Livestock mobility is practiced by pastoralists to cope with some of the variability and unpredictability of limited forage resources and because a diverse portfolio of strategies is needed to manage risk. The global trend towards rangeland privatization, fragmentation and land-use intensification is eroding many of the institutions that have traditionally facilitated pastoral mobility. While Australia’s pastoral industry was developed as a European private-property system, livestock mobility has recently been increasing, indicating an important response to variability regardless of a nation’s wealth or development. This paper discusses how opportunistic movements of livestock over large scales, by trading grazing rights between enterprises are effective but imperfect. Knowledge about the trustworthiness of individuals and local environments is often limited and poorly monitored. There is scope for policy to support mobility by targeting these institutional failures. The Australian system of trading grazing rights can inform efforts to maintain spatial flexibility in the industrial era.

Keywords: Customary institutions; drylands; desert; ranching; grazier; agistment; desert; spatial heterogeneity

Introduction

For pastoralists to survive and thrive in arid and semi-arid environments they need to buffer the impact of resource variability. Accordingly, pastoralists worldwide have developed suites of strategies to manage risk (Scoones 1994). These strategies are imbedded within sets of social norms, customary practices and laws which constitute institutions. The widespread utilisation of institutions which facilitate the movement of livestock indicates the importance of mobility for pastoralists (e.g. Hoffmann 2002, Ladio and Lozada 2009, Oba 2001, Scoones 1992). However, institutions evolve not just...
in response to climate variability, but also to the local political and social histories, and land-use and tenure (Mehta et al. 1999). What is telling is that, while there is great diversity in the mechanics of the institutions (see Niamir-Fuller and Turner 1999) the ability to spread resource use across spatial scales is a constant theme.

From a ‘range ecologist’ perspective (Adriansen 2005), different strategies for buffering the impact of resource variability have associated expectations regarding future costs and payoffs (returns). Accordingly, strategies can be seen as investments with expected returns and uncertainties. Amongst a range of strategic alternatives, there will be one method for dealing with variability that will return the greatest payoffs on average. However, because these returns are variable, even the ‘best’ strategy is likely to lead to an unsustainable high risk of catastrophe. Risk is best managed using a portfolio of strategies (McAllister et al. 2009). Hence, livestock mobility is critical not because it is the best approach to dealing with resource variability, but because it adds diversity to the portfolio of variability-coping strategies.

Despite the importance of livestock mobility, its practice is being subdued in many countries. Enabled by the growing influence of capitalism and centralized governance (Behnke 2008), there is a global trend towards the privatization of communal grazing of rangelands (Galvin 2008). Within narrowly defined objectives, privatization has been successful (Sandford and Scoones 1994). A recent review by Hobbