency by which individuals signal their cooperative value relative to other members of their communities.

Regarding the effects of kinship on generosity, the study results present a problematic analysis of the role of kinship in driving generosity among Mongolian pastoralists. Both male and female participants most commonly cited kinship relationships as the reason they chose to allocate funds to other players. Comparisons of the relative amounts household heads allocated to blood kin, marital kin, and non-kin indicate that players allocate significantly more to kin than non-kin, more to blood kin than marital kin, but not significantly more to blood kin than non-kin. Therefore, there is support for the first hypothesis that players would allocate more money to blood and

marital kin than non-kin. However, the lack of significant positive linear relationships between the amount players allocated to others, received from others, or kept for themselves and their number of kin complicates the interpretation of these results and indicate potential problems with the way kin relationships were collected and analyzed in this study. For example, the kinship data collected in this study does not account for participants' perceptions of the relative importance of various kinship categories.

While the amount of money players allocated to the various kin categories is positively correlated with the numbers of various kin relationships they reported having, more complex analyses of kinship may be required to explore the potential relationships between kinship and generosity in the study population. For example, rather than collecting kin relationships using self-reported pile sorts and then cross-examining results across players, it may be more appropriate to compile comprehensive genealogies or genetic information to classify ties based on genetic relatedness. In addition, other studies of Mongolian herding societies have highlighted the importance of extended patrilines in determining land access and social connectivity (Murphy 2014; Humphrey and Sneath 1999; Endicott 2012; Bold 1996). Therefore, more accurate methods for measuring relatedness may be required to capture relationships between giving and kinship in future studies. In addition, it may be more appropriate to gather both kin ties and players' assessments of their relative interdependence with other individuals to more adequately assess players' decisions to give to certain individuals relative to others.

While the results of kinship analyses are problematic, my ethnographic analyses of Tosontsengel's pastoral communities (discussed in Chapter 3) highlight the importance of kinship in determining families' access to land, labor, and resources. In the case of the

Shumultei Valley, where ideal winter camping spots that provide suitable microclimates for livestock survival during the harsh winter months are limited, blood and marital kinship ties factor greatly into how herders gain access to winter pastures. Access to these winter camping sites is often determined by either blood or marital kinship with other families that use winter sites. Most winter campsites are occupied by more than one family, and very often, these winter *khot ail* are comprised of groups of siblings or extended marital kin. Usually, families with greater numbers of blood and marital kin have an easier time securing annual access to a winter camping site than those with less kin ties.

Regarding the claim above, it is interesting to note that three of the household heads in the study sample are not native to Tosontsengel and moved into the Shumultei Valley from other parts of Zavkhan Province. Two of these three household heads are brothers who have only a single marital relationship with another family in the study population. The third is a close marital relative to a group of brothers who occupy several winter camping sites in Shumultei. Neither of the household heads who lack extensive kinship ties to other families in the study population received a single allocation from another household head (save for from each other). They also occupy winter pastures in an area that is reported by locals as being the lowest quality winter range because they were unable to secure access to a winter camping site among the other families and had to rely on the local government to find an unoccupied winter camping site for them. The third household head who is not native to the study community, on the other hand, received multiple allocations from other household heads and has access to a higher quality winter campsite, due, ostensibly, to his more extensive marital ties to other

families in the area. Therefore, as the quantitative results and ethnographic data from the study population suggest, both blood and marital kinship are an important way that families gain access to labor and resources in the study site. And so, player's self-reported reasons for giving to others reflect the importance of kinship relative to reciprocity, friendship, perceived need, age, and other factors.

Although kinship was the most common reason players cited for allocating experimental funds to other players in my Mongolian sample, Gervais finds that a player's perceptions of other players' need was the most common reason Fijian fishermen cited for allocating funds to others (Gervais 2017). While perceived need was the second most common reason both male and female Mongolian players gave for allocating funds to other players and accounted for roughly 20% of allocations, it was still second in frequency to blood and marital kinship. This may be due either to the importance of kinship in securing land and labor access as described above, or the study procedure's failure to capture player's relative neediness. However, the fact that players tended to give more money to individuals with more children (and often citing a person's number of children as a reason that they might need money) suggests that perceptions of a players' financial neediness might be a driving factor in game decision making. In addition, it is interesting to note that the household head who received the greatest amount of money from others (41,000 MNT) was severely ill during the winter of 2017 and passed away soon after data collection was completed.

Tosontsengel herders often cite a person's neediness or a sense of compassion for others as the reason they provide help to other families or individuals in the community. For example, herders will often describe a sense of compassion for other community

members who have serious medical conditions, are elderly and no longer able to care for their herds effectively, have extensive bank loans, have tuition debts for children entering universities, have lost large numbers of livestock, or men and women who have lost their spouses. These reasons are reflected in post-game interview responses, and while they are secondary to kinship, their frequency indicates that they are an important factor in determining players' choices on who to allocate money to. Therefore, the third hypothesis that perceived need would be a major driver of player decisions has some qualitative and quantitative support.

2.7 Conclusion

This study represents one of the first implementations of RICH allocation games in a real-world, non-Western setting, the first ever study to include a RICH allocation game involving an all-female sample, and among the first applications of experimental economic games in rural Mongolia (see Gil-White 2004 for another application of economic games in Mongolia). The results indicate that kinship, social reputations, and perceptions of need are important drivers of generous giving among pastoral nomads living in the countryside of western Mongolia. Furthermore, the results provide support for the findings of other behavioral ecology and agent-based modeling studies that have highlighted the importance of social reputations and kin ties in determining social relationships and partner choice in small-scale societies (Lyle and Smith 2014; Murphy 2014; Macfarlan et al. 2012; Fu et al. 2008).

To expand current understandings of how kinship and social reputations affect generosity and social connectivity among Mongolian pastoral nomads, future research should focus on the following. First, future studies should assess kinship ties among

experimental participants in a more systematic way to construct more accurate genealogies and determine actual coefficients of genetic relatedness among study participants. This would ultimately be more effective for assessing the role of kinship in generous giving because it would allow for the construction of extended genealogies and maps of the extended patrilines which have been shown to help determine families' access to labor, land, and resources in rural Mongolia (Murphy 2014). In addition, kinship analyses should also account for players' perceptions of their relative interdependence with other individuals to provide more complex metrics of both genetic relatedness and players' perceptions of the importance of their relationships with others (Aktipis et al. 2018).

Second, although assessing the wealth of Mongolian pastoral families may be difficult, and livestock may be a poor proxy for a family's net financial wealth, it is important for future studies to focus on accurately measuring study participants' wealth in both animals and other income sources and to more effectively determine players' relative need. The positive relationship between how much a player received and his or her total number of children observed in this study is telling, especially considering pastoral families' desires to diversify their children's access to career opportunities with higher education and ties to urban economies. However, this measure provides only a partial representation of the diverse set of needs Mongolian pastoralists can encounter. Therefore, future research should focus on categorizing net wealth and potential needs in a more comprehensive way than offered in this study.

Finally, this study provides a second successful implementation of RICH games in a real-world setting and shows that these experimental methods can be successfully

used to assess generosity in societies with different subsistence patterns and to explore potential differences in men and women's generous giving. Therefore, there is significant potential to implement RICH games in a variety of sociocultural milieus and to build the possibility for cross-cultural comparisons of generous giving that are more grounded in ethnographic context than previous applications of experimental economic games.

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Chapter 3:

Assessing social networks of labor sharing among nomadic pastoralists in Tosontsengel, Mongolia

In this chapter, I use social network analysis to explore labor sharing networks in a community of pastoral nomads living in Tosontsengel, Zavkhan Province in western Mongolia. Social network analysis allows researchers to assess a variety of social connectivity metrics in light of an individual's economic, demographic, social, and reputational characteristics. Here, I analyze labor sharing networks for six typically collaborative types of labor that Mongolian pastoralists conduct over the course of a year in a community of forty-seven herding households that share the same seasonal pastures and annual migration routes. Specifically, I focus on the potential intersection between the heads of these households' kinship, wealth, and social reputations and their connections with other households in the herding community. This study presents the first-ever application of social network analysis among Mongolian pastoralists, and the results provide valuable insights in determining the main social and demographic drivers of labor exchange and cooperation in rural Mongolia.

3.1 Introduction: The Behavioral Ecology of Cooperation and Social Networks

The global ethnographic and human behavioral records suggest that generosity and cooperation are widespread in diverse human societies and subsistence patterns (Cronk and Leech 2013). Evolutionary psychologists, human behavioral ecologists, and ethnographers have noted the commonality of cooperation cross-culturally and posit that cooperation and generosity may serve as a means for individuals and communities to mitigate economic and ecological risks (Aktipis et al. 2018), forge cooperative alliances

with other individuals or groups (Macfarlan et al. 2013; Flynn et al. 2006), and gain access to scarce resources and social capital (Kaplan et al. 2009). In addition, other scholars have hypothesized that cooperation in human societies may be maintained through norms of reciprocity (Boyd and Richerson 1989; Trivers 1971; Sahlins 1965), costly signaling of prosociality or willingness to adhere to prescribed social norms (Cosmides and Tooby 2005; Sosis and Ruffle 2003; Bliege-Bird et al. 2001), or through the punishment of non-cooperative individuals (West et al. 2007; Gintis 2000; Boyd and Richerson 1989).

Other researchers have highlighted the importance of kinship and inclusive fitness as a mechanism for promoting cooperation and sharing in social groups and argue that individuals can promote their long-term fitness by behaving altruistically towards genetically related kin (Scelza and Bliege-Bird 2008; Richerson and Boyd 1999; Chagnon and Bugos 1979; Hamilton 1964). Affinal and fictive kin relationships may also serve as an important means by which people form cooperative partnerships (Macfarlan et al. 2018; Thomas et al. 2015; Alvard 2009), and this may partially explain the widespread use of kin terms to describe relationships between non-genetically related members of social groups, religious institutions, mutual aid societies, and fraternal organization (Cronk and Gerkey 2007). Thus, genetic relatedness, affinal kinship, and fictive kinship may serve the formation of cooperative relationships both within and between social groups.

Cooperative relationships are often dyadic in nature but are also frequently couched in the context of larger networks within a broader social group. Dyadic relationships between two people can help actors in a social group not only gain access to

cooperative partnerships with single individuals but also access to other social groups that may offer other resources, services, or economic opportunities (Semmann et al. 2004). However, to access the benefits of these relationships, individuals must assess potential cooperative partners for their willingness to adhere to social norms regarding cooperation and avoid people who will violate norms or cheat (Cosmides et al. 2005). Prestige and reputations for prosociality may serve as a means by which individual actors negotiate broader social networks and avoid engaging in partnerships with norm violators or non-cooperative people (Although, dos Santos and Wedekind 2015 also suggest that cooperation can be maintained by individuals with strong reputations for punitive actions against norm-violation) (Iniguez et al. 2014).

Prestige, leadership ability, and prosociality can serve as powerful currency through which actors broker relationships with others and signal their quality as cooperative partners (von Rueden and van Vugt 2015). Thus, it is reasonable to expect that a person would not only seek to increase his or her status and reputation for prosociality relative to other individuals in the social group but also to seek partnerships with people with positive reputations for these qualities. In agent-based models, Fu et al. (2008) find that reputations can reinforce cooperation and sharing in networked relationships and eliminate the risks of selecting non-cooperative partners. Similarly, Nowak and Sigmund (1998) find that reciprocity can be strengthened in agent-based models if agents select for ties with individuals with high reputational scores and avoid those with lower scores. Empirical tests of the effects of social reputations on cooperation in experimental economic games have also shown that people are acutely aware of observation by others and have also demonstrated the effectiveness of social reputations

and reputation-based partner choice in reinforcing cooperation and solving collective action dilemmas (Sylwester and Roberts 2013; Ahn et al. 2009; Iredale et al. 2008; Haley and Fessler 2005).

Within cultural anthropology, the importance of status, prestige, and social reputations was first systematically studied by Sahlins and has since become an important area of inquiry throughout the social and behavioral sciences (Sahlins 1963). There have been extensive ethnographic and behavioral ecology studies to test the hypothesis that social status and reputations are primary drivers for the evolution and maintenance of cooperation in human societies. Empirical studies in horticultural and hunting and gathering societies have shown that social status, prestige, and reputations not only help reinforce cooperation and sharing in small-scale societies, but also provide fitness enhancing benefits to high-status individuals including increased economic benefits and access to reproductive partners (Macfarlan et a. 2013; von Rueden et al. 2011). Furthermore, high status community members have also been shown to have greater health benefits, decreased morbidity, and increased offspring survivability relative to lower status individuals (Lyle and Smith 2014; von Rueden et al. 2011). Social status and positive reputations also provide people with greater influence over others and greater decision-making power in social groups (von Rueden et al. 2008). Thus, it is possible that social reputations and prestige serve as a valuable currency in a market for access to partnerships with high status people (Macfarlan and Lyle 2015; Barclay 2011; Noe and Hammerstein 1994).

Social networks of cooperation and labor sharing have been studied extensively in horticultural and hunting and gathering populations (Bliege-Bird and Power 2015;

Macfarlan et al. 2013; Apicella et al. 2012; Hill et al. 2011). Relative to these subsistence patterns, the social networks of cooperation in pastoralist societies, especially pastoral nomad societies, is less well documented. Previous research has shown that pastoral nomadic peoples across the globe display strong traditions of mutual aid, cooperation, and social networks of labor sharing (Thomas et al. 2015; Lyle and Smith 2014; Aktipis et al. 2011; McCabe 1990). The pastoral nomadic societies of Inner and Central Asia have also been shown to display systems of cooperation, mutual defense, and risk management that help nomadic herders manage the ecological variability typically found in these regions (Bold 1996; Cooper 1993).

Previous research on cooperation and sharing in Inner Asian pastoralists has tended to focus more heavily on historical changes in social organization, especially in response to the collapse of socialism in many parts of Inner Asia in the late 20th Century (Endicott 2012; Upton 2008; Humphrey and Sneath 1999). Comparatively little behavioral research has been conducted to explore the social organization of Eurasian pastoralists, especially those living on the Mongolian Plateau relative to other global pastoral peoples (Murphy 2015; Murphy 2014; Ericksen 2014; Sneath 2002). This study attempts to fill these knowledge gaps by exploring the intersections between social reputations, kinship, and other behavioral and demographic characteristics with social connectivity in a remote community of Mongolian nomadic pastoralists living in Zavkhan Province, western Mongolia.

3.2 Cooperation in Mongolian Pastoral Societies

The Inner Asian steppes have been populated by nomadic pastoralists for at least three millennia (Lattimore 1941). On the Mongolian Plateau, cooperation among

nomadic herders has allowed pastoral communities to ensure the mutual defense of

territories, access to seasonal pastures, and secure labor for herding tasks (Murphy 2014;

Humphrey and Sneath 1999; Bold 1996; Cooper 1993). Contemporary herding labor in

the Republic of Mongolia is shaped both by the history of land use, social organization,

and the pastoral economy of the Mongolian Plateau, as well as the present integration of

the Mongolian livestock economy with global markets for livestock products. To

understand how cooperation and sharing behavior function on the contemporary

Mongolian steppes, it is essential to understand the history of land use, social

organization, and the pastoral economy of the Mongolian Plateau, especially in the

context of the 20th and 21st Century Republic of Mongolia.

Mongolian nomadic pastoralists rely primarily on natural grassland and seasonal

mobility to sustain herds of sheep, goats, horses, camels, cattle, and yaks (Humphrey and

Sneath 1999). During the last 1,500 years of Mongolian history, the sociopolitical

structure of the pastoral economy has transitioned from loose tribal and clan

confederations, the unified Mongol Empire, territorial components of imperial China, and

in the early 20th Century, an independent Mongol Kingdom (Batsaikhan 2014; Endicott

2012). During the 20th Century, Mongolia became a socialist republic that was heavily

influenced and subsidized by the Soviet Union (Humphrey and Sneath 1996a; 1996b).

After the end of socialism in the early 1990s, Mongolia became a market economy, and

the pastoral economy has become increasingly integrated with global markets for

livestock products since the early 1990s (Dierkes 2012; Potkanski 1993).

Prior to the founding of the Mongolian People's Republic in the 1920s, land,

society, and economic life were controlled by Tibetan Buddhist monasteries or by feudal

princes that represented the reigning Manchu emperor in Beijing (Endicott 2012). Land and grazing territory were organized according to clans based on extended patrilines and governed by a ruling prince, monastery, or clan patriarch (Batsaikhan 2014; Humphrey and Sneath 1999). During this period, pastoral labor and seasonal migration were managed by groups of extended kin known as *khuree*. *Khuree* were organized to ensure the mutual defense of a group of herding families in the event of attack by outside groups (Bold 1996). *Khuree* were further subdivided into smaller groups of herding families known as *khot ail* which consisted of groups of 2-10 usually interrelated families who would co-manage livestock, share seasonal labor, and occupy grazing territory based on customary use rights (Sneath 2003; Fernandez-Gimenez 1999; Bold 1996; Cooper 1993; Mearns 1993).

During the Mongolian People's Republic (1924 – 1992), clan identity and *khot ail'*s role in land management and herding life were suppressed in favor of the formation of socialist herding collectives in the 1930s (Batsaikan 2014). Collectives enforced government-mandated quotas for livestock products, organized herding labor, and divided state-owned animals among herding families who often specialized in single-species herds (Endicott 2012; Upton 2008). The collectives also provided herders with veterinary assistance, emergency livestock fodder, transportation for nomadic migrations, and annual salaries (Batsaikhan 2014; Humphrey and Sneath 1999). Therefore, during the socialist period, customary systems of cooperation and labor sharing among extended kin were diminished as the local and national governments regulated the pastoral economy and the production of livestock products.

After the collapse of the Mongolian People's Republic in the early 1990s, pastoral collectives were dissolved, and formerly collectively-owned livestock were privatized and distributed to individual households (Endicott 2012). Herding families now became responsible for managing their own livestock and making decisions on what types of livestock products to produce. In addition, the services and technical support formerly provided to families by the collectives were discontinued and families were now required to secure their own sources of emergency fodder, seasonal transportation, and veterinary services (Humphrey and Sneath 1996a). Pastoral communities also became responsible for regulating access to grassland resources and winter camping sites at a time in which there was a sharp increase in the number of rural families, and this has contributed to an increase in overstocking and pasture degradation in Mongolia since the 1990s (Hilker et al. 2013; Fernandez-Gimenez and Allen-Diaz 2001).

As the state's role in regulating land use and pastoral production has diminished, ethnographic research in post-socialist Mongolia has found a resurgence of traditional kin-based ties and land use strategies that were common prior to socialism (Sneath 1993). Pastoral communities are once again relying on membership in extended patrilines to determine access to land resources (Murphy 2014; Sneath 2004). In the absence of state-provided services, herders are also relying more heavily on kinship ties, *khot ail* groupings, and dyadic relationships with other herding households to manage livestock, develop social support networks, choose cooperative partners, and hire seasonal labor (Thrift and Byambaatar 2015; Murphy 2014; Humphrey and Sneath 1999; Sneath 1993). Ericksen (2014) has found that Mongolian herders value reputations for hard work, herding skill, and herding knowledge when evaluating others, and herders often cite

"laziness" as the mark of a poor-quality herder or a person who experiences frequent misfortune. Murphy (2014) also argues that kinship ties are an important factor in determining both labor sharing relationships among herders and access to land in rural Mongolia.

Previous ethnographic research in rural Mongolia has highlighted the importance of cooperation and labor sharing in rural Mongolia as well as the importance of kinship and social reputations in fostering ties among herding families (Murphy 2014; Ericksen 2014; Sneath 2002). Given these findings, this study aims to explore labor sharing ties in rural Mongolia empirically. To do this, I used social network analysis to assess labor sharing ties among pastoral household heads in a community of 47 full-time herding families living in Tosontsengel, Zavkhan Province, Mongolia. These network analyses explore labor sharing ties for six types of commonly cooperative herding labor and were used to test two main hypotheses: 1) Consanguineal and affinal kinship are primary drivers of social connectivity and 2) Positive social reputations drive social connectivity in small scale societies. These hypotheses lead to two main predictions in the study community: 1) Household heads with greater numbers of consanguineal and affinal kin will display greater degrees of connectivity with other household heads in the study population and 2) Household heads with more positive social reputations will display a greater degree of social connectivity than household heads with lower reputational scores.

3.3 Materials and Methods: Social Network Analysis

Social network analysis allows researchers to create a quantitative map of social connectivity in a given community and to assess how economic, demographic, and reputational characteristics might drive patterns of social ties in a network or contribute

to network structure (Hannemann and Riddle 2005; Wasserman and Faust 1994). Using network analyses, researchers can determine which individuals within the network are the most central to the network and display the greatest degree of incoming our outgoing ties with others. This is accomplished using four specific metrics. *Eigenvector centrality* provides a metric for assessing which individuals provide the most bridging connections with disparate sections of the network. It is a measure of the proportional centrality of a node to each of its neighbors. *Network degree* provides a measure of the number of incoming and outgoing social ties between an individual and other individuals in the network. *In-degree* is a measure of how many incoming ties a network node has and *out-degree* is a measure of how many outgoing ties a node has (Hannemann and Riddle 2005).

Within the scope of anthropology and behavioral ecology, social network analysis has been successfully employed to study social ties in both humans and non-human primates (Brent et al. 2011; Galaskiewicz and Wasserman 1994). In human behavioral ecology, social network analysis and social network metrics have been used to study labor sharing and cooperation in a variety of communities including horticultural populations (Macfarlan et al. 2013), mixed foraging and horticultural societies (Borgerhoff-Mulder et al. 2009; Rucas et al. 2006), hunting and gathering populations (Bliege-Bird and Power 2015), and pastoralist societies (Lyle and Smith 2014; Thomas et al. 2013). Thus, social network analysis not only provides a method to quantitatively map social ties in a given community but also allows for cross-cultural and cross-subsistence pattern comparison of network structure and dynamics.

3.4 Site Description: Tosontsengel, Mongolia

Tosontsengel is an administrative subdivision (*sum*) of Zavkhan Province in western Mongolia. The region is known for being one of the most climatologically harsh in Mongolia and holds the record for the coldest temperature in Mongolia (-52.9ºC) and the highest barometric pressure ever recorded globally (Purevjaw et al. 2014). The *sum* consists mainly of mountainous forest-steppe and is largely within the central Mongolian Khangai mountain range. The Ider river runs east-west through the *sum* and is joined by numerous tributary rivers that flow into the Ider from the slopes of the Khangai Range. The population of Tosontsengel is just over 9,000 residents, and it is the largest *sum* by population in Zavkhan Province after the provincial capital, Uliastai. Most of the population are Khalkha Mongols (Mongolia's largest ethnic group) who practice Tibetan Buddhism with syncretic elements of traditional Mongolian shamanism (Batsaikhan 2014).

Figure 3.1: Study Location in Mongolia
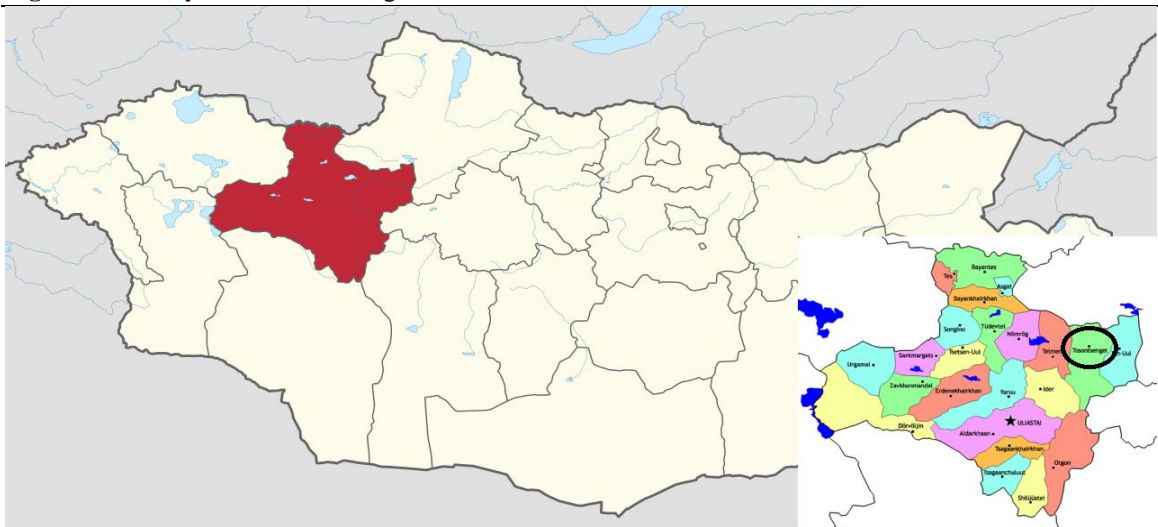
(Wikimedia 2019)

The chief source of income for the majority of Tosontsengel's rural families is animal husbandry, and pastoralists typically specialize in mixed-species herds of sheep,

goats, horses, and cattle. Wool and cashmere are the main sources of income for pastoral families, and these are sold to traders in Tosontsengel's administrative village who transport them to Ulaanbaatar, the national capital, where they enter global markets for livestock products. Some herding families also make supplementary income from cutting timber, driving trucks, producing handicrafts and operating small shops in the administrative village. These supplementary income sources are usually viewed as secondary to animal husbandry, and rural families generally hold pastoral income and wealth in animals in higher regard than other income sources (Empson 2012). Tosontsengel's pastoral families are involved in what Murphy (2018) refers to as the "cashmere debt cycle" in which herding families are generally cash poor and finance their annual expenses by taking out bank loans which they then repay during the cashmere combing season in the late spring (Murphy 2018). This debt cycle often contributes to herding families' inability to invest in alternate sources of income or to effectively purchase supplies and emergency fodder.

Tosontsengel pastoralists are nomadic and make between four and six seasonal movements for a total annual migration of 40-80 kilometers. Families typically live in river valleys that run north-south and drain into the Ider River floodplain. They spend the winter in sheltered mountain valleys and move along the banks of tributary rivers in the spring. During the summer, families move into the Ider River floodplain where land and water resources are abundant before moving back into the tributary river valleys in the autumn months. Tributary valleys tend to be exogamous with men spending their lives living in the tributary valley of their birth and women marrying in from adjacent valleys, with some exceptions. During the winter, small groups of 2-5 families, who are usually

extended kin, form *khot ail* and co-manage livestock in the limited winter campsites. The
household heads of these families sometimes take turns herding all families' combined
livestock while other household heads remain in camp. These groups then fission in the
spring and summer when grassland resources are more available.

Figure 3.2: Location of Winter *Khot Ail* in Shumultei
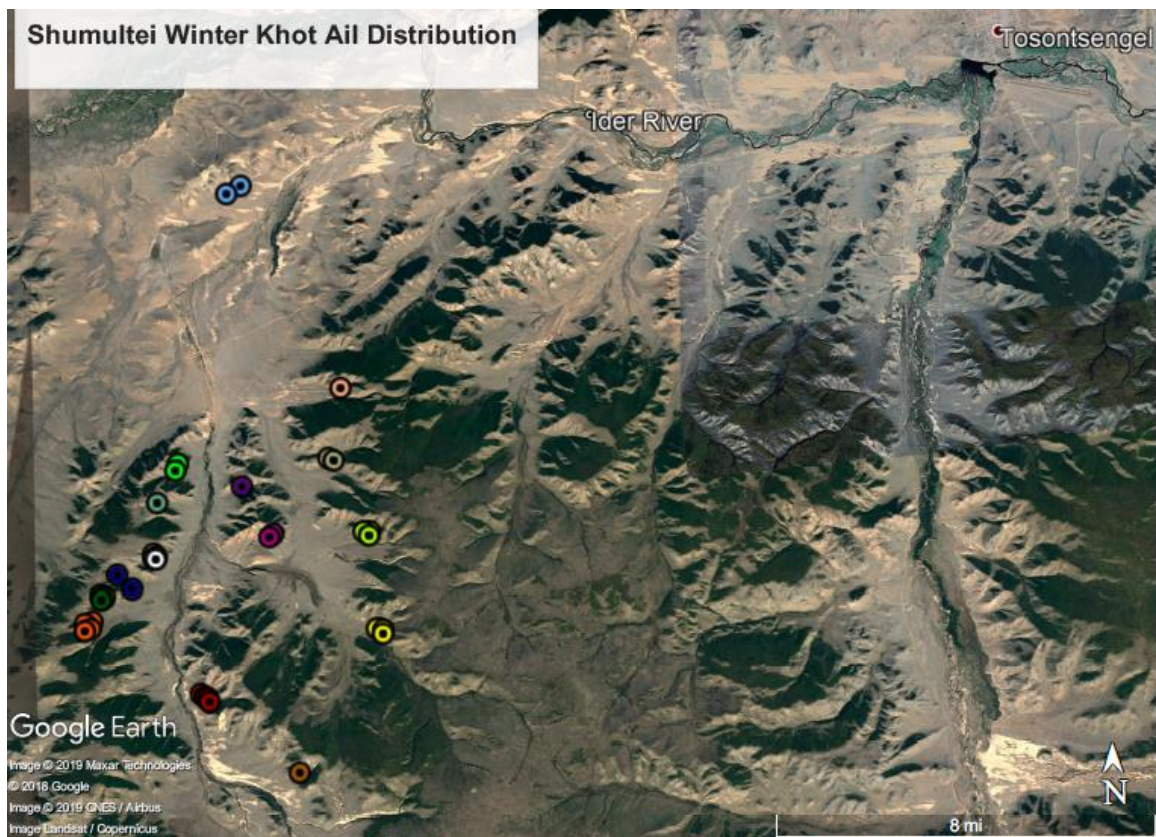
Most of Tosontsengel's full-time pastoral families also maintain a secondary
residence in the administrative village, where a portion of the family will remain during
the winter months. Local children all attend regional boarding schools during the school
year (September – June) and these secondary residences often serve as a place for
children to live during the school year so that they do not have to live in school
dormitories. They will often be joined by elderly grandparents or sometimes the wife of

the household during these months while the household head remains in the countryside managing the family's livestock. Following the completion of the school year in the late spring, these families will leave their village residences and spend the late spring and summer months in the countryside. Because of this, it is often difficult to find the exact whereabouts of family members when visiting a family in the countryside.

To select an appropriate sample for social network analysis, I focused this analysis on a tributary valley in Tosontsengel known as Shumultei. One of the major assumptions and constraints of social network analysis is that all individuals or families in the network must be present in the analysis. Because Tosontsengel's pastoral population consists of close to 1,000 pastoral households, and this research was conducted between November 2016 and July 2017, it would have been logistically impossible to represent every household in the *sum* in network analyses. Tributary valleys on the northern flanks of the Khangai Mountains tend to consist of between 25 and 60 herding families. While kinship and social ties often extend beyond a herding family's home tributary valley, the bulk of labor sharing, seasonal migration, and social interaction occur within the home valley itself. Therefore, a tributary valley presents not only a logistically feasible area of study but also a culturally appropriate area to explore inter-family labor exchange.

The Shumultei Valley is one of the largest of Tosontsengel's tributary valleys and is also the most distant from the *sum*'s administrative village. It consists of 47 full-time pastoral households who spend the year living and herding near one another. Social network analyses were limited to the household heads of 47 families that spend at least 3 of 4 seasons living in the countryside. These household heads are mostly the eldest men

in each nuclear family, but the valley is also occupied by seven female-led households.

Table 3.1 illustrates the demographic characteristics of the 47 household heads included

in the network analyses.

Table 3.1: Descriptive statistics for study population

	N	Age (*M, SD*)	Herd Size (*M, SD*)	Children (*M, SD*)	Dependent Children (*M, SD*)
Household Heads	47	46.72 (13.17)	189.53 (150.83)	3.35 (1.88)	2.07 (1.48)

3.5 Procedure

After selecting the Shumultei Valley as the community of focus for this study, one

field assistant and I consulted the local government to determine population size and to

identify any families in the Shumultei Valley that spent at least 3 of 4 seasons living and

herding livestock in the countryside. Families that own livestock but who are not active

in managing them throughout the year were not included in the analysis. Following

identification, photographs, names, and winter camp locations were obtained for each of

the household heads of the 47 families included in the study. These photographs were

printed and posted to 3.5 x 5inch index cards along with printed Cyrillic text of each

household head's first name and surname initial.

After we obtained photographs and location information on the families living in

Shumultei from the local government, the field assistant and I spent two months

conducting rapport-building activities, participant observation of daily life, and

preliminary semi-structured ethnographic interviews with Shumultei families and other

local populations. These interviews (N = 65) were continued during the social network

data collection phase and focused on individuals' perceptions of labor sharing, seasonal

mobility, and economic life in Tosontsengel. During these interviews, pastoral household members were asked which types of herding labor were typically conducted collaboratively with other families and which types were typically done by families on their own. Based on these interviews, I identified 4 different types of labor that are most frequently done with other families throughout the year. These included hay cutting, building and repairing fences (*hasha*), cleaning thick livestock dung from fences (*hurzon*), and carrying out seasonal migrations. In addition, herders reported that they did not frequently cooperatively herd livestock, sheer sheep, or comb cashmere. However, these labor types were included in the social network analysis because, while herding families do often conduct these labor types alone, they often perform these labor types cooperatively in the winter when they are living in *khot ail* with other families. During field research, I observed and participated in each of these labor types with the exception of hay cutting, which is conducted in the late summer when I was not present at the field site. Figure 3.2 describes each of these labor types, their significance, and when they are typically conducted during a calendar year.

Once the total number of families and location of seasonal camps was established, I began to collect labor sharing data for each of the six labor types described above. Network data were collected at individual families' households either in the countryside (usually a traditional Mongolian felt *ger* or a small wooden cabin) or at the family's secondary home in the administrative village. All network analysis interviews were conducted in standard Khalkha Mongolian by the field assistant, who is fluent in both English and Mongolian, who translated my instructions to participants. Prior to beginning interviews, each participant was assured that participation in the study was completely

voluntary and that he or she could stop participation at any time. Oral informed consent

procedures were used to ensure that participants were willing to participate in the social

network analysis study.

Table 3.2: Description of labor types included in analysis

Labor Type	Purpose	Season	Location	Conducted With
1. Hay Cutting	Cutting and storing hay for winter livestock fodder	Late Summer	Winter Pasture	Various Individuals
2. Hurzon Cleaning	Cleaning thick livestock dung deposits from corrals	Late Winter/Spring	Winter/Spring Corrals	Various Individuals
3. Fence Repair/Building	Insulating and repairing livestock enclosures for seasonal use	Spring, Summer, Autumn	Winter/Spring Corrals	Various Individuals
4. Seasonal Migration	Moving and arranging transportation between seasonal pastures	Spring, Summer, Autumn, Winter	Various	Various Individuals
5. Daily Herding	Moving and monitoring livestock for daily grazing	Daily	Various	Nuclear Family and *Khot ail*
6. Wool/Cashmere Collection	Sheering sheep and combing cashmere from goats	Spring, Summer	Spring, Summer Pasture	Nuclear Family and *Khot ail*

During network analysis interviews, we made efforts to minimize observation by

non-nuclear family members or other household heads, but this was sometimes

unavoidable because of both customary Mongolian social norms surrounding visitors and

hospitality or severe winter weather that prevented individuals from leaving the family's

ger. Prior to beginning the interview, the field assistant explained to participants that the

purpose of the study was to learn about how Mongolian herders work throughout the year

and that participants would be asked a series of questions about who in the local

community they worked with on various types of labor. They would be required to look

at photographs of other members of their community and sort them based on certain

categories.

Once verbal and visual cues of understanding were obtained, each participant was handed 46 index cards bearing the names and photos of the other household heads in the community (a participant's own card was excluded from the analysis) and was asked to sort the cards based on the following question: *In the past twelve months, which household heads in the stack of cards helped you with labor type X?* This process was completed for each of the six types of labor included in the analysis in random order and the photograph cards were randomized by shuffling before each sort. In the first five social network analysis interviews, we attempted to also ask participants "*In the past twelve months, which household heads in the stack of cards did you help with labor type X?*" However, these questions were discontinued because participants reported feeling fatigued and frustrated with the amount of time required to complete the interview.

Following the completion of social network analysis card sorts, we conducted a structured household demographic and economic survey which included questions regarding a household's number of children, average annual expenditure, number and type of livestock, and additional sources of annual income. Then, household heads were asked to complete a pile sort activity aimed at assessing kinship relationships and reputational characteristics for all other household heads. Each household head was presented with the same photographs and names used in the social network analyses card sorts and was asked to sort these cards according to individuals he or she shared blood and marital kinship relationships with.

To determine kinship ties among game players and to calculate the number of blood and marital kin each participant had, I cross-examined participants' kinship pile sorts to determine the number of consanguineal and affinal kin each player had in the

community. These kin relationships were then categorized as close consanguineal kin (e.g. mother, father, sibling), distant consanguineal kin (e.g. uncle, aunt, first cousin, second cousin), close affinal kin (e.g. father-in-law, mother-in-law, brother-in-law, sister-in-law), or distant affinal kin (e.g. uncle-by marriage, aunt-by-marriage). Only relationships that were mutually agreed upon by both individuals claiming a consanguineal or affinal tie in cross-examination were included in the analysis.

To assess reputational characteristics, reputational data from a separate research project involving the same 47 household heads in the Shumultei Valley were used (The RICH allocation games described in Chapter 1). In this research project, the same household heads were asked to perform a card sort of the other household heads in the community according to who they felt had the following reputational characteristics: strong work ethic, herding skill, and generosity. These reputational characteristics were chosen because previous ethnographic research indicates that Mongolian herders value these characteristics in others and use them to assess other individuals in rural communities (Ericksen 2014).

Social network analyses were conducted for each of the six labor types to obtain the following network characteristics for each of the 47 household heads included in the analysis: in-degree, out-degree, degree (the sum of in-degree and out-degree), and Eigenvector centrality. Once these measures were calculated, I used Pearson correlations to assess potential linear relationships between kinship, demographic, and reputational data and network metrics. Multiple linear regressions were used to assess the strength of these linear relationships. Finally, Mann-Whitney U-tests were used to compare social network metrics between male and female household heads. Mann-Whitney U-tests were

used instead of more common parametric analyses because Shapiro-Wilks tests for

normality indicated that the data are not normally distributed. Data were analyzed using

Gephi social network analysis software and the IBM Statistical Package for Social

Sciences (SPSS) Version 20.

3.6 Results

3.6.1 *Descriptive statistics and comparison of male and female household head's network metrics*

Across the six labor types, the forty-six household heads that were included in the

social network analysis had an average in-degree of 3.09 incoming ties with other

individuals in the labor sharing networks. They gave help to an average of 3.05 other

individuals across labor types and had an average Eigenvector Centrality of .184 (Min. =

.01, Max. = .75). Table 3.3 illustrates the average in-degree, out-degree, degree, and

Eigenvector Centrality for each of the six labor types included in the analysis.

Table 3.3: Network descriptive statistics for each labor type

Labor Type	N	In-Degree (*M, SD*)	Out-Degree (*M, SD*)	Degree (*M, SD*)	Eig. Centrality (*M, SD*)
1. Hay Cutting	46	3.33 (3.20)	3.33 (2.22)	6.63 (4.05)	.187 (.257)
2. Fence Repair	46	3.24 (3.59)	3.24 (2.19)	6.48 (3.94)	.166 (.227)
3. Hurzon Cleaning	46	3.01 (2.94)	3.09 (3.75)	6.17 (3.75)	.172 (.257)
4. Migration	46	4.22 (3.91)	4.22 (2.62)	8.43 (4.81)	.190 (.223)
5. Daily Herding	46	2.71 (2.77)	2.65 (1.51)	5.36 (2.81)	.237 (.300)
6. Wool and Cashmere	46[1]	1.84 (2.11)	1.76 (1.39)	3.52 (2.71)	.148 (.226)
Total[2]	46	3.09 (2.59)	3.05 (1.70)	6.12 (3.03)	.184 (.181)

[1]Two participants' data was missing for degree and Eigenvector centrality for this variable.
[2]This measure is a calculation of mean degree and centrality variables for all six labor types.

As shown in these descriptive statistics, individuals in the Tosontsengel sample tend to receive and provide more assistance to others in certain labor types relative to others. Notably, household heads reported both giving and receiving the most help for migrating between seasonal pastures and the least amount for sheering sheep and combing cashmere, which are typically only performed by individual nuclear families or *khot ail*.

To compare men's and women's reported in-degree, out-degree, degree, Eigenvector centrality, and reputational characteristics, I performed Mann-Whitney U-Tests. It should be noted, however, that these data are of limited explanatory power because the analysis includes only six female household heads relative to forty male household heads. The results of these tests are illustrated in Table 3.4. For the reputational characteristics, male household heads are more frequently cited for being skilled herders than females, but do not statistically significantly differ in their reputations for being hard working or generous. Furthermore, female composite reputational scores (computed by adding the reputational scores across the three reputational categories) do not significantly differ from male composite reputational scores.

Within social network analyses across the six labor types, female household heads differ significantly from their male counterparts for outgoing connections for all labor types except for daily livestock herding. Male household heads were reported to give more help to other household heads than female household heads. Female household heads also received more incoming connections from other household heads for fence building and repair and daily herding. Male and female household heads do not

significantly differ in their overall degree or Eignevector Centrality for any of the six

labor types or for mean degree and centrality across labor types.

Table 3.4: Comparison of reputational characteristics and social networks metrics for males and females

Variable	Male (*M, SD*)	Male *M* Rank	Female (*M, SD*)	Female *M* Rank	*z* - value	St. Error	*p* – value
Rep. Hard Work	5.62 (6.55)	25.59	1.14 (1.07)	14.93	76.50	33.12	.057
Rep. Skill	5.92 (6.99)	25.92	.86 (1.22)	13.00	63.00	33.05	.020*
Rep. Generosity	4.45 (3.97)	24.14	3.29 (1.50)	23.21	134.50	33.27	.870
Rep. Composite	16.00(15.89)	25.45	5.29 (2.81)	15.71	82.00	33.40	.083
Hay In-Degree	3.25 (3.33)	22.64	3.83 (2.31)	29.25	154.50	30.14	.252
Hay Out-Degree	3.65 (2.17)	25.64	1.17 (1.17)	9.25	34.50	30.23	.005**
Hay Degree	6.88 (4.22)	24.20	5.00 (2.19)	18.83	92.00	30.42	.360
Hay Eig. Centrality	.186 (.260)	23.00	.187 (.252)	26.83	140.00	30.64	.514
Hasha In-Degree	2.68 (2.90)	21.82	7.00 (5.55)	34.67	187.00	30.25	.030*
Hasha Out-Degree	3.58 (2.11)	25.68	1.00 (1.26)	9.00	33.00	30.67	.004**
Hasha Degree	6.25 (3.81)	22.80	8.00 (4.86)	28.17	148.00	30.48	.360
Hasha Eig. Centrality	.128 (.160)	21.99	.422 (.415)	33.58	180.50	30.48	.046*
Hurzon In-Degree	2.98 (3.09)	22.42	3.83 (1.47)	30.67	163.00	30.36	.157
Hurzon Out-Degree	3.40 (2.18)	25.46	1.00 (1.26)	10.42	41.50	30.35	.010**
Hurzon Degree	6.38 (3.97)	24.36	4.83 (1.17)	17.75	85.50	30.41	.257
Hurzon Eig. Centrality	.166 (.253)	22.98	.210 (.309)	27.00	141.00	30.57	.492
Migration In-Degree	4.13 (3.68)	23.32	4.83 (4.54)	24.67	127.00	30.26	.817
Migration Out-Degree	4.65 (2.54)	26.00	1.33 (.52)	6.83	20.00	30.38	.001**
Migration Degree	8.78 (4.84)	24.60	6.17 (4.26)	16.17	76.00	30.52	.160
Migration Eig. Centrality	.185 (.218)	23.36	.229 (.278)	24.42	125.50	30.65	.860
Herding In-Degree	2.49 (2.64)	21.37	4.17 (3.37)	33.58	180.50	29.10	.031*
Herding Out-Degree	2.80 (1.49)	24.80	1.67 (1.37)	14.83	68.00	29.96	.094
Herding Degree	5.28 (2.94)	22.64	5.83 (2.79)	25.33	131.00	29.58	.660
Herding Eig. Centrality	.220 (.308)	21.77	.344 (.230)	31.00	165.50	29.71	.114
Wool In-Degree	1.82 (2.24)	21.79	2.00 (1.10)	27.00	141.00	28.52	.374
Wool Out-Degree	1.93 (1.37)	25.15	.67 (1.03)	12.50	54.00	29.80	.030*
Wool Degree	3.65 (2.81)	24.09	2.67 (1.97)	19.58	96.50	30.38	.453
Wool Eig. Centrality	.159 (.240)	22.34	.078 (.078)	23.50	120.00	28.83	.855
Mean In-Degree	2.91 (2.58)	22.34	3.33 (1.61)	31.25	166.60	30.62	.132
Mean Out-Degree	3.33 (1.61)	25.85	1.14 (.97)	7.85	26.00	26.00	.001**
Mean Degree	6.23 (3.16)	23.84	5.42 (2.04)	21.23	106.50	30.63	.667
Mean Eig. Centrality	.175 (.181)	22.68	.245 (.181)	29.00	53.00	30.66	.297

*Comparison is significant at $p \leq .05$.
**Comparison is significant at $p \leq .01$.

3.6.2 *Correlational analyses to assess covariance among variables*

      To assess potential relationships between social reputations, demographic characteristics, and kinship, I conducted Pearson correlations. These analyses indicate that individuals' social reputation scores are not significantly correlated with their reported number of total kin, total consanguineal kin and total reported affinal kin.

Table 3.5: Correlation matrix for social reputations and demographic/kinship variables

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Reputation Work Ethic	1								
2. Reputation Herding Skill	.819**	1							
3. Reputation Generosity	.744**	.580**	1						
4. Reputation Composite	.957**	.922**	.808**	1					
5. Age	-.064	.074	.082	.026	1				
6. Herd Size	.683**	.702**	.439**	.699**	-.166	1			
7. Total Kin	.142	.073	.212	.143	.026	.259	1		
8. Total Consanguineal Kin	.106	.063	.089	.094	.-.031	.241	.547**	1	
9. Total Affines	.065	.024	.165	.078	.062	.070	.600**	-.283	1

[**]Comparison is significant at $p \le .01$.

Participants reported having 9.52 (SD = 3.81) total kin, 6.24 (SD = 3.18) consanguineal kin, and 3.28 (SD = 3.19) affinal kin on average but their reported number of kin is not significantly related to the number of times they were cited by other household heads for being hard working, skilled at herding livestock, or generous. However, the results of these Pearson correlations indicate that the three reputational characteristics are significantly positively correlated with one another. Reputations for being hard working are strongly positively correlated (r = .819, $p \le .01$) with being cited as having strong herding skill and also strongly positively correlated (r = .744, $p \le .01$) with being cited as being a generous person. Reputations for being a skilled herder are also moderately

positively correlated with reputations for generosity (r = .580, $p \leq .01$). Due to this covariance, I created a composite reputational score which was computed by adding the raw reputational scores for the three reputational variables. This composite score is used in all regression models discussed later in this chapter.

Correlational analyses also indicate that a participant's age is not significantly correlated with the number of animals in his or her herd or his or her reputational characteristics. However, the number of animals in a household head's herd is strongly positively correlated with his or her reputation for strong work ethic and herding skill (r = .683, $p \leq .01$, r = .702, $p \leq .01$, respectively) and moderately positively correlated with his or her reputation for generosity (r = .439, $p \leq .01$). Herd size is also strongly positively correlated with an individual's composite reputational score (r = .699, $p \leq .01$). The results of the correlational analyses described above are illustrated in Table 3.5.

3.6.3 *Social network analysis results for each labor type and mean social network metrics*

The following section illustrates the results of social network analyses for each of the six labor types explored in this study. I include both the results of Pearson correlations between demographic, reputational, and kinship characteristics and social network metrics as well as the results of multiple linear regressions and linear regressions for these variables. In addition, I include a network map for each of the six labor types included in the analysis. The nodes in each network map represent each of the forty-six household heads included in the network analysis and node size corresponds to each individual's relative composite reputational score.

3.7 *Hay Cutting*

As described in Figure 3.2, Tosontsengel's pastoral families cut hay in the late summer and early autumn to prepare winter fodder for livestock. Hay is cut on the winter pastures from standing biomass that grows in sheltered mountain valleys during the summer months. In network analyses for hay cutting, household heads reported to have a mean in-degree of 3.33 individuals (SD = 3.20), out-degree of 3.33 (SD = 2.22), degree of 6.63 (SD = 4.45) and Eigenvector centrality of .187 (SD = .257).

Figure 3.3: Social Network Map for Hay Cutting[1]
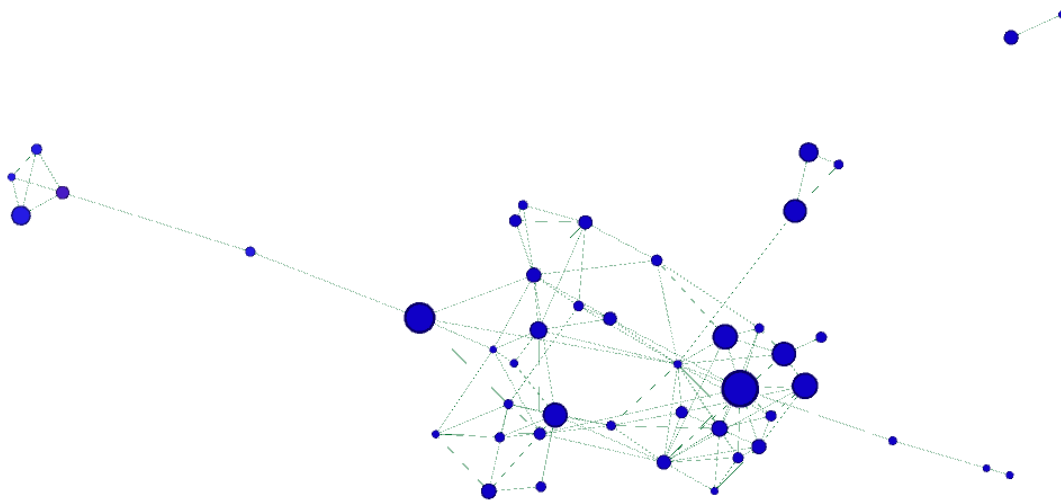
[1]Node sizes are proportional to individuals' composite reputational score

For demographic characteristics including the number of animals in a participant's herd, his or her age, and his or her reported number of children and dependent children, there are no significant correlations between these variables and Eigenvector centrality or in-degree for hay cutting. However, a participant's number of livestock is significantly positively correlated with his or her reported out-degree (r = .657, $p \leq .01$) and degree (r = .357, $p = .02$) for hay cutting.

Analyses of social network metrics for hay cutting and reputational characteristics indicate no significant correlations between reputational characteristics and Eigenvector centrality or in-degree. However, reputations for strong work ethic ($r = .576, p \leq .01$), herding skill ($r = .508, p \leq .01$), generosity ($r = .465, p = .001$), and composite reputational scores ($r = .577, p \leq .01$) are all moderately positively correlated with the amount of help an individual gave to others with hay cutting. In addition, overall degree for hay cutting is moderately positively correlated with reputations for strong work ethic ($r = .303, p = .04$) but not herding skill, generosity, or composite reputational scores.

Analyses of kinship variables indicate that a participant's reported number of total kin, consanguineal kin, and affinal kin are not significantly correlated with in-degree for hay cutting. However, the number of people a household head gave hay cutting help to is significantly positively correlated with his or her number of total kin ($r = .504, p \leq .01$) and total number of reported affinal kin ($r = .385, p = .008$). However, hay cutting out-degree is not significantly correlated with a participant's reported number of consanguineal kin. Overall degree for hay cutting is moderately positively correlated with a household head's number of total reported kin ($r = .386, p = .008$), but not his or her reported number of affines or consanguineal kin, and hay cutting Eigenvector centrality is only significantly positively correlated with a participant's total number of reported affinal kin ($r = .379, p = .009$).

To assess the explanatory power of the correlations described above and hay cutting out-degree, I conducted a multiple linear regression using total reported kin, composite reputational scores, and herd size as independent variables and hay cutting out-degree as the dependent variable. The results of this analysis indicate the model is

significant ($F(3, 42) = 19.81$, $p \leq .01$, $r^2 = .56$) and explains 56% of the variance within

hay cutting out-degree. However, only herd size ($\beta = .383$, $t = 2.69$, $p = .01$) and total

reported kin ($\beta = .368$, $t = 3.58$, $p = .001$) are significant predictors in the model. Table

3.6 illustrates the results this multiple linear regression model.

Table 3.6: Hay cutting regression model results

Variable	St. Error	β	*t* - value	*p* - value
Herd Size	.002	.383	2.69	.01*
Total Kin	.060	.368	3.58	.001*
Reputation	.020	.257	1.86	.07

$r^2 = .56$
F -ratio $= 19.81$
SEE $= 1.48$
N $= 45$

*Significant at $p \leq .01$

Two additional linear regressions were performed on the variables that were

significantly correlated with hay cutting Eigenvector centrality and hay cutting degree.

Players' overall number of reported affinal kin is significantly positively correlated with

Eigenvector centrality in the labor sharing network for hay cutting ($r = .379$, $p = .009$).

The linear regression for this relationship is significant ($F(1, 44) = 7.37$, $p = .009$, $r^2 = .14$) and total affines explains 14% of the variance in Eigenvector centrality (S.E. $= .01$, t $= 2.72$, $\beta = .38$, $p = .009$). In addition, a participant's reputation for strong work ethic is

also positively correlated with overall degree in the labor sharing network ($r = .303$, $p = .04$). The linear regression for this relationship indicates a significant model ($F(1, 44) = 4.46$, $p = .04$, $r^2 = .09$), but this relationship explains only 9% of the variance in overall

degree in the labor sharing network for hay cutting (S.E. $= .09$, $\beta = .30$, $p = .04$).

3.8 *Hurzon Cleaning*

Pastoral families in Tosontsengel typically clean *hurzon*, a deposit of thick compacted livestock dung, in late winter or early spring before they migrate to spring pastures. *Hurzon* can be up to half a meter thick and must be cleaned to ensure that a family's winter corral is prepared for the following winter. *Hurzon* is dangerous for livestock because it can help spread livestock diseases and parasites and diminishes the corral's ability to insulate livestock during the harsh winter months. Cleaning *hurzon* is one of the most labor-intensive annual tasks Mongolian nomadic herders engage in and is usually done collaboratively with multiple families. In network analyses for *hurzon* cleaning, participants reported receiving help from 3.01 (SD = 2.94) individuals on average, giving help to an average of 3.09 (SD = 3.75) individuals, having an average overall degree of 6.17 (SD = 3.75), and an average Eigenvector centrality of .172 (SD = .257).

There are no significant correlations for any of the social network analysis metrics for *hurzon* cleaning and the number of animals in a participant's herd, his or her age, and his or her reported number of children or dependent children. Similarly, none of the three reputational characteristics or participants' composite reputational scores are significantly correlated with in-degree, overall degree, or Eigenvector centrality in the *hurzon* cleaning labor sharing network. There are, however, multiple positive correlations between the reputational characteristics and the number of people a participant gave help cleaning *hurzon* to except for participants' reputations for herding skill, which is not significantly correlated with *hurzon* cleaning out-degree. A participant's reputation for strong work ethic (r = .335, *p* = .02), generosity (r = .356, *p* = .02), and composite reputational score (r

= .343, *p* = .02) are all moderately positively correlated with the number of household

heads participants gave help to in this network.

Figure 3.4: Social Network Map for Hurzon Cleaning[1]
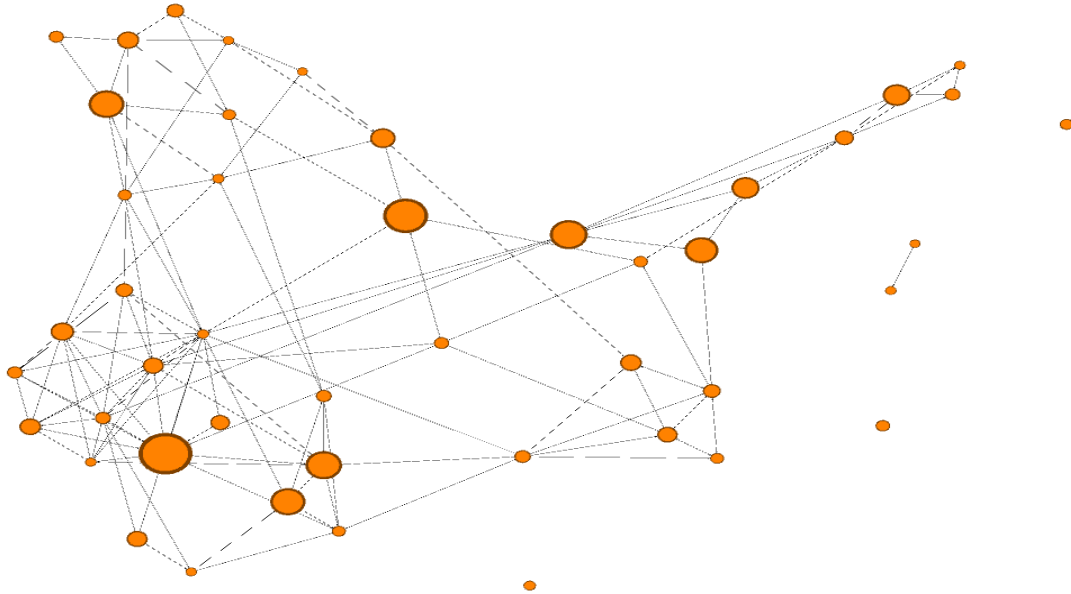
[1]Node sizes are proportional to individuals' composite reputational score

For kinship variables, there are no significant correlations between a participant's

total number of kin, total number of consanguineal kin, or total number of affinal kin and

the number of people he or she received help cleaning *hurzon* from. However,

participants' total number of kin (r = .382, *p* - .009) and total number of affinal kin (r =

.465, *p* = .001) are both moderately positively correlated with out-degree in the *hurzon*

cleaning network. A similar relationship exists for overall degree for *hurzon* cleaning and

participants' total number of reported kin (r = .410, *p* = .005) and total reported affinal

kin (r = .407, *p* = .005). Total kin (r = .316, *p* = .03) and total affinal kin relationships (r =

.359, *p* = .01) are both also positively correlated with Eigenvector centrality in the *hurzon*

cleaning labor sharing network. Participants' total number of reported consanguineal kin

is not significantly correlated with any of the social network metrics in this labor sharing network.

To analyze the explanatory power of the correlations described above and *hurzon* cleaning out-degree, I conducted a multiple linear regression using total reported kin and composite reputational scores and *hurzon* cleaning out-degree. The results of this analysis indicate that the regression model is significant (F(2, 43) = 17.20, $p \leq .01$, $r^2 = .42$) and explains 42% of the variance in *hurzon* cleaning out-degree. Both total kin ($\beta = .343$, $t = 2.99$, $p \leq .01$) and composite reputations ($\beta = 525$, $t = 4.57$, $p = .005$) are significant predictors in the model. Table 3.7 illustrates the results of this multiple linear regression model.

Table 3.7: *Hurzon* cleaning out-degree regression model results

Variable	St. Error	β	t - value	p - value
Total Kin	.066	.343	2.99	$\leq .01^*$
Reputation	.017	.525	4.57	.005*

$r^2 = .42$
F- ratio = 17.20
SEE = 1.67
N = 45

*Significant at $p \leq .01$

I performed two additional linear regressions on the variables that were significantly correlated with *hurzon* cleaning overall degree and Eigenvector centrality. Correlational analyses indicated that participants' total reported number of kin is positively correlated with Eigenvector centrality (r = .359, $p = .01$) in the *hurzon* cleaning network. However, a linear regression performed on this relationship indicates that the model is not statistically significant (F(1, 44) = .22, $p = .65$, $r^2 = .005$). For the positive relationship between total kin and overall degree in the *hurzon* cleaning network, the regression model is significant (F(1, 44) = 8.91, $p = .005$, $r^2 = .17$) which indicates that

participants' overall number of reported kin explains 17% of the variance in overall

degree in this network ($\beta = .410$, $t = 2.99$, $p = .005$).

3.9 *Fence Building and Repair*

Fences and corrals (known as *hasha* in Mongolian) are an essential component of

winter, spring, and autumn encampments in Tosontsengel. Corrals provide shelter for

livestock from both the elements and from wolf predation. While corrals are often

permanent structures on winter and spring encampments, they require annual

maintenance which includes gathering raw materials (usually timber from surrounding

forests), insulating fences using dried livestock dung, and repairing existing structures.

Fence repair is usually performed during the spring and summer to ensure that corrals are

adequately prepared for the following winter. In network analyses for corral building and

repair, participants reported receiving help from 3.24 (SD = 3.59) other household heads

on average, giving help to an average of 3.24 (SD = 2.19) individuals, having an overall

degree of 6.48 (SD = 3.94), and an average Eigenvector centrality of .166 (SD = .224).

There are no significant correlations for any of the demographic characteristics

(age, herd size, number of children, number of dependent children) and in-degree, overall

degree, or Eigenvector centrality in the fence maintenance labor sharing network.

However, herd size was significantly moderately positively correlated with out-degree in

this network ($r = .474$, $p = .001$). Therefore, only herd size is positively associated with

reported social ties in the fence maintenance labor sharing network.

Regarding social reputations and labor sharing in the fence maintenance network,

there are no significant correlations between any of the reputational characteristics and

the number of people participants reported receiving fence repair help from. The same

Figure 3.5: Social Network Map for Fence Maintenance[1]
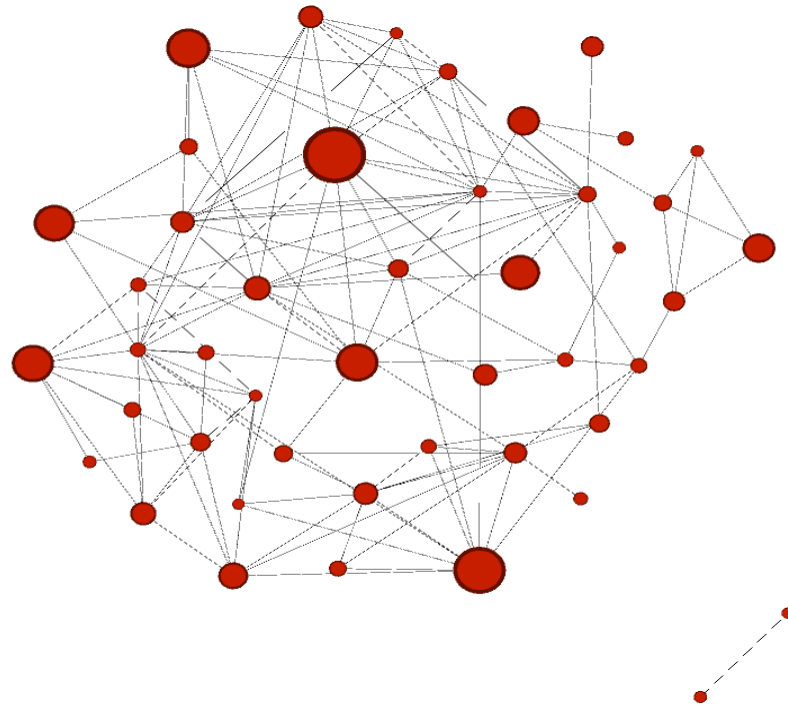
lack of significant correlations exists for reputational characteristics and Eigenvector centrality in the fence maintenance network. However, there are significant moderate positive correlations between the reported number of people participants gave help to and reputations for strong work ethic (r = .567, $p \leq$ .01), herding skill (r = .485, p = .001), generosity (r = .510, $p \leq$ .01), and composite reputational scores (r = .574, $p \leq$ .01). There is a similar trend for overall degree in the fence maintenance social network and reputations for strong work ethic (r = .306, p = .04), generosity (r = .352, p = .02), and composite reputational scores (r = .314, p = .03), but not for reputations for herding skill.

There are no significant linear relationships between kinship variables and in-degree, overall degree, or Eigenvector centrality in the fence maintenance network.

However, participants' total number of reported kin (r = .418, p = .004) and total number of reported affinal kin (r = .324, p = .03) are both moderately positively correlated with the number of individuals household heads reported giving help with fence repair to.

To assess the explanatory power of the correlations described above and fence maintenance out-degree, I conducted a multiple linear regression using herd size, total reported kin, and composite reputational scores. The results of this analysis indicate that the model is statistically significant (F(3, 42) = 11.23, $p \leq .01$, r^2 = .41) and explains 41% of the variance in fence maintenance out-degree. Both total kin (β = .337, t = 2.82, p = .007) and composite reputations (β = .497, t = 3.10, p = .003) are significant predictors in the model, but total herd size is not significant (β = .040, t = .24, p = .81). Table 3.8 illustrates the results of this multiple linear regression.

Table 3.8: Fence maintenance out-degree regression model results:

Variable	St. Error	β	t - value	p -value
Total Kin	.07	.337	2.82	.007*
Reputation	.02	.497	3.10	.003*
Herd Size	.002	.040	.24	.81

r^2 = .41
F – **ratio** = 11.23
SEE: 1.69
N = 45

*Significant at $p \leq .01$

I performed one additional linear regression to assess the positive correlation between overall degree and social reputations in the fence maintenance network (r = .314, p = .03). The results of this analysis indicate that the regression model is significant (F(1, 44) = 4.82, p = .03, r^2 = .10) and this relationship explains 10% of the variance in overall degree in this network (β = .314, t = 2.19, p = .03).

3. 10 *Seasonal Migration*

Tosontsengel pastoralists conduct between four and six seasonal nomadic migrations annually for a total migration route of 40-80km. They migrate to both give seasonal pastures time to regenerate after intense grazing pressure and to move to more favorable seasonal microclimates. Nomadic migrations are typically made by truck, but livestock are still driven to new pastures by herders on horseback. Migration labor includes packing camps, loading trucks, and driving livestock as well as unpacking and setting up new seasonal encampments. Relative to the other types of labor included in the social network analyses, Tosontsengel herders report both requiring and receiving more labor support for seasonal migrations than any other labor type. In migration network analyses, participants reported receiving help from 4.22 (SD = 3.91) other household heads on average, giving help to 4.22 (SD = 2.62) individuals, having an overall degree of 8.43 (SD = 4.81), and an average Eigenvector centrality of .190 (SD = .223).

Figure 3.6: Social Network Map for Seasonal Migrations[1]
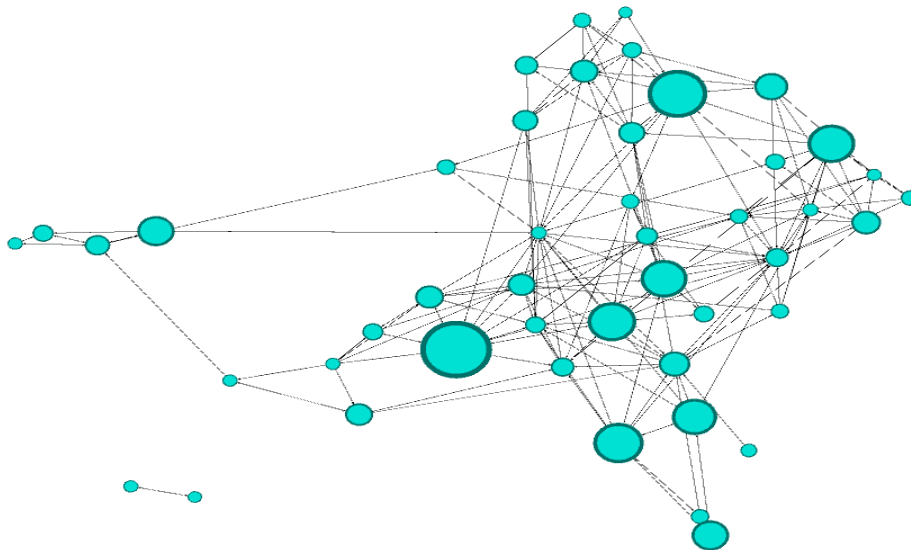
[1]Node sizes are proportional to individuals' composite reputational score

There are no significant correlations for any of the demographic characteristics (age, herd size, number of children, number of dependent children) and in-degree, overall degree, or Eigenvector centrality in the migration labor sharing network. However, herd size was moderately positively correlated with out-degree in this network (r = .558, $p \leq$ .01). Therefore, out of all the demographic characteristics included in the analysis, only herd size is positively associated with the amount of migration labor Tosontsengel pastoralists reported giving to others in this labor sharing network.

Pearson correlation analyses indicate that there is are no significant linear relationships between any of the three reputational characteristics or composite reputational scores and in-degree or Eigenvector centrality for the migration labor sharing network. However, there are significant strong positive correlations between migration out-degree and reputations for strong work ethic (r = .712, $p \leq$ .01), herding skill (r = .619, $p \leq$ .01), generosity (r = .685, $p \leq$ .01), and composite reputational scores (r = .736, $p \leq$ .01). In addition, these reputational characteristics are also significantly correlated with overall degree in the migration labor sharing network. Reputations for strong work ethic (r = .414, p = .004), herding skill (r = .353, p = .02), generosity (r = .473, p = .001), and composite reputational scores (r = .443, p = .002) are all moderately positively correlated with overall degree.

Correlational analyses of kinship variables and network metrics in the migration labor sharing network indicate that there are no significant linear relationships between any kinship category and in-degree or Eigenvector centrality. However, participants' total number of reported kin and total reported affinal kin are both positively correlated with the number of outgoing connections in migration labor sharing (r = .431, p = .003, r =

.303, $p = .04$, respectively). In addition, participants' total number of reported kin is also positively correlated (r = .389, $p = .008$) with overall degree in the migration labor sharing network.

To assess the explanatory power of the positive correlations described above and migration out-degree, I conducted a multiple linear regression using herd size, total reported kin, and composite reputational scores and migration out-degree. The results of this multiple regression indicate that the model is statistically significant (F(3, 42) = 26.02, $r^2 = .63$, $p \leq .01$) and explains 63% of the variance in migration labor sharing out-degree. Both total kin ($\beta = .335$, $t = 3.54$, $p = .001$) and composite reputational scores ($\beta = .701$, $t = 5.50$, $p \leq .01$) are significant predictors in the model, but total herd size is not a significant predictor ($\beta = -.018$, $t = -.136$, $p = .893$). Table 3.9 illustrates the results of this multiple linear regression.

Table 3.9: Migration out-degree regression model results:

Variable	St. Error	β	t - value	p – value
Total Kin	.065	.335	3.54	.001*
Reputation	.022	.701	5.50	≤ .01*
Herd Size	.002	-.018	-.136	.893

$r^2 = .63$
F - ratio = 26.02
SEE = 1.61
N = 45

*Significant at $p \leq .01$

Finally, because both total kin and composite reputational scores are both positively correlated with overall degree in the migration labor sharing network, I performed an additional multiple linear regression to assess the explanatory power of these linear relationships. The results of this multiple regression indicate that the model is statistically significant (F(2, 43) = 9.41, $r^2 = .27$, $p \leq .01$) and explains 27% of the

variance in migration labor sharing overall degree. Both participants' total reported

number of kin (β = .332, *t* = 2.59, *p* = .01) and composite reputational scores (β = .395, *t*

= 3.08, *p* = .004) are significant predictors of overall degree in the regression model.

Table 3.10 illustrates the results of this multiple regression analysis.

Table 3.10: Migration degree regression model results:

Variable	St. Error	β	*t* - value	*p* - value
Total Kin	.162	.332	2.59	.013*
Reputation	.041	.396	3.08	.004**

r^2 = .27
F – ratio = 9.41
SEE = 4.10
N = 45

*Significant at $p \leq .05$
**Significant at $p \leq .01$

3.11 *Daily Livestock Herding*

Daily livestock herding involves managing livestock as they graze on seasonal

pastures. This includes taking livestock to grazing areas in the morning and returning

animals to corrals in the evening. It also involves moving livestock on the landscape to

ensure that they do not mix with other herders' animals and, especially on winter

pastures, to prevent animals from entering another family or *khot ail*'s winter rangeland.

In Tosontsengel, most daily grazing work is done by adult males, but it is not uncommon

for women to engage in herding labor if men are not available. It is more common,

however, for female pastoralists to conduct most of their labor within the family's

encampment itself and this labor includes managing camp, gathering water, cooking

meals, and producing dairy products. Study participants indicated that they felt that most

daily herding labor is not done collaboratively with other families and is managed by

members of a nuclear family itself. However, during the winter, multiple families living

in the same winter encampment will often combine their livestock and take turns

managing the animals in daily shifts. In daily herding network analyses, participants

reported receiving help from 2.71 (SD = 2.77) other household heads on average, giving

help to 2.65 (SD = 1.51) individuals, having an overall degree of 5.36 (SD = 2.81), and

an average Eigenvector centrality of .237 (SD = .300).

Figure 3.7: Social Network Map for Daily Livestock Herding[1]
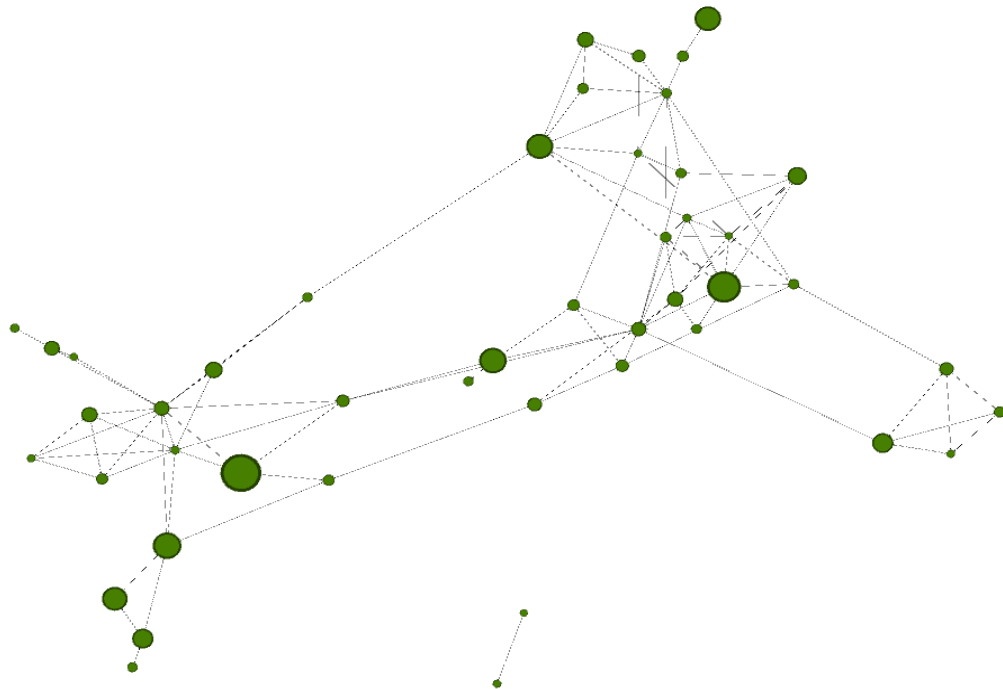
[1]Node sizes are proportional to individuals' composite reputational score

Pearson correlation analyses indicate that there are no significant linear

relationships for any of the household heads' demographic characteristics and any of the

network analysis metrics for the daily herding labor sharing network. Similarly, Pearson

correlation analyses of the potential linear relationships between reputational variables

and network metrics revealed no significant correlations between any of the three

reputational variables, nor composite reputational scores, and in-degree, degree, or

Eigenvector centrality in the daily herding labor sharing network. However, household heads' reputations for herding skill (r = .432, p = .003) and composite reputational scores (r = .370, p = .01) are moderately positively correlated with out-degree in the daily herding labor sharing network.

Correlational analyses for kinship variables and network metrics in the daily herding labor sharing network indicate that there are no significant linear relationships between kinship variables and in-degree. However, household heads' total reported number of kin is positively correlated with out-degree in this network (r = .322, p = .03). Similarly, participants' total number of reported kin is also positively correlated with overall degree in the daily herding network (r = .307, p = .04). Finally, participants' total number of reported consanguineal kin is positively correlated with Eigenvector centrality in this network (r = .319, p = .03).

To assess the explanatory power of the positive correlations described above and out-degree in the daily herding labor sharing network, I conducted a multiple linear regression model that included participants' total number of reported kin and composite reputational scores. The results of this analysis indicate that the model is significant (F(2, 43) = 5.75, r^2 = .17, p = .006) and explains 17% of the variance in out-degree in this network. However, only participants' composite reputational scores (β = .275, t = 2.42, p = .02) is a significant predictor variable in the model. Table 3.11 illustrates the results of this multiple linear regression analysis.

To assess the significant positive correlation between participants' total reported number of kin and overall degree in the daily herding network, I performed a linear regression. The results of this analysis indicate that the linear regression model is

significant ($F(1, 43) = 4.46$, $r^2 = .09$, $p = .04$), but this relationship explains only 9% of the variance in overall degree in this network ($\beta = .31$, $t = 2.11$, $p = .04$). Similarly, a linear regression performed on the relationship between participants' total reported number of consanguineal kin and Eigenvector centrality in the daily herding labor network revealed a statistically significant model ($F(1, 43) = 4.87$, $r^2 = .10$, $p = .03$), but the relationship between participants' total number of reported consanguineal kin only explains 10% of the variance in Eigenvector centrality in this network ($\beta = .32$, $t = 2.21$, $p = .03$).

Table 3.11: Daily herding out-degree regression model results:

Variable	St. Error	B	t – value	p - value
Total Kin	.054	.275	2.01	.051
Reputation	.014	.331	2.42	.02*

$r^2 = .17$
$F-\text{ratio} = 5.75$
$\text{SEE} = 1.37$
$N = 45$

*Significant at $p \leq .05$

3.12 *Wool Sheering and Cashmere Combing*

Livestock products such as sheep wool and goat cashmere form the bulk of Tosontsengel pastoralists' annual income. These products are typically collected in late spring and early summer and are often sold to middlemen in the Tosontsengel administrative village who then ship the raw wool and cashmere to buyers in Ulaanbaatar. Herders will sheer sheep when they are confident that the sheep will no longer need the wool for insulation. Similarly, cashmere is combed from goats when they begin to shed in the early summer. Sheering and combing are performed by both men and women, and like daily herding activities, study participants indicated that these tasks are

often completed by individual nuclear families or *khot ail* and are not often done

collaboratively among multiple families. This fact is evident in the general metrics for

this network, which are lower than in the other five labor sharing types. Participants

reported an average in-degree of 1.84 (SD = 2.11), out-degree of 1.76 (SD = 1.39),

overall degree of 3.52 (SD = 2.71), and Eigenvector centrality of .148 (SD = .226) in the

wool sheering and cashmere combing labor sharing network.

Figure 3.8: Social Network Map for Cashmere Combing and Wool Sheering[1]

[1]Node sizes are proportional to individuals' composite reputational score

Correlational analyses between social network metrics and demographic variables

for the wool and cashmere labor sharing network reveal no significant linear relationships

between any of the demographic variables and in-degree, general degree, and

Eigenvector centrality. However, there is a moderate significant positive correlation

between participants' herd size and out-degree in this network (r = .337, *p* = .02).

Similarly, Pearson correlations between reputational variables and network metrics

indicate no significant linear relationships between any of the three reputational variables, nor composite reputational scores and in-degree, general degree, or Eigenvector centrality. However, reputations for strong work ethic (r = .352, *p* = .02), herding skill (r = .308, *p* = .04), generosity (r = .397, *p* = .006), and composite reputational scores (r = .379, *p* = .009) are all moderately positively correlated with out-degree in the wool and cashmere labor sharing network.

Finally, correlational analyses between wool and cashmere labor sharing network metrics and kinship variables reveal no linear relationships for in-degree and any of the kinship variables. However, participants' total reported number of kin (r = .407, *p* = .005) and total reported number of affinal kin (r = .333, *p* = .02) are both moderately positively correlated with out-degree in this labor sharing network. Similarly, total reported number of kin is weakly positively correlated (r = .293, *p* = .05) with overall degree in the wool and cashmere network and moderately positively correlated (r = .365, *p* = .02) with Eigenvector centrality.

To assess the explanatory power of the positive correlations described above and out-degree in the wool and cashmere labor sharing network, I conducted a multiple linear regression model that included participants' total number of reported kin, composite reputational score, and herd size. The results of this analysis reveal that the model is statistically significant (F(3, 42) = 5.21, r^2 = .22, *p* = .004) and explains 22% of the variance in out-degree in this network. However, only participants' total reported number of kin (β = .355, *t* = 2.60, *p* = .01) is a significant predictor variable in model. Table 3.12 illustrates the results of this analysis.

To explore the significant positive correlation between participants total reported number of kin and overall degree in the wool and cashmere labor sharing network, I performed a linear regression. The results of this analysis indicate that the linear regression model is significant ($F(1, 44) = 4.14$, $r^2 = .09$, $p = .05$), but this relationship explains only 9% of the variance in overall degree in this network ($\beta = .29$, $t = 2.04$, $p = .05$). Similarly, a linear regression analysis of the positive correlation between participants' total number of reported kin and Eigenvector centrality in the wool and cashmere labor sharing network revealed a statistically significant model ($F(1, 42) = 6.47$, $r^2 = .13$, $p = .02$), but this relationship explains only 13% of the variance in Eigenvector centrality in this network ($\beta = .37$, $t = 2.54$, $p = .02$).

Table 3.12: Wool and cashmere network out-degree regression model results:

Variable	St. Error	B	*t* - value	*p* - value
Total Kin	.05	.355	2.60	.01*
Reputation	.02	.306	1.66	.10
Animals	.002	.032	.17	.87

$r^2 = .22$
F – ratio = 5.21
SEE = 1.22
N = 45

*Significant at $p \le .01$

3.13 *Network Metrics across Labor Types*

To assess the potential effects of demographic, reputational, and kinship variables and overall connectivity across labor sharing types, I calculated mean in-degree, out-degree, overall degree, and Eigenvector centrality across the six labor sharing networks included in this study. I then performed Pearson correlation, multiple linear regression, and linear regression analyses on these data. Household heads reported an average in-

degree of 3.09 (SD = 2.59), out-degree of 3.05 (SD = 1.70), overall degree of 6.12 (3.03), and Eigenvector centrality of .184 (SD = .181) across the six labor sharing networks.

Pearson correlation analyses of mean social network analysis metrics and demographic variables indicate no significant linear relationships between demographic variables and mean in-degree, overall degree, or Eigenvector centrality across labor types. However, participants' herd sizes are significantly positively correlated with mean out-degree across labor types (r = .514, $p \leq$ .01). The results of Pearson correlations and reputational variables also indicate no significant linear relationships between the three reputational variables and composite reputational scores and mean in-degree or Eigenvector centrality across labor types. However, reputations for strong work ethic (r = .590, $p \leq$ .01), herding skill (r = .537, $p \leq$ .01), generosity (r = .560, $p \leq$ .01), and composite reputational scores (r = .619, $p \leq$ .01) are all significantly positively correlated with mean out-degree across labor types. Furthermore, the same relationships exist between mean overall degree and reputations for strong work ethic (t = .344, p = .02), generosity (r = .365, p = .01), and composite reputational scores (r = .343, p = .02), but not for reputations for herding skill.

Correlational analyses between kinship variables and mean network metrics reveal no significant linear relationships between any kinship variable and mean in-degree across labor types. However, participants' total number of reported kin (r = .496, $p \leq$ .01) and total number of affinal kin (r = .408, p = .005) are both significantly positively correlated with mean out-degree across labor types. These significant positive relationships also exist for mean overall degree across labor types and total reported kin (r = .431, p = .003) and total affinal kin (r = .319, p = .03). Finally, a significant positive

correlation also exists between total reported number of kin and mean Eigenvector

centrality across labor types (r = .329, p = .03).

To explore the strength of the positive correlations described above and mean out-

degree across labor types, I performed a multiple linear regression model that included

participants' herd size, composite reputational scores, and total number of reported kin.

The results of this analysis indicate that the model is statistically significant (F(3, 42) =

17.33, r^2 = .52, $p \leq .01$) and explains 52% of the variance in mean out-degree across the

six labor types. Both total reported number of kin (β = .411, t = 3.84, $p \leq .01$) and

composite reputational scores (β = .536, t = 3.72, p = .001) are significant predictors in

the model, but herd size is not a significant predictor variable. The results of this multiple

linear regression are illustrated in Table 3.13.

Table 3.13: Mean out-degree regression model results:

Variable	St. Error	β	t - value	p - value
Total Kin	.048	.411	3.84	$\leq .01$*
Reputation	.016	.536	3.72	.0001*
Herd Size	.002	.034	.230	.82

r^2 = .52
F – ratio = 17.33
SEE = 1.18
N = 45

*Significant at $p \leq .01$

I performed an additional multiple linear regression analysis to assess the positive

linear relationships between social reputations, total number of reported kin, and mean

overall degree across labor types. The results of this analysis reveal that the model is

significant (F(2, 43) = 7.81, r^2 = .23, p = .001) and explains 23% of the variance in

overall degree across labor types. Both composite reputational scores (β = .287, t = 2.17,

p = .04) and total reported kin (β = .390, t = 2.96, p = .005) are significant predictors of

mean overall degree in this model. The results of this analysis are illustrated in Table

3.14.

Table 3.14: Mean degree regression model results:

Variable	St. Error	β	*t* - value	*p* – value
Total Kin	.11	.390	2.96	.005**
Reputation	.03	.287	2.17	.04*

r^2 = .23
F – **ratio** = 7.81
SEE = 2.65
N = 45

*Significant at $p \leq .05$
**Significant at $p \leq .01$

Finally, to assess the positive correlation between mean Eigenvector centrality

across labor types and participants' total reported number of kin, I conducted a linear

regression analysis to explore the explanatory power of kinship in Eigenvector centrality

across the six labor types. The results of this linear regression reveal a significant model

(F(1, 44) = 5.33, r^2 = .11, *p* = .03), but household heads' reported total number of kin

explains only 11% of the variance in mean Eigenvector centrality (β = .33, *t* = 2.31, *p* =

.03) for the six labor sharing networks.

3.14 Discussion

The results of this study provide several important findings regarding the study of

labor sharing and cooperation in humans and the Mongolian ethnographic record. The

study began with two main hypotheses: 1) Household heads with greater numbers of

consanguineal and affinal kin would display greater degrees of connectivity with other

household heads in the study population and 2) Household heads with more positive

social reputations would display a greater degree of social connectivity than household

heads with lower reputational scores. The results of social network analyses across labor

types indicate broad support for both hypotheses, especially regarding the amount of labor household heads gave to other individuals in the study sample.

3.14.1 *The Importance of Social Reputations*

Social reputations are positively linked to the number of other household heads study participants gave help to across labor types in the study sample. This indicates that individuals who are more frequently cited for having positive social reputations are giving more help to others, but not necessarily receiving more help from others in return. Therefore, it is unclear whether individuals with high reputational scores are giving more help to others because of their positive social reputations or if the fact that they give more help to others is the cause of their positive social reputations.

Social network analysis provides descriptive metrics on social connectivity that can then be assessed based on other social, economic, and demographic variables. Therefore, it merely describes the characteristics of a network rather than explaining causal relationships between social network metrics and other variables. It is often necessary to develop greater explanatory power using ethnographic context and qualitative data. In the case of the Tosontsengel study population, my 9 months of participant observation living and working with families in the study population as well as the 65 semi-structured ethnographic interviews provide relevant context with which I can interpret the linkages between helping others, social reputations, social influence, and economic wealth.

While the results of the multiple linear regressions described above indicate that the positive correlation between giving help to others and wealth in animals has limited explanatory power, the positive correlation between wealth in animals and positive social

reputations merits deeper discussion. Three of the most well-connected individuals in the study community in terms of providing help to other household heads are also the three wealthiest members of the community in the absolute number of livestock in their respective herds. Furthermore, based on participant observation of cooperative labor sharing and community activities, they are also more able than other household heads to garner support from other families to organize labor, and, at times, convince other individuals to help with social activities or cooperative labor projects that they are reluctant to engage in.

One of the three individuals described above is noteworthy in his ability to gather support for group labor projects for both his kin and other families in the community. On one occasion, a maternal uncle (who is another household head with lower reputational scores and lower degree in labor sharing networks) was having difficulty gathering the necessary labor to clean two years' worth of *hurzon* from his winter corral, a job that would require up to 10 helpers and a full day of strenuous physical labor. The household head with high social reputation, greater wealth in animals, and higher numbers of reported outgoing ties in each of the labor networks was able to convince 12 consanguineal and affinal relatives to assist with the difficult labor, which the lower-ranking household head was unable to do himself.

The same high-status household head is also married to a woman who is from a much less climatologically harsh region of Mongolia than Tosontsengel. Because he specializes primarily on herding cattle, he is able to pay a family in his wife's birthplace to herd these livestock for him over the winter, but he refuses to permanently relocate his family to this region even though he is able to do so and acknowledges that conditions in

this area would be more favorable for his animals. When asked why he felt this way in interviews, he asserted that he felt that because he was not well known in his wife's community, he would not be able to influence others or have as much leadership capabilities as he enjoys in his community in Tosontsengel. Therefore, while the example above is anecdotal, the fact that while all three individuals who give the most help to others do not receive the same amount of help in return yet enjoy strong positive social reputations and greater degrees of social influence suggests that there are indirect benefits to high-status individuals in terms of social reputations, wealth, and influence. This finding supports the findings of Lyle and Smith (2014), Macfarlan et al. (2013), and von Rueden et al. (2008) who all suggest that social reputations are valuable currency by which individuals navigate social networks and increase influence and prestige.

3.14.2 *The Importance of Kinship in Determining Sharing and Land Access*

Regarding the intersection between kinship and social connectivity in the Tosontsengel sample, there is support (albeit complex) for the first hypothesis that individuals with greater numbers of reported consanguineal and affinal kin would enjoy a greater degree of social connectivity than individuals with less reported kin in the study community. Like social reputations, the results of network analyses across labor types indicate that individuals with greater numbers of total kin have greater numbers of outgoing social ties, but not necessarily greater numbers of in-coming labor assistance from other household heads. Furthermore, individuals with greater numbers of affinal kin also tend to be more central in labor sharing networks (e.g. they bridge disparate sections of the networks that are often populated by their blood and marital kin).

Participant observation, qualitative interviews, and previous research also provide some relevant explanations for the trends I observe in the six labor sharing networks and in mean network analysis metrics across the networks. Herding families in Tosontsengel often use kinship as a means of securing access to limited resources and access to assistance for labor intensive activities. Most notably, affinal and consanguineal kinship serve as a means for herding families to gain access to limited winter pastures and camping sites. To an untrained observer, visiting a winter *khot ail* in Tosontsengel can give one a sense that families form *khot ail* and camp together during the winter out of a desire to cooperatively manage livestock during the extremely difficult winter season and to avoid "going it alone.". However, observation in the field and ethnographic interviews indicate that this assumption is inaccurate. In interviews, Tosontsengel pastoralists asserted that they are limited by the availability of suitable winter camping places that provide the ideal microclimate that livestock need to survive in extreme cold. Because the number of herding families exceeds the number of ideal winter camping places, families must camp together out of necessity even though they would prefer to do anything but. Multiple families asserted that they would much prefer to camp alone during the winter to avoid having greater livestock numbers on already limited land during a season when grazing resources are already scarce.

To gain access to a winter camping spot or *khot ail*, herding families must have either 1) been granted a 60-year renewable government-sponsored access contract to a winter camping spot or 2) be welcomed into a winter *khot ail* by affinal or consanguineal kin who already have access to the site in question. This presents a difficult situation for new herding families that are formed when children reach adulthood and start their own

households. Because herders are acutely aware of the carrying capacity of winter sites, it is often impossible for children to remain in their parents' winter *khot ail* if there are already multiple families sharing the camping spot. New herding families must look elsewhere to gain access to essential winter grazing land. Based on participant observation and interviews with Tosontsengel herders, it is evident that individuals with greater numbers of kin often have an easier time gaining access to a winter camping site than those with fewer kin.

Affinal kinship can serve as a means for individuals with fewer numbers of kin in the local community to ensure future access to limited resources, cooperative partnerships, and winter camping sites. Winter *khot ail* are often comprised of groups of consanguineal kin camped with affinally-related household heads (e.g. brothers and brothers-in-law). This indicates that marrying into a family that has access to adequate winter camp sites, labor supplies, and economic resources can be a viable strategy for individuals with less kin to gain access to resources.

In the Shumultei study community, one patriline is noteworthy for illustrating the importance of not only consanguineal kinship but also affinal kinship in driving social connectivity in Mongolian nomadic communities. This patriline is made up of the five sons and two daughters of a single, now deceased household head who all grew up in the Shumultei Valley and formed pastoral households in adulthood. This family has access to five winter camping sites in the Shumultei Valley. As a result, both the children of the members of this patriline and affinally related household heads can enjoy greater access (and future access) to these winter camping sites than household heads with fewer kin. Therefore, relationships such as these might explain the reason why affinal kinship, but

not consanguineal kinship, is positively correlated with out-degree throughout the labor sharing networks in the study population. This may be because herders are more conscious of the need to cultivate strong affinal ties with other families to ensure future generations' access to land resources.

The importance of affinal kin ties in helping household heads with fewer numbers of consanguineal kin gain access to land resources is further illustrated in the case of three additional pastoral families in the study population. The household heads of each of these three families are not native to the Shumultei Valley or to Tosontsengel *sum* and moved into the region as children or adults (2 are brothers from the northwest of Zavkhan Province, and one is from the southwestern part of Zavkhan Province). Therefore, each of these three household heads has fewer kin ties than the other household heads in the study community. The two brothers who grew up in the northwest of the province have only a single affinal tie to another household head in the study population and were not able to gain access to any of the winter camping sites in the Shumultei Valley, or anywhere else in the *sum*. As a result, the local government created a new winter camping site for them which is far from the other 45 families living in the valley (the *khot ail* located in the extreme north of the map in Figure 3.2) and is on marginal land that is poorly suited for winter rangeland (in fact, it is located on the slope of a hill on what is traditionally used as summer pastures). By contrast, the third non-native household head in the Shumultei community is married to a daughter of one of the seven siblings of the patriline described above. Because of this affinal connection to a family with more access to winter camping sites, this household head is able to share winter pastures with his father-in-law's family.

Building affinal kin ties may serve as a means for certain families to gradually expand their influence, economic opportunities, and control of the limited land resources that ensure effective pastoral production. Therefore, it remains to be seen what longitudinal effects kin relationships will have in terms of which pastoral families are able to gain greater access to land resources over time, and which patrilines gradually leave the pastoral economy because they are unable to secure access to winter camping places for future generations. The results of kinship analyses provide broad support to the finds of Murphy (2015; 2014), Sneath (2002), Cooper (1993), and Bold (1996) who all suggest that kin ties play a vital role in land access and cooperative connectivity in rural Mongolia.

3.14.3 *The Importance of Network Analysis Results for Understanding Mongolian Rural Livelihoods*

From the perspective of the general study of Mongolian pastoral cultures, the results of this study provide interesting insights into the types of labor that Mongolian herders typically conduct cooperatively, and which they tend to perform only within nuclear families or *khot ail*. From this study, we know that *hurzon* cleaning, hay cutting, migration, and fence maintenance are key collaborative pastoral labor types. By contrast, we also now know that cashmere combing, wool sheering, and daily herding labor tend to be restricted to the nuclear family or seasonal *khot ail*, specifically. While in winter, families living in *khot ail* with others tend to take turns managing combined livestock herds, Tosontsengel herders insist that herding is done "all on one's own" and that regardless of herds being combined, they are still conscious of their own animals even when multiple families' herds are grouped together.

Finally, the results of this study indicate that, as some scholars suggest, Mongolia's transition from socialism may be complete (Dierkes 2012) and that in the absence of the centralized control of the pastoral economy that existed both in the pre-socialist period and during socialism, Mongolian herders are now relying on social reputations and kin ties to regulate access to land resources and to create economic opportunities. Therefore, the future of the Mongolian pastoral economy and grassland management may hinge on herders' ability to effective build strategic labor-sharing ties that enable households to both gain social capital and access to economic opportunities.

3.15 Conclusion

This study represents the first-ever application of social network analysis to the study of labor sharing in Mongolian nomadic herding communities. The results indicate that kinship and social reputations drive social connectivity in rural Mongolian nomadic communities and provide indirect benefits to high-status individuals. Furthermore, the results also suggest that affinal kin ties may be an important means by which Mongolian herders create cooperative alliances and labor-sharing relationships. Finally, the results of social network analyses in Tosontsengel provide broad support for the importance of kinship and social reputations in driving social ties in small-scale societies as found in the broad human behavioral ecological literature (Lyle and Smith 2014; Macfarlan et al. 2013, von Rueden et al. 2008) and in the Mongolian ethnographic record (Ericksen 2014; Murphy 2014; Humphrey and Sneath 1999).

To expand further on our current understanding of labor sharing among Mongolian nomadic pastoralists, future studies might explore the following topics. First, future social network analyses among Mongolian pastoral nomads should be conducted

in a way that includes pastoral families' cooperative ties to families living in administrative villages, urban centers, and in neighboring valleys. Previous research suggests that herding families often draw on kin and friends living in urban areas for support and access to economic opportunities (Humphrey and Sneath 1999). Furthermore, this study explored the importance of affinal and consanguineal kinship ties in a single tributary valley consisting of 47 full-time pastoral families. However, it is also clear that herding families also have kinship ties with families in neighboring tributary valleys, and future network analysis studies should take these ties into consideration to present a fuller picture of cooperative connectivity in rural Mongolia. Finally, I also recommend that future studies collect longitudinal network, demographic, and reputational data to assess how reputations, kin-ties, and land access change over time in rural Mongolia.

3.16 Acknowledgments

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Chapter 4

A natural disaster framed common pool resource experimental game yields no framing effects among Mongolian pastoralists

In this chapter, I explore Mongolian nomadic herders' decision making in common pool resource games conducted in the Republic of Mongolia. The grassland and forest ecosystems of the Mongolian Plateau have been successfully managed as common pool resources for at least three millennia (Lattimore 1941). Although overgrazing and pasture degradation increased in the 20th and 21st Centuries, nomadic pastoralists living in Mongolia continue to successfully manage common grasslands to sustain livestock even as neighboring countries have enacted policies to sedentarize nomadic herders and privatize rangeland.

In the present, grassland degradation is increasing on the Mongolian Plateau as the pastoral economy responds to global demands for livestock products, rising living costs, and climate change (Fernandez-Gimenez et al. 2018; Middleton 2018). However, how grassland management is affected by the presence of resource scarcity and climatological shocks in Mongolia is still poorly understood. The Mongolian Plateau is subject to periodic severe winter storms known as *dzud* which often lead to increased livestock mortality and grassland resource scarcity (Begzsuren et al. 2004; UNDP 2010). *Dzud* also strain pastoralists' access to grassland resources and place greater grazing pressures on available grasslands. In this study, I employ three different common pool resource games, one of which is framed in the context of a winter *dzud*, to experimentally assess Mongolian herders' common pool resource decision making both generally and in response to climatic stochasticity. These games were first piloted in Bulgan Province

(2015), a region with low-to-moderate risk for winter weather disasters, and then

conducted in Zavkhan Province (2016), a region of Mongolia with higher risk for winter

dzud.

4.1 Common Pool Resources: Economic and Management Implications

Common pool resources are resources that are too costly for individuals to

exclusively manage or exclude access to and to which communities of individuals have

simultaneous access (Ostrom 1990). These include forest, grassland, and marine

resources, among others. Common pool resources are often too large to effectively

police, and aggregate offtake by all users both decreases available resources for all users

and determines regeneration rates (Ostrom et al. 2002). Thus, common pool resources are

characterized by subtractability, in which every unit of a resource harvested by one user

decreases the available resources for all other users (Berkes 2006).

Common pool resource management has been one of the most controversial

issues in the social and behavioral sciences, especially in the 20th Century. Researchers

from various disciplines have argued over the ecological and economic viability of

common pool resource management due to these resources being both easy to access and

difficult to effectively exclude access to (Berkes 2006). Ever since Garett Hardin (1968)

published his seminal article, "The Tragedy of the Commons," governments, social

scientists, and ecologists have often assumed that common pool resource use would

inevitably lead to over-extraction of resources and a decline in both ecosystem and

economic productivity. Hardin argues that this is because it is in each resource user's

economic interest to maximize his or her extraction of common pool resources at the

expense of both other users and the surrounding ecology. Namely, this is due to the fact

that a user gains economic benefit from overextraction but only incurs a fraction of the net cost of exploiting the resource (Hardin 1968). Through this process, a "tragedy of the commons" develops in which rational, self-interested actors over-extract resources and ultimately lead to economic and ecological collapse.

In response to the tragedy of the commons, policy makers and development agencies in nations with extensive common pool resources began to rethink natural resource management policy and to shift development goals away from common pool resources and towards private ownership of resources (Li and Huntsinger 2011; Lesorogol 2008; Fratkin and Mearns 2003; Humphrey and Sneath 1999). Many policy makers assumed that the tendency for users to over-extract resources could only be prevented by incentivizing resource conservation by delineating individual resource patches as private property. This was particularly the case for global grassland resources that were traditionally managed by pastoralists as commons (Fratkin 1994). For example, policy makers and development organizations in East Africa, the former Soviet Union, Northern China, and Tibet have made efforts to stave off desertification and overgrazing by privatizing formerly common grasslands as contracted land or private ranches (Conte and Tilt 2014; Wang et al. 2014; McCabe et al. 2010; Humphrey and Sneath 1996; Zukosky 2008). These privatization policies were developed under the assumption that privatization would eliminate over-extraction by clearly delineating which users have access to pastures.

While intended to prevent ecological degradation, policies aimed at curbing the tragedy of the commons through privatization, particularly in Inner Asian grassland ecosystems, have been shown to increase overgrazing and grassland degradation while

also increasing economic inequality among users (Taylor 2012; Li and Huntsinger 2011; Williams 2002). This is because privatization has disrupted customary systems of land management that were centered on flexible seasonal grassland use and community-based decision making. Thus, intensive grazing pressure is consistently placed on privatized pasture and can lead to desertification and decreased plant species biodiversity (Fernandez-Gimenez et al. 2015; Taylor 2006; Williams 1996). In China, for example, the privatization of common grasslands in the Inner Mongolia Autonomous Region has led to the end of seasonal nomadism in herding communities and overstocking on privatized grasslands (Conte 2015). This has been shown to be a major contributor to overgrazing and desertification in northern China because intensive grazing pressure is placed on privatized grasslands that were formerly allowed to regenerate through flexible seasonal use (Deng et al. 2009).

The failure of privatization to effectively regulate common pool resource use and to prevent overuse has led economists and other social scientists to re-examine the tragedy of the commons. Elinor Ostrom, among others, draws a distinction between common pool resources and resources that are open access. Open access resources are non-excludable resources which are difficult to effectively govern and police (Ostrom 1990; Feeny et al. 1990). Ostrom argues that while open access resources are susceptible to the tragedy of the commons (although see Scholte et al. 2006 for a case of successful open access grassland management), common pool resources can be managed in a way that effectively curbs individuals' tendency to overuse resources (Ostrom 1990). Namely, over-extraction can be prevented through social norms surrounding resource use and access, clear delineation of which users have access to resources (and which do not), and

the regulation of extraction through the punishment of individuals who fail to observe prescribed norms surrounding common pool resource use (Ostrom 1990).

Although common pool resources can be effectively managed through the enforcement of social norms, use rules, community-based decision making, and public policy, how common pool resource use is affected by environmental stochasticity and resource scarcity is less clear. In Inner Asian grassland ecosystems and pastoral populations, for example, environmental shocks such as drought, severe winter storms, and livestock diseases often lead to livestock population collapses and are a major contributor to pastoralists' decisions to leave livestock herding and seek alternative livelihoods (Vernooy 2011; SDC 2011; UNDP 2010; Templer et al. 1993; Barfield 1993). However, it is less clear how the presence of risks affects individual resource users' decisions on how much of a resource to extract from the surrounding ecosystem. For example, it is unclear whether resource users are more, or less cooperative with other users in the presence of environmental risks or resource scarcity (Bartos 2015; Aktipis et al. 2011; Cronk et al. In press.).

The Republic of Mongolia presents an ideal place to study the effects of climatological shocks on common pool resource users' decision making because it both contains some of the worlds' most extensive common grasslands and experiences frequent environmental shocks in the form of severe winter storms and droughts (Thrift and Byambabaatar 2015; Fernandez-Gimenez et al. 2015; UNDP 2010; Swift and Siura 2002; Templer et al. 1993). Therefore, the overall purpose of this study is to assess Mongolian herders' decision making in a common pool resource experimental game that is framed as a natural disaster scenario.

4.2 The Mongolian Grazing Commons and *Dzud* Disasters

The Mongolian Plateau's extensive forest, grassland, mountain, and desert ecosystems have been managed by nomadic pastoralists as common pool resources for at least three millennia (Lattimore 1941). Common grasslands were traditionally maintained as territories managed by the leaders of patrilineal clans, feudal princes, or (after the introduction of Tibetan Buddhism to Mongolia), Buddhist monasteries (Endicott 2012). Following the establishment of the socialist Mongolian People's Republic in the early 1920s, Mongolia transitioned into a communist command economy, and grassland access was regulated by socialist collectives that set production quotas for livestock products and regulated stocking rates and seasonal access to pasture resources (Batsaikhan 2014; Humphrey and Sneath 1999; Fernandez-Gimenez 1999).

After the collapse of socialism in the early 1990s, Mongolia became a market economy and the pastoral economy was opened to international markets for livestock products (Sneath 2002). The end of socialism, and the marked reduction in government employees that followed, resulted in the growth of Mongolia's rural population and the expansion of the number of families engaged in animal husbandry (Humphrey and Sneath 1999). This has resulted in a dramatic increase in livestock numbers and has challenged the way that common pool resources were traditionally managed in Mongolia (Upton 2008). Most pasture land in Mongolia has remained common pool resources since the collapse of socialism, but overgrazing, particularly on vulnerable winter rangeland, has increased in the last twenty years (Hilker et al. 2014). This is due in part to increases in the population of cashmere goats, which provide the chief source of income for

pastoralists, and an overall decline in nomadic mobility as herders seek to be closer to urban centers (Liu et al. 2013; Fernandez-Gimenez 2001; Mearns 1996).

The Mongolian Plateau is characterized by a continental climate that experiences frequent temperature extremes and climatic variability. At a time in which the United Nations has identified Mongolia as one of the epicenters of global climate change, the Mongolian Plateau has experienced a rise in unpredictable weather conditions and severe droughts and winter weather events (SDC 2011; UNDP 2010). Key among these severe weather events is a natural disaster event known as *dzud*. *Dzud* often occur when snowstorms are followed by severely cold temperatures that cause an impenetrable layer of ice to form over grassland that prevents livestock from grazing (Begzsuren et al. 2004). These conditions are particularly hazardous for nomadic pastoralists because they often lead to livestock mortality from starvation and exposure.

As climate change makes annual precipitation and weather more unpredictable on the Mongolian steppes, *dzud* are becoming increasingly more common and severe. National censuses of livestock numbers conducted from 2015 - 2016 indicate that the Mongolian national livestock herd fluctuated between 40 and 55 million total animals between 2012 and 2015 (Eldevochir 2016). Current estimates indicate that the Mongolian economy suffered the loss of over 21 million livestock because of *dzud* between 1990 and 2010 (UNDP 2010). The most recent nationwide *dzud* in the winter of 2009 – 2010 resulted in the death of over 8.5 million livestock, roughly 20% of the national livestock population at the time (Vernooy 2011). *Dzud* have been identified as a major driver of rural poverty in Mongolia and have forced many of the nation's pastoral nomads to abandon herding after losing most, or all, of their livestock to winter weather disasters

(Templer et al. 1993). In addition, Mongolian pastoralists often rely heavily on traditional ecological knowledge to predict *dzud* conditions. However, the increasing unpredictability in interannual grazing and precipitation conditions may render herders less able to predict, and thus, react to *dzud* conditions when they occur (Fernandez-Gimenez 2000).

The Mongolian ethnographic and historical records suggest that nomadic herders often rely on extended kin networks to mitigate the risks of *dzud* and co-manage common pool resources (Murphy 2014; Cooper 1993; Sneath 1993). These cooperative networks help herders coordinate seasonal migrations, cooperatively herd livestock, and share labor to prepare for risks such as severe winter conditions (Bold 1996). During Mongolia's pre-socialist history, these informal kin networks were supplemented by state-level support from feudal princes, Buddhist monasteries, and clan leaders. This state-level support was continued during the socialist period (1924-1992) when herding collectives provided mechanized transport for seasonal migration, regulated land use, and provided herders with supplementary fodder for livestock in the event of difficult conditions (Humphrey and Sneath 1996). However, following the dissolution of the Mongolian People's Republic, this state social support largely disappeared and herding families have now been placed in the position of being largely individually responsible for *dzud* preparation and mitigation.

Previous research suggests that in the absence of the state social support herders enjoyed under socialism, informal social support networks of labor and resource sharing that exist among individual pastoral families are becoming increasingly important for both daily herding tasks and risk management strategies (Murphy 2014; Ericksen 2014;

Humphrey and Sneath 1996). However, the precise dynamics of how natural disasters such as winter *dzud* affect herders' willingness and ability to co-manage common pool resources and cooperate with other resource users are not well understood. This is because the synchronous nature of *dzud* may make individual herding families less able to effectively co-manage common pool grassland resources because all families are simultaneously dependent on limited resources.

This study utilizes common pool resource experimental economic games to explore the above issues and test the following predictions: 1) individuals will behave more selfishly in common pool resource games when presented with a game that is framed as a winter disaster than in a game not framed as a disaster, and 2) individuals will expect other players to behave more selfishly in common pool resources framed as winter disaster scenarios than in games not framed as disasters. These predictions are derived from the following hypothesis: individuals perceiving a limit on available common pool resources will be more likely to over-extract resources. The study relies on three different common pool resource economic games to test for the effects of a disaster frame: a game where two anonymous players have access to a common pot of money that is certain, one where the amount of money in the common pot can change by chance, and one where the amount of money in the common pot can change, and the probability of change is framed as a winter *dzud*. These games were performed in 2015 and 2016 in two regions of Mongolia, one that has low-to-moderate risk of winter *dzud* and one that is highly susceptible to winter weather disasters.

4.3 Materials and Methods: Common Pool Resource Economic Games

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Experimental economic games are commonly used by human behavioral ecologists, economists, and evolutionary psychologists to assess economic decision making in controlled settings (Cronk and Leech 2013). Experimental games allow researchers to control for social, economic, and environmental factors present in real-world economic decision making and isolate individual and group behavioral responses to economic or cultural stimuli (Cronk 2007). Because the various types of experimental games rely on similar sets of assumptions and experimental designs, games have been successfully used in both laboratory and field settings. Furthermore, while many experimental economic studies have relied on Western educated populations as test subjects, games have also been used to comparatively assess economic behavior cross-culturally and in a variety of small-scale societies (Henrich et al. 2010; Henrich et al. 2004; Henrich et al. 2001).

Experimental games also enable researchers to develop game scenarios that are designed to test cultural or behavioral hypotheses and compare test versions of experimental games to control versions. For example, numerous studies have measured priming or framing effects which can take the form of implicit cues of observation or culturally salient terms or framing of the game decision (Hagen and Hammerstein 2006; Haley and Fessler 2005). Framing effects have been observed in a variety of experimental studies both with Western and non-Western populations and highlight the potential importance of the intersection between social norms, membership in organizations, and economic behavior (Gelcich et al. 2013; Gerkey 2013; Dreber et al. 2012; Cronk and Wasielewski 2008; Camerer and Fehr 2004).

Experimental economists have also developed games involving two or more players that aim to assess players' responses to collective action dilemmas, coordination problems, and common pool resource scenarios. Common pool resource games present players with the ability to draw funds from a common pot of money that all players have equal access to. Players can withdraw any amount of money from the common pot that they wish, but the experimenters place an incentive on taking as little as possible by ensuring players that not only may they keep whatever they withdrew from the common pot, but also that anything that remains in the pot after all players have withdrawn funds will be multiplied by a factor greater than one and divided evenly among all the players (Ostrom et al. 1994). However, if the cumulative withdrawals of all players are greater than the total sum of money in the common pot, then none of the players gets to keep any of the funds they withdrew from the common pot. Players must negotiate between the Pareto optimal decision in which players maximize returns by taking nothing from the common pot and the Nash Equilibrium decision that predicts over-extraction (Cardenas et al. 2015). Therefore, the game simulates the subtractability inherent in common pool resources and incentivizes cooperation among players (Gardner et al. 1990; Walker et al. 1990).

Common pool resource games have been used to study the effects of uncertainty in the total size of the common pot and allowing communication among players (Rapoport et al. 1993; Messick et al. 1988). They have also been used to study the effects of religious membership and participation in religious rituals on players' willingness to behave cooperatively in common pool resource economic scenarios (Ruffle and Sosis 2007; Sosis and Ruffle 2003). Finally, common pool resource games have been used to

explore the effects of membership in social institutions and user-groups on players'

tendency to over-exploit common pool resources (Gelcich et al. 2013). Therefore,

common pool resource games are an effective means to assess players' baseline

responses to common pool resource decision making and the potential effects of

communication, social norms, membership in social organizations, and uncertainty on

players' willingness to cooperatively manage experimental funds.

4.4 Field Site Descriptions

4.4.1 *Tosontsengel Sum, Zavkhan Province, Mongolia*

Tosontsengel is an administrative subdivision (*sum*) of Zavkhan Province in

western Mongolia. The region is known for being one of the most climatologically harsh

in Mongolia and holds the record for the coldest temperature recorded in Mongolia (-

52.9ºC) and the highest barometric pressure ever recorded globally (Purevjaw et al.

2014). The region consists mainly of mountainous forest-steppe and is largely within the

central Mongolian Khangai mountain range. The Ider River runs east-west through the

sum and is joined by numerous tributary rivers that flow into the Ider from the slopes of

the Khangai Range. The population of Tosontsengel is just under 9,000 residents, making

it the largest *sum* by population in Zavkhan Province after the provincial capital, Uliastai.

Most of the population are Khalkha Mongols (Mongolia's largest ethnic group) who

practice Tibetan Buddhism with syncretic elements of traditional Mongolian shamanism

(Batsaikhan 2014).

The chief source of income for the majority of Tostontsengel's rural families is

animal husbandry, and pastoralists typically specialize in mixed-species herds of sheep,

goats, and cattle. Wool and cashmere are the main sources of income for pastoral

families, and these are sold to traders in Tosontsengel's administrative village who

Figure 4.1: Study Location in Zavkhan, Mongolia
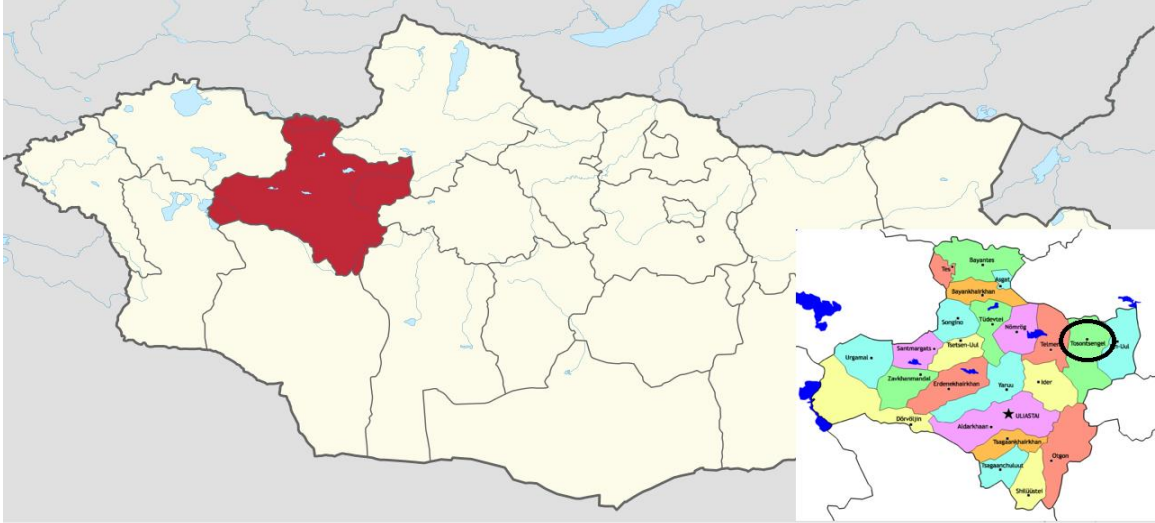
transport them to Ulaanbaatar, the national capital. Some herding families also make

supplementary income from cutting timber, driving trucks, producing handicrafts, and

operating small shops in the administrative village. These supplementary income sources

are usually viewed as secondary to animal husbandry, and rural families generally hold

pastoral income and wealth in animals in higher esteem than other income sources

(Empson 2012).

Tosontsengel pastoralists are nomadic and make between four and six seasonal

movements for a total annual migration of 40-80 kilometers. Families typically live in

river valleys that run north-south and drain into the Ider River floodplain. They spend the

winter in sheltered mountain valleys and move along the banks of tributary rivers in the

spring. During the summer, families move into the Ider River floodplain where land and

water resources are abundant before moving back into tributary river valleys in the

autumn. During the winter months, families tend to camp with extended kin and are

heavily dependent on supplementary sources of livestock fodder which they purchase

from the administrative village or cut during the summer months in designated hay fields.

The region is noted for being at higher risk for winter *dzud* relative to other provinces of

Mongolia, and herders are keenly aware of winter risks and potential livestock mortality

(Swift and Siura 2002).

4.4.2 *Orkhon Sum, Bulgan Province, Mongolia*

Orkhon is an administrative subdivision (*sum*) of Bulgan Province in central

Mongolia. Relative to Tosontsengel, the region is noted for being less climatologically

harsh and experiences milder winters. The *sum* consists mainly of mountainous forest-

steppe and is also within the central Mongolian Khangai range. The population of the

sum is just over 3,000 residents, the majority of which are directly employed in the

countryside as nomadic pastoralists. The Orkhon River runs east-west through the *sum*

and the borders of the sum are directly adjacent to Bulgan, the provincial capital of

Bulgan Province and Erdenet, Mongolia's second largest city. Most of the population are

Khalkha Mongols who practice Tibetan Buddhism, but there is also a substantial amount

of inward migration of herders from western Mongolia (particularly from Zavkhan and

Uvs Provinces) who have moved into the sum in the last three decades to take advantage

of Orkhon's strategic location near two major cities.

Orkhon's proximity to both the provincial capital of Bulgan Province and Erdenet

places it in a unique economic position relative to many other remote areas of the

Mongolian countryside. Orkhon is close to the Erdenet Mine, one of Mongolia's largest

copper mines, and the *sum* is noted for having unexploited copper deposits of its own.

Copper deposits also made Bulgan an area of international interest in the 20th Century,

Figure 4.2: Study Location in Bulgan, Mongolia

(Wikimedia 2019)

and the Soviet Union stationed 30,000 troops of the 39th Army at a base in Orkhon before withdrawing after the collapse of the USSR in 1990 (CIA 1979). The remains of this military base are still visible in the *sum* today.

Rural families in Orkhon are chiefly employed in animal husbandry, although unlike many other herding communities who depend on hiring middle-men to transport livestock products to Ulaanbaatar, Orkhon pastoralists can sell livestock products directly in the provincial capital and in Erdenet. Pastoral families typically specialize in mixed-species herds of sheep, goats, and cattle, but the region is also noted as being one of the main centers for the production and sale of *airag*, a beverage made from fermented mare's milk. Thus, herding families tend to keep larger horse herds relative to herders in neighboring provinces. In addition, the local climate is mild enough that Orkhon is one of Mongolia's major centers for wheat production and increasing amounts of land are currently being devoted to wheat cultivation at the expense of animal husbandry.

Orkhon's pastoral families are seasonally nomadic and make between four and six seasonal movements for a total annual migration of 40-100 kilometers. Families typically spend the winter in sheltered valleys on the slopes of low mountains or hills. During the spring months, families move to lower elevations before moving to the banks of the Orkhon River or to the shores of numerous small lakes on valley floors during the summer months. Relative to other regions of Mongolia, Bulgan Province experiences lower winter livestock mortality and less risk of winter *dzud* (Tachirii et al. 2008; Templer et al. 1993). As a result, in ethnographic interviews I collected during the study period, Orkhon herders typically report being more concerned about the effects of overgrazing, livestock population density, and inward migration of herders from other provinces than winter weather conditions or winter *dzud*.

4.5 Procedure

Because this study represents one of the first applications of experimental economic games in rural Mongolia (see Gil-White 2004 for another application), common pool resource games were piloted with a sample of 60 participants in Orkhon, Bulgan Province, Mongolia in June, 2015. A larger study with a sample of 120

Table 4.1: Orkhon Sample Population Statistics

Game Version	Sex	Age (*M, SD*)	Herd Size (*M, SD*)[1]	Number of Children (*M, SD*)	Yrs. Herding Experience (*M, SD*)
Standard	7M, 13F	37.40(10.26)	495.30(360.22)	2.20(1.15)	13.99(8.80)
Stochastic	10M, 10F	43.80(9.50)	366.28(275.60)	2.75(1.12)	21.68(8.93)
Dzud	7M, 13F	43.60(9.64)	502.95(424.09)	2.65(1.09)	20.32(8.31)
Total	24M, 36F	41.60(10.10)	457.90(360.15)	2.53(1.13)	18.58(9.19)

[1]Herd size measured in total number of animals in a player's herd.

participants was then conducted in Tosontsengel, Zavkhan Province, Mongolia in December 2016. The following describes the game procedures for each of these

experiments. Tables 4.1 and 4.2 illustrate the sample population statistics for both study

locations.

Table 4.2: Tosontsengel Sample Population Statistics

Game Version	Sex	Age (M, SD)	Herd Size (M, SD)[3]	Number of Children (M, SD)	Yrs. Herding Experience (M, SD)
Standard	13M, 14F	44.03(14.74)	78.77(73.85)	3.07(2.02)	13.80(14.22)
Stochastic	15M, 14F	39.66(12.73)	59.21(64.20)	2.75(1.55)	10.85(10.43)
Dzud	13M, 18F[1]	40.09(10.78)	73.59(81.54)	2.81(1.86)	14.43(14.41)
Total	41M, 46F[2]	41.36(12.79)	70.47(73.30)	2.87(1.80)	13.02(13.14)

[1]1 participant did not mark his or her sex on participation form.
[2]A total of 32 participants were omitted from the analysis for failing the study comprehension check.
[3]Herd size measured in a total number of animals in a player's her.

4.5.1 *Game Versions: Standard, Stochastic, and Dzud Framed*

Three versions of common pool resource games were used in both study

locations: a standard common pool resource game in which the amount of money in the

common pot is certain, a stochastic version of the game where there is a probability that

the amount of money in the common pot will be reduced, and a *dzud* framed version of

the game in which there is a probability that the amount of money in the common pot will

be reduced because of a hypothetical winter *dzud*. Each version of the game was played

with pairs of players and each participant played only one version of the game.

Each version of the game presented players with a hypothetical common pot

containing 20,000 Mongolian tugriks (MNT, hereafter) which at the time games were

played in each field site was equivalent of approximately $8 (enough to buy 10kg of

wheat flour or a 750ml bottle of vodka). In the standard version of the game, players were

instructed that the 20,000 MNT in the hypothetical common pot was fixed and that they,

and the player they had been paired with, could remove any amount of money they

wished from the envelope in 1,000 MNT increments. They were then told that they would

not know the amount of money the person they were paired with would take from the

envelope and that if there was any money left in the envelop after both players made their decision, that remainder would be multiplied by a factor greater than 1 and divided equally between both players. If the summed withdrawals of both players exceeded 20,000 MNT, then neither player received any payment at the close of the game.

In the Orkhon common pool resource games, I used a multiplier of 2. However, after consideration, this multiplier was changed to 1.5 in the Tosontsengel common pool resource games. When a multiplier of 2 is used, a player who decides to remove all 20,000 MNT from the envelope, and who is paired with a player who takes 0 MNT from the envelope, cannot do any better than if he or she decided to leave all the money in the common envelope. This creates a coordination problem that requires both players to understand the mathematics of how the game works rather than a conflict of interest that depends on trusting the other player to cooperate. A multiplier of 1.5, however, creates this conflict of interest because it is smaller than the number of people playing the game. Thus, players can attain the Pareto optimal payout (e.g. both players remove nothing from the common pot and thus, maximize their individual payouts) only through cooperation when the multiplier is 1.5.

The rules for the stochastic version of the game are the same as those of the standard version, but the amount of money in the envelope is uncertain. Along with the rules described above, players in the stochastic version were informed that the amount of money in the envelope could change based on the roll of a 10-sided die (rolled by the researchers) after they and the individual they were paired with make their decisions on how much money to withdraw from the envelope. If the die roll was a 1, 2, or 3, then the amount of money in the envelope is reduced by 20% to 16,000 MNT. If the die roll is a 3,

4, 5, 6, 7, 8, 9, or 10, then the amount of money in the envelop remains 20,000 MNT. The *dzud*-framed version of the game is the same as the stochastic version, but the game is framed as a "*dzud g*ame" in which the amount of money in the envelope is uncertain because of the possibility of a severe winter *dzud*. The probabilities and reductions in the stochastic and *dzud*-framed versions of the game were selected because *dzud* occurred in 30% of winters between 1990 and 2010 and the most severe of these, the 2009 winter *dzud*, killed 20% of the national livestock herd (UNDP 2010). Instructions for both games were translated and back-translated into standard Khalkha Mongolian. Figure 4.3 illustrates the instructions for each of the game versions.

Figure 4.3: Game Instructions*

Standard Game Instructions:

You and one other person in the room have access to an envelope containing 20,000 Tugriks. Each of you can take any portion of it for yourself, in increments of 1,000 Tugriks. If anything is left in the envelope, the experimenters will multiply it by 1.5 and then divide it equally between the two of you. You get to keep this money along with whatever your took from the envelope initially. However, if the total amount of money removed from the envelope adds up to more than 20,000 Tugriks, neither of you will get anything.

Stochastic Game Instructions*:

You and one other individual in the room have access to an envelope containing some money. Each of you can take any portion of it for yourself, in increments of 1,000 Tugriks. However, the amount of money that will be in the envelope is uncertain. There is a 30% chance that the amount of money in the envelope will be 16,000 Tugriks. There is a 70% chance that the amount of money in the envelope will be 20,000 Tugriks. How much is in the envelope will be determined by a roll of a 10-sided die after you and the other person make your decisions about how much to take out of the envelope. If the die lands with a 1, 2 or 3 up, then the amount will be 16,000 Tugriks. If it is a 4, 5, 6, 7, 8, 9 or 10, it will be 20,000 Tugriks.

If anything is left in the envelope after you and the other individual decide how much money to take out, the experimenters will multiply it by 1.5 and then divide it equally between the two of you. You get to keep this money along with whatever you took from the envelope initially. However, if the total amount of money removed from the envelope is greater than the total in the envelope (either 16,000 or 20,000 Tugriks), neither of you will get anything.

***Dzud* Game Instructions:**

This is a dzud game. You and one other individual in the room have access to an envelope containing 20,000 Tugriks. Each of you can take any portion of it for yourself, in increments of 1,000

Figure 4.3 (Continued)

Tugriks. However, the amount of money that will be in the envelope is uncertain. This is because there is a 30% chance that a dzud will occur that will reduce the amount of money in the envelope from 20,000

Tugriks to 16,000 Tugriks. There is a 70% chance that no dzud will occur and the full 20,000 Tugriks will remain in the envelope. Whether or not a dzud occurs will be determined by a roll of a 10-sided die after you and the other person make your decisions about how much to take out of the envelope. If the die lands with a 1, 2 or 3 up, then a dzud will occur and the amount will be 16,000 Tugriks. If it is a 4, 5, 6, 7, 8, 9 or 10, no dzud will occur and it will be 20,000 Tugriks.

      If anything is left in the envelope after you and the other individual decide how much money to take out, the experimenters will multiply it by 1.5 and then divide it equally between the two of you. You get to keep this money along with whatever you took from the envelope initially. However, if the total amount of money removed from the envelope is greater than the total amount in the envelope (either 16,000 or 20,000 Tugriks), neither of you will get anything.

*A multiplier of 2 was utilized in the pilot version of the game in Orkhon, Mongolia.

4.5.2 *Orkhon Game Procedure*

      In June 2015, common pool resource games were conducted at the annual Youth

Day Festival in a *bag* (administrative subdivision of a *sum* equivalent to a township) of

Orkhon Sum. Games were conducted at the *bag*'s cultural center, a central meeting place

where festivities, meetings, and elections are held for the rural population. A convenience

sample of 60 male and female participants was recruited from festival attendees and were

screened based on two criteria: if they were 18 years or older and if they were rural

residents of Orkhon *sum*.

      Once recruited, participants were gathered at the front courtyard of the cultural

center and instructed that they should remain in the courtyard until they had completed

the activity. Food and drink were provided to each participant and field assistants ensured

that participants did not leave the courtyard area. Once 60 participants had been gathered,

cards numbered from 1 - 60 were randomly distributed to participants and they were

instructed to enter the cultural center once their number had been called. Twenty numbers

were randomly selected at a time, and the ordering of the standard, stochastic, and *dzud*-framed versions of the game was randomized. Participants were gathered in the central room of the cultural center and provided a pencil and a set of game instructions by a field assistant. Field assistants also continued to supervise the remaining participants outside the cultural center to minimize potential observer effects.

A field assistant that was fluent in both English and Mongolian translated my opening instructions in which participants were assured that their participation in the activity was voluntary and that they could leave at any time they wished. Participants were also informed that they would be playing with real money that they would be paid in cash after the completion of the activity. They were also made aware that although the game would be anonymous, they would be playing with a random individual also sitting in the room. In addition, participants were also instructed that they were not permitted to discuss the game with others during the game or with the individuals outside the cultural center who had not yet completed the activity. Finally, to avoid potential confusion, if players were playing the stochastic or *dzud*-framed versions of the game, they were informed that the experimenters would be rolling the 10-sided die after they had made their decision.

Following the explanation of the rules of the activity, the field assistant presented participants with game instructions according to the version they were playing. Following these initial instructions, the field assistant gave participants 4 randomly chosen examples of game situations and observed for visual and verbal cues of understanding from individual participants. After these examples were completed and participants were given the opportunity to ask clarifying questions, the field assistant instructed them to make two

decisions: 1) how much money they would like to withdraw from the common envelop and 2) how much money they expected the player that they were paired with would withdraw from the envelope. After they had marked their decisions on data recording sheets, players' decision sheets were randomly paired with other players and payouts were recorded. While payouts were being calculated and recorded, participants were given an understanding check that asked them to calculate the results of hypothetical players' decision making and mark their answers on the question sheet.

After the completion of the game and collection of the understanding check, participants were led out of the cultural center by a different exit from where they had entered and were not permitted to re-enter the main courtyard where other participants were waiting to complete the game. The above process was then repeated for the remaining 40 participants until each of the 3 versions of the game had been completed with 20 participants each. Following the completion of all 3 versions of the game, participants were debriefed and paid the experimental funds they had earned in sealed manila envelopes marked only with their participation number. Twelve participants were then randomly selected (4 from each version) from the 60 participants for follow up interviews that were conducted in June 2015 after the game had been completed.

4.5.3 *Tosontsengel Game Procedure*

In December 2016, common pool resource games were conducted at the Tosontsengel Elementary School in the Tosonstengel administrative village. One hundred twenty male and female participants were recruited from the local pastoral population as well as residents of the administrative village if they met the following two criteria: 1) they were 18 years or older and 2) that they were residents of Tosontsengel *sum*. The

experiment was advertised by word of mouth and through announcements from the local government 3 weeks before the game and the first 120 individuals who met the qualifications of the game were admitted into the activity.

Due to cold temperatures, participants were gathered in the elementary school's main classroom building where they remained until they were called to participate in the activity. Each participant was randomly given an index card labeled from 1 - 120 and instructed by 3 field assistants that they would be randomly called in groups of 40 to complete the activity. Once called, participants were led to the school library (in a separate building) by 1 field assistant and were seated at tables where they were provided a pencil and a set of game instructions corresponding to the version of the game they would be playing.

A field assistant fluent in both English and Mongolian translated my opening instructions in which players were assured that participation in the activity was strictly voluntary and that they were free to leave at any time they wished. Participants were also given instructions regarding to the fact that while the game would be played anonymously and on paper forms, they would be paid in real money and would be playing with a randomly assigned individual in the room. They were also informed that discussion of game decisions during the game was not permitted. Finally, to avoid confusion, the field assistant also informed participants that were playing the stochastic or *dzud* framed versions of the game that the experimenters would be rolling the 10-sided die after they had made their decisions and completed the activity. The field assistant then gave players 4 randomly selected game examples and gave participants the opportunity to ask questions regarding game rules and instructions. Once the examples

were completed, players were then instructed to make two decisions: how much they would like to take from the common envelope and how much they expected the individual they were paired with would take.

After the game was completed, participants were instructed to mark their participation number at the top of their decision sheet and decision sheets were collected by 2 field assistants. They were then randomly paired, and payouts were calculated by the author. While game results were being calculated, study participants were given a paper survey that contained an understanding check, a set of Likert-scale survey questions regarding the game, a set of survey variables that assessed how zero-sum oriented individual players felt, and a set of zero-sum orientation questions related to the game itself (Sznycer, personal communication). Because understanding check questions that required participants to compute answers to game situations caused a great deal of stress among participants in the Orkhon sample, these were substituted with True/False questions regarding game rules in the Tosontsengel sample. Participants were retained in sample if they answered at least 3/5 of the understanding questions correctly. In total, 32 players were excluded from the analysis in the Tosontsengel sample for failing the game understanding check. The survey statements used in the end-of-game survey are illustrated in Figure 4.4 and all variables were coded on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree.

Once I had completed the calculation of game results and recorded them, cash payments were provided to study participants for each version of the game in sealed white envelopes marked only with a player's participation number. Following the distribution of payments, participants were led out of the study location by a field

assistant and allowed to leave. They were not permitted to re-enter the main school

building where other participants were still waiting to complete the activity. The

procedure above was then completed with the remaining 80 study participants in sets of

40.

Figure 4.4: Tosontsengel Post-Game Survey Variables[1]

Game Survey Statements:
1. I was worried that I would take too much money from the envelope.
2. I was worried that the person I was paired with would take too much money from the envelope.
3. I wanted to cooperate with the person I was paired with.
4. I wanted to earn more money than the person I was paired with.
5. I believed that the person I was paired with wanted to earn more money than me.
Zero-Sum Orientation Statements:
1. It is only by stepping on others that people get ahead.
2. No one can achieve much unless they bring others down.
3. Wealth can definitely be created without exploiting others.
4. Cooperating with others is more profitable than taking advantage of others.
5. If someone makes a profit, it will be at the expense of someone else.
Game Zero-Sum Orientation Statements:
1. The only way to make money in the game is to step on others.
2. No one can be successful in the game unless they bring others down.
3. Both players can definitely make money in the game without exploiting on eanother.
4. Cooperating with the person you were paired with is more profitable than taking advantage of the person.
5. If someone makes a profit in the game, it will be at the expense of the other person.

[1]Variables coded on a 5-point scale where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

Once I had completed the calculation of game results and recorded them, cash

payments were provided to study participants for each version of the game in sealed

white envelopes marked only with a player's participation number. Following the

distribution of payments, participants were led out of the study location by a field

assistant and allowed to leave. They were not permitted to re-enter the main school

building where other participants were still waiting to complete the activity. The

procedure described above was then completed with the remaining 80 study participants

in sets of 40.

4.5.4 *Results Analysis:*

I used Pearson correlations and linear regressions to analyze the potential relationship between demographic variables and survey questions and the amount of money players took from the hypothetical common pot and expected the person they were paired with to take out of the envelope. Because Shapiro-Wilks Tests for normality indicate that the distributions of the amount players took from the envelope and expected others to take are not normally distributed, I used nonparametric Kruskal-Wallace tests to test for differences in taking and expected taking across the 3 game versions. Furthermore, I used nonparametric Mann-Whitney U tests to assess the differences between male and female study participants across the three game versions in each study site. The data were analyzed using the IBM Statistical Package for Social Sciences (SPSS) Version 20.

4.6 Results

4.6.1 *Orkhon Game Results*

In the Orkhon common pool resource game, participants in the standard version of the game removed 5,100 MNT (25.5%) from the envelope on average and 5,000 MNT (25%) and 6100 MNT (30.5%) in the stochastic and *dzud*-framed versions, respectively. Players in the Orkhon sample expected the players they were paired with to remove 6,400 MNT (32%) from the envelope in the standard version of the game and 4,900 MNT (24.5%) and 7,350 (36.8%) in the stochastic and *dzud*-framed versions, respectively. Kruskal-Wallace tests to compare rates of taking and expected taking across game versions revealed that the amount players removed from the hypothetical common pot does not statistically significantly differ across versions ($p = .644$). However, the amount of money players expected the individuals they were paired with to remove from the

envelope does statistically significantly differ ($p = .01$) across versions. Players in the

dzud-framed version of the game expected the players they were paired with to take

significantly more money out of the envelope than in the stochastic version of the game,

but not in the standard version of the game. Tables 4.3 and 4.4 illustrate the results of

these analyses.

Table 4.3: Mean Taking and Expected Taking in Orkhon

Version	N		Amount Taken (*M, SD*)	Expected Taking (*M, SD*)
Standard	20		5,100 (2,552.60)	6,400 (3,408.97)
Stochastic	20		5,000 (2,635.79)	4,900 (2,023.55)
Dzud	20		6,100 (3,210.18)	7,350 (2,412.19)
Total	60		5,400 (2,811.60)	6,216.07 (2,822.98)

Table 4.4: Kruskal-Wallace Comparison of Taking and Expected Taking across Versions in Orkhon

Category	N	Z - value	D*f*	*p* – value
Amt. Taken	60	.88	2	.644
Expected Taking	60	9.26	2	.01**

**Significant comparison at $p \leq .01$.

        Correlational analyses reveal no significant correlations between the demographic

variables collected for each of the 60 game participants and the amount of money they

removed from the envelope or expected other players from the envelope. However, the

amount of money players removed from the envelope is weakly significantly positively

correlated ($r = .35, p \leq .01$) with how much money they expected the player they were

paired with to remove from the common envelope. Table 4.5 illustrates the results of

these correlational analyses. Finally, Mann-Whitney U Tests revealed no statistically

significant differences in the amount of money male and female participants removed

from the envelope or expected other players to remove from the envelope across the three

game versions.

Table 4.5: Correlation matrix for demographic variables and game behavior in Orkhon

Variable	(1)	(2)	(3)	(4)	(5)	(6)
1. Animals	1					
2. Age	.130	1				
3. Children	.168	.389**	1			
4. Yrs. Herding	.216	.680**	.369**	1		
5. Amt. Taken	-.010	-.096	.242	-.140	1	
6. Expected Taking	.135	-.167	.054	-.207	.350**	1

**Significant correlation at $p \leq .01$.

4.6.2 *Tosontsengel Game Results*

In the Tosontsengel common pool resource games, players in the standard version of the game removed an average of 4,370.37 MNT (21.9%) from the common envelope and 5,275.86 MNT (26.4%) and 4,406.25 MNT (22%) in the stochastic and *dzud*-framed versions, respectively. Players in the Tosontsengel common pool resource games expected the players they were paired with to remove 4,222.22 MNT (21.1%) in the standard version of the game, 4,246.38 MNT (21.2%) in the stochastic version, and

Table 4.6: Mean Taking and Expected Taking in Tosontsengel[1]

Version	Amount Taken (*M, SD*)	Expected Taking (*M, SD*)
Standard	4,370.37 (4,133.80)	4,222.22 (4,423.13)
Stochastic	5,275.86 (3,954.17)	4,246.38 (2,502.22)
Dzud	4,406.25 (3,025.26)	4,343.75 (3,469.77)
Total	4,681.82 (3,684.53)	4,272.73 (3,486.35)

[1]N = 88

4,343.75 MNT (21.7%) in the *dzud*-framed versions. Kruskal-Wallace tests to compare taking and expected taking in the Tosontsengel sample reveal no significant differences among the versions for the amount players took from the hypothetical common pot ($p =$

.479) or the amount they expected other players to remove from the envelope (p = .481).

Tables 4.6 and 4.7 illustrate the results of these analyses.

Table 4.7: Kruskal-Wallace Comparison of Taking and Expected Taking across Versions in Tosontsengel

	N	*F* - value	D*f*	*p* – value
Amount Taken	88	1.47	2	.479
Expected Taking	88	1.46	2	.481

Because the results of Kruskal-Wallace tests indicate no significant differences in taking and expected taking across the three versions of the game in the Tosontsengel sample, further analyses were performed on the entire sample of 88 players who were included in the analysis. To compare male and female players' decision making, Mann-Whitney U Tests were performed on both rates of taking and expected taking across the 3 versions of the game. The results of these analyses indicate no significant differences in either taking (p = .286) or expected taking (p = .880) between male and female study participants. Table 4.8 illustrates the results of these Mann-Whitney U Tests.

Table 4.8: Comparison of Male and Female Taking and Expected Taking

Category	N	*M, SD*	*M* Rank	Z - value	St. Z - value	*p* – value
Male Taking	41	5,097.56 (4,023.76)	47.04	818.50	-1.07	.286
Female Taking	46	4,326.09 (3,399.70)	41.29			
Male Exp. Taking	41	4,048.78 (3,065.54)	43.57	960.50	.15	.880
Female Exp. Taking	46	4,478.26 (3,880.09)	44.38			

Correlational analyses reveal no significant correlations between the demographic variables collected for each of the 88 study participants included in the analysis and the amount players removed from the envelope or expected the player they were paired with to remove from the envelope. However, the amount players removed from the

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hypothetical common pot across versions is significantly strongly positively correlated

with the amount players expected others to remove from the envelope (r = .69, $p \leq .01$).

Table 4.9 illustrates the results of these analyses.

Table 4.9: Correlation Matrix for Demographic Variables and Game Behavior

Variable	(1)	(2)	(3)	(4)	(5)	(6)
1. Age	1					
2. Animals	.009	1				
3. Children	.608**	-.127	1			
4. Yrs. Herding	.581**	.081	.462**	1		
5. Amount Taken	.03	-.177	.022	-.033	1	
6.Exp. Taking	-.062	-.101	-.004	-.099	.690**	1

**Significant correlation at $p \leq .01$.

To assess whether the post-game survey questions, zero-sum orientation

questions, and game-specific zero-sum orientation questions described in Figure 4.4

could be combined into indices that measure unified constructions, I performed reliability

analyses on these variables. Reliability analyses revealed that none of the variables

designed to measure players' attitudes toward the game, zero-sum orientation, or game-

specific zero-sum orientation can be reliably formed into indices. Therefore, Kruskal-

Wallace tests were performed on each individual survey variable for these 3 categories

across game versions. These tests revealed no significant differences among the 3 game

versions and participants' responses to any of the post-game survey questions and the

game-specific zero-sum orientation questions. However, there was one significant

comparison for the fourth zero-sum variable "Cooperating with others is more profitable

than taking advantage of others" (N = 87, $Z = 7.226$, $p = .03$). In the case of this variable,

players in the *dzud*-framed version of the game were more likely to disagree with the

variable statement than players in the standard version of the game, but not the stochastic

version of the game.

Table 4.10: Mean responses to post-game survey variables[1]

Survey Variable	Standard (M, SD)	Stochastic (M, SD)	Dzud (M, SD)	Total (M, SD)
Game Variables				
Game 1	3.44 (.85)	3.45 (.91)	3.25 (.98)	3.38 (.91)
Game 2	2.85 (1.06)	2.83 (1.20)	2.81 (1.09)	2.83 (1.11)
Game 3	3.65 (.98)	3.56 (1.19)	3.81 (.93)	3.68 (1.03)
Game 4	2.00 (1.00)	2.21 (1.05)	2.42 (1.13)	2.22 (1.07)
Game 5	3.00 (1.21	2.67 (.90)	2.90 (1.11)	2.86 (1.08)
Zero-Sum Variables				
Zero-Sum 1	1.81 (1.21)	1.68 (1.16)	2.20 (1.40)	1.91 (1.27)
Zero-Sum 2	3.22 (1.42)	3.39 (1.34)	3.74 (1.18)	3.47 (1.32)
Zero-Sum 3	3.78 (1.15)	3.72 (1.25)	3.83 (1.17)	3.78 (1.18)
Zero-Sum 4	4.41 (.80)	3.90 (1.20)	3.61 (1.28)	3.95 (1.16)
Zero-Sum 5	3.23 (1.42)	4.41 (1.02)	3.26 (1.18)	3.30 (1.20)
Game Zero-Sum Variables				
Game Zero-Sum 1	2.35 (1.20)	2.14 (1.13)	2.34 (1.04)	2.28 (1.11)
Game Zero-Sum 2	2.48 (1.00)	2.66 (1.14)	2.38 (.94)	2.50 (1.03)
Game Zero-Sum 3	4.04 (1.04)	3.83 (.97)	3.72 (.92)	3.85 (.97)
Game Zero-Sum 4	3.54 (1.33)	3.07 (1.00)	3.32 (1.22)	3.30 (1.19)
Game Zero-Sum 5	2.65 (1.32)	2.48 (1.18)	2.88 (.91)	2.68 (1.14)

[1]All survey variables coded on a 5-point scale in which 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

Finally, to assess the potential relationships between each post-game survey

variable and rates of taking or expected taking across the three game versions, I

performed Pearson correlations. The results of these analyses indicate that there are no

significant correlations between the zero-sum orientation variables and game-specific

zero-sum orientation variables and the amount players took from the envelope or

expected other players to take from the envelope. In the game-specific survey variables,

the survey variable "I was worried that I would take too much money from the envelope"

is weakly positively correlated with the amount of money a player took from the

envelope (r = .224, p = .036). The correlational analyses between survey variables and expected taking revealed no significant correlations between zero-sum orientation variables and expected taking. However, for the game-specific survey questions, players' responses to the survey variables "I wanted to earn more money than the person I was paired with" and "I believed the person I was paired with wanted to earn more money than me" are both weakly positively correlated with the amount of money players across versions expected others to take from the envelope (r = .265, p = .012, R = .270, p = .012, respectively). Furthermore, for the game-specific zero-sum orientation variables, the survey variable "No one can be successful in the game unless they bring others down" is weakly positively correlated with the amount of money players expected other players to remove from the common envelope (r = .259, p = .016).

4.7 Discussion

The results of this study provide several important insights on how Mongolian nomadic pastoralists treat common pool resource decision making. However, the results are inconclusive in predicting how the risk of winter *dzud* might affect herders' willingness or ability to cooperatively co-manage common pool grassland resources. The Mongolian Plateau boasts a long tradition of successful common pool resource management and a system of traditional (and contemporary) land laws that prevent unrestricted access to land and flexible seasonal management of grassland resources (Endicott 2012). This study began with two central hypotheses that predicted individual players in the common pool resource games would take more money for themselves and would expect other players to take more for themselves when presented with a common pool resource game that was framed as a winter disaster scenario. While neither of these

hypotheses is supported in the Tosontsengel sample and have limited support in the

Orkhon sample, this study represents the first attempt to experimentally assess the effects

of *dzud* on common pool resource decision making in rural Mongolia.

The game results in both study sites indicate that herders may be acutely aware of

the possibility of over-extracting common pool resources, and, thus, they may have

played the game conservatively to prevent the potential of overdrawing from the

hypothetical common pot. In total, 0 of the 30 games in the Orkhon sample resulted in

over-extraction (and thus, 0 payment for each player) from the common envelope and

only 2 of 44 games in the Tosontsengel sample resulted in over-extraction. This may

point to the strength of cultural norms and rules associated with common pool resource

use in rural Mongolia. For example, one player in the Orkhon sample commented that she

did not worry at all about overdrawing from the common envelope because "I was

playing with other Mongols, and I'm sure they would play the game the same way I

would." This interpretation is further evidenced by the strong positive correlation (R =

.69, $p \leq .01$) between the amount of money players took from the common envelope and

how much they expected other players to remove across the 3 game versions in the

Tosontsengel sample.

In Tosontsengel, while summer pasture tends to be open access with little

regulation, herding families are acutely aware of the boundaries between winter pastures

and seek to prevent unrestricted or out-of-season access to winter land because of the

tendency for Zavkhan Province to experience harsh winter conditions. In ethnographic

interviews I conducted in 2017, herders in Tosontsengel asserted that they believe that

dzud often drives people to behave more selfishly simply because they may be physically

unable to help other families or unwilling to ask others for help. When asked if he can cooperate with or ask for help from others during a winter disaster, one Tosontsengel herder commented that "Asking other people for help during a *dzud* is like asking your brother to let his animals starve to death so that yours can eat." As a result of the acute necessity for grazing resources and supplementary livestock fodder during winter *dzud*, many Tosontsengel herders commented in interviews that they felt that the best course of action during a *dzud* (if they were physically able to move) would be to get away from other families so as to not concentrate the number of sick or starving livestock onto already limited seasonal pastures. This practice is known as *otor* in Mongolian and involves moving to a new area if poor conditions are expected. As the number of rural families has increased in Mongolia, this practice has largely fallen out of use.

The lack of a framing effect in the experimental games in the Tosontsengel sample might be due to players' confidence in their ability to predict other individuals' behavior as well as the fact that many individuals in Tosontsengel acknowledge difficult winter conditions as something they regularly must contend with simply by virtue of the location they live in. One herder commented that he felt that every winter in Tosontsengel presents unfavorable conditions, and that herders from any other region of Mongolia would call even a normal winter in Tosontsengel a *dzud* winter.

Similar to the Tosontsengel sample, there were no significant differences in individual decision making across the standard, stochastic, and disaster-framed versions of the common pool resource game in Orkhon. However, the statistically significant difference between the stochastic and disaster framed versions in the amount of money players expected others to withdraw from the hypothetical common pot lends some

support to hypothesis 2 that players would expect others to take more from the common envelope if the game was framed as a *dzud*-scenario. While players in the *dzud*-framed version in Orkhon did not take statistically significantly more from the common envelope for themselves than in the other two versions, they expected the players they were paired with to remove more from the envelope than players in the standard or stochastic versions of the game expected.

The explore the significant differences in expected taking across game versions in the Orkhon sample, I asked participants in post-game interviews for their interpretation of the game results and decision making. Players asserted that they did not feel worried that they or their partners' combined decisions would result in taking too much money from the common envelope, but players in the disaster-framed version of the game asserted that they felt the players they had been paired with might take more money from the envelope than they did. While this could be interpreted as a perception of greater selfishness on the part of other players, many of the interviewed players did not attribute this view to selfishness. For example, several players in the *dzud*-framed game asserted that while they did not choose to remove a greater amount of money from the envelope because of the possibility of a disaster, their partners might choose to take more money from the envelope because they might need this money if an emergency like a *dzud* were to happen. Therefore, often, a concern for other players' needs, rather than selfishness, was cited as the reason other players might take more out of the common envelope. This may be characteristic of the fact that rural Mongolians are generally cash-poor and need cash during *dzud* to secure supplementary sources of fodder to support vulnerable livestock (Murphy 2018).

The difference in expectations of player behavior in the *dzud*-framed version of the game in the Orkhon and Tosontsengel samples may also be related to the fact that Orkhon is experiencing net inward migration of herders from surrounding provinces while Tosontsengel is not. Because of its central location near both the capital of Bulgan Province and Erdenet, the second largest city in Mongolia, Orkhon is a prime location for herding families to be close to two major urban markets for livestock products. Orkhon is also located less than a one-day drive to Ulaanbaatar, the national capital. This economic situation is quite uncharacteristic for much of the Mongolian countryside where herding families rely on middle-men to sell livestock products in rural markets before they are shipped to Ulaanbaatar. Therefore, over the last two decades, Orkhon has seen a large degree of inward migration of herding families, especially from the more remote western provinces of Mongolia. Herders in Orkhon often cite this inward migration as one of their chief concerns and many attribute inward migration to an increase in livestock density and overgrazing in a region where herd sizes are already larger than average. Therefore, the weaker positive correlation (R = .35, $p \leq .01$) between taking and expected taking in Orkhon relative to the strong positive correlation (R = .69, $p \leq .01$) between the two in Tosontsengel may indicate that players felt less confident in their ability to predict others' behavior in Orkhon relative to Tosontsengel.

4.8 Conclusion

This study represents the first ever application of common pool resource games in rural Mongolia, where common property systems are still functioning and codified in both local tradition and national policy. The results indicate that Mongolian pastoralists can effectively manage common pool resource decisions in an experimental setting, at

least when paired with a single individual in a non-iterated experimental game. Furthermore, the results provide support for the effectiveness of cultural values and social norms for enabling individuals to both avoid over-extracting common pool resources like grasslands and the ability to predict other resource users' behavior.

Regarding the original study hypotheses, which predicted that the presence of a *dzud*-frame would lead rural Mongolian herders to both behave more selfishly and expect others to do the same, there is only limited support for the expectation that other individuals would extract more from a common pool resource when faced with a potential *dzud*. These inconclusive results may be due to two possible reasons. First, players could have been so confident that neither they, nor the people they were paired with would remove enough from the common envelope to risk destroying the resource. This confidence may have been strong enough that players who were faced with the stochastic and *dzud*-framed versions of the game did not alter their behavior significantly from those playing the game in which the amount of money in the common envelope was certain. Second, it is also possible that the *dzud*-frame was not strong enough to elicit psychological or behavioral responses in the game. This may be because the *dzud*-frame presents a counterfactual that players might have disregarded, or which did not influence how they made their decision.

In the future, studies that aim to explore the potential effects of natural disasters on Mongolian herders' economic and social decision making might focus on the following. First, because herders often assert that they are unable to help others during winter *dzud*, but are able to assist family and neighbors both before and after *dzud* have occurred, future studies might explore *dzud*'s effect on cooperative responses to winter

preparation and recovery. In addition, future studies might employ an iterated common pool resource game with a built-in probability that a natural disaster will reduce available resources. In this way, the annual probability for a winter *dzud* could be more effectively simulated than in a non-iterated common pool resource game.

4.9 Acknowledgements

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Chapter 5:

Conclusion

5.1 Summary and Conclusions

The body of human behavioral ecological research indicates that human generosity and cooperation enable people to mitigate the effects of risk (Cronk et al. In Press; Akitpis et al. 2018), gain access to scarce resources (Kaplan et al. 2009), engage in aggressive coalitions (Mathew and Boyd 2014; Bowles 2009) and navigate complex social interactions to gain influence in communities (Macfarlan et al. 2013 von Rueden et al. 2011). Mounting evidence suggests that kinship, fitness interdependence, and social reputations at least partially explain the form and function of cooperation in diverse human societies (Aktpis et al. 2018; Macfarlan and Lyle 2015; Roberts 2005; Richerson and Boyd 1999).

In rural Mongolia, most previous research has focused on historical perspectives of land use, social organization, and economic change in Mongolia, especially considering Mongolia's recent transition from a socialist economy to a market economy and the economic and environmental effects of this transition (Endicott 2012; Upton 2008; Humphrey and Sneath 1999; Fernandez-Gimenez 1999). However, at present, behavioral investigations into Mongolian pastoralist communities are increasing and providing valuable insights into contemporary social organization, economic behavior, and land use practices among nomadic pastoralists (Murphy 2018; 2015; 2014; Ericksen 2014; Gil-White 2003). In this dissertation, I sought to expand on this behavioral research by exploring labor sharing, generous giving, and common pool resource management

decisions in one of the most climatologically harsh and natural disaster-prone regions of western Mongolia.

In chapter 2, I investigated generous giving in a community of 47 full-time pastoral nomad households in Tosontsengel, Mongolia using a recipient identity conditioned heuristic (RICH) allocation game (Gervais 2017). This allocation game explored non-anonymous financial allocations in a sample of 42 females and 46 male and female household heads. The results of the game indicate that kinship and perceived need were the primary drivers of both male and female players' decisions to allocate money to other players in the study sample. There were no significant differences in money allocated to others, money received from others, or money players kept for themselves between men and women. The results of this allocation game also indicate that the amount of money players received from others is positively correlated with both the number of consanguineal and affinal kin ties they had in the community as well as their social reputations for having strong work ethic, being skilled livestock herders, and being generous members of the community.

Chapter 3 presents my exploration of labor sharing among 47 household heads in Tosontsengel, Mongolia for 6 types of common pastoral labor using social network analyses. The results of these network analyses indicate that outgoing labor sharing ties are driven primarily by household heads' social reputations for being hardworking, generous, and skilled herders as well as their total reported number of consanguineal and affinal kin relationships in the community. Household heads with more positive social reputations and greater numbers of kin tended to provide more help with pastoral labor to other household heads but did not receive more help from others. These results and

qualitative investigations into labor sharing ties in this herding community indicate that individuals who give more help to others may receive indirect benefits which come in the form of social influence, economic wealth, and access to land resources and labor. These results are consistent with the findings of Lyle and Smith (2014), Macfarlan et al. (2013) and von Rueden et al. (2011) which all highlight the importance of social reputations as predictors of social ties, wealth, and influence in small-scale societies. The social network analysis results also suggest that kinship relationships, especially affinal kin ties, may also be a powerful mechanism by which herding families gain access to limited winter pastures and camping sites.

In chapter 4, I focused on exploring the effects of climatic variability on cooperation and common pool resource management in rural Mongolia using a common pool resource experimental economic game (Gelcich et al. 2013; Sosis and Ruffle 2003; Rapoport et al. 1993). In this study, I presented two groups of herders living in Orkhon, central Mongolia, and Tosontsengel, western Mongolia with 3 different common pool resource games. The 3 versions included a standard game with a stable amount of money in a hypothetical common envelope, a stochastic game in which the amount of money in the common envelope was uncertain, and a disaster-framed game in which a hypothetical winter *dzud* could reduce the amount of money in the common envelope. I aimed to assess whether the *dzud*-framed version of the experimental game would induce a framing effect in study participants (Cronk 2007). In each game, study participants were asked to both decide how much money they would like to extract from the common envelope and how much money they expected the player they had been paired with to extract. The results of the game indicate that there was no statistically significant

difference in taking or expected taking among any of the 3 game versions in the

Tosontsengel sample. However, there was a significant difference in expected taking in

the stochastic and disaster-framed games in the Orkhon sample.

5.2 Future Directions

The 3 studies that comprise this dissertation provide interesting results in light of

both current human behavioral ecology research and Mongolian studies more generally.

However, they also point to important future research directions and methodological

improvements both for understanding Mongolian social organization and disaster

preparedness and the behavioral ecology of nomadic pastoralists. In the following

section, I present 4 potentially beneficial research directions that will provide additional

insights and expanded scientific understanding of Mongolian social organization,

economic decision making, and cooperative behavior.

I began my dissertation design process in 2013 with the express desire to explore

the effects of winter *dzud* on Mongolian herders' social behavior and ability to engage in

cooperation. However, at the end of this dissertation, I lament that I was unable to

provide much empirical insight into the effects of natural disasters on social behavior in

rural Mongolia. The results of the common pool resource games I described in chapter 4

provide interesting quantitative results regarding Mongolian herders' common pool

resource management decisions. However, the disaster frame I originally hypothesized

would lead players to behave more selfishly had no effect on game behavior.

Qualitatively, however, many interview subjects in Tosontsengel asserted that they felt

that the synchronous nature of winter *dzud* made helping others impossible and that, by

sheer necessity and inability to help, herding families tend to focus on the survival of their own herd over helping other families during a *dzud*.

Based on these qualitative results, I believe that experimental economic games may be a less effective way of studying the effects of *dzud* in Mongolia because they may present counterfactuals that do not adequately invoke study participants' sense of winter *dzud*. Furthermore, because the allocation games described in chapter 2 and common pool resource games described in chapter 4 are (to the best of my knowledge) only the second and third published experimental economic game studies from rural Mongolia, it could also be that experimental games are too novel for rural Mongolians for a framing effect to be detected. This same sense is described by Gil-White (2004), who reports the methodological and logistic difficulties of carrying out experimental economic games in rural Mongolia.

Because of the difficulties in conducting experimental economic games in rural Mongolia, I believe that future *dzud*-focused research in Mongolia should take a more ethnographic and observational approach than I took during my dissertation fieldwork. This approach is also not without its difficulties because customs in rural Mongolia make discussions of negativity and misfortune difficult to conduct. For example, many interview participants were extremely uncomfortable discussing *dzud* because of a prevailing belief that by discussing misfortune or negative events, one is inviting these misfortunes into his or her life. Therefore, discussions of *dzud* often do not lead to more than cursory understandings of preparations, experiences, and recovery when winter weather disasters occur.

In the future, researchers interested in winter *dzud*'s effects on social behavior and cooperation should focus on being present in a nomadic herding community during an actual *dzud* itself so that observations of actual social behavior during synchronous disasters can be made. This is, of course, easier said than done because of the unpredictability of winter weather disasters and difficulty in traveling to remote communities during these events. In addition to this direct behavioral observation, future behavioral research that focuses on *dzud* should be more holistic in its approach and focus not only on what happens to social behavior during a disaster but also how communities prepare for and recover from a *dzud* through interactions with community members, government agencies, and NGOs.

From the perspective of social scientists' general understanding of labor sharing in rural Mongolia, my social network analyses provide insight into how economic, demographic, kinship, and reputational characteristics drive labor sharing among household heads. However, these network analyses undoubtedly provide only a cursory understanding of social relationships among pastoral household heads. This is largely because the social networks I describe in chapter 3 describe interactions among household heads rather than entire nuclear families (e.g. wives and children who also provide labor assistance to others). To more fully understand the complexity of labor sharing, financial decisions, and patterns of mutual assistance, future research must focus on understanding herding families' connections not only within local communities but also their ties with people living in neighboring herding communities, towns, and cities. By focusing on these connections, we can understand how herders use connections with

non-pastoral families to secure access to cash, economic opportunities, and markets for livestock products in broader Mongolian society.

The results of the studies in chapters 2 and 3 indicate that sharing and generous giving in rural Mongolia is driven by more complex factors than kin-based connections. Mounting evidence from broader human behavioral ecology studies indicates that perceived need and individuals' perceived interdependence with others may better explain cooperation than genetic relatedness alone (Akitpis et al. 2018; Gervais 2017). In the future, I advocate a deeper investigation into Mongolian herders' perceptions of need in others as well as their perceived interdependence with other members of the herding community. This can be accomplished with survey-based and ethnographic research but might be better served with more long-term longitudinal studies of individual herding communities.

New behavioral ecology studies indicate that social reputations are not only important for driving social connections and influence in small-scale societies but also that by having relationships with high-status individuals, a person can increase his or her own social status over time (von Rueden and Redhead 2018). Given these results, it is important to conduct these types of analyses in other small-scale communities, including Mongolian pastoral communities, to fully understand how social reputations change over time and affect resource access. This is especially important given that the results of my network analyses suggest that social reputations and affinal kinship may have important long-term implications for access to limited winter pastures. By gathering more long-term data on social ties, social reputations, and economic behavior, researchers can better

understand how these factors contribute to the success or failure of particular lineages through time.

5.3 Concluding Remarks

In summary, this dissertation provides evidence that labor sharing and generous giving in Mongolian herding communities is heavily influenced by kinship, perceived need, and social reputations. These results build on the findings of previous human behavioral ecology studies and expand current knowledge of resource management, labor sharing, and social organization in an understudied pastoralist population.

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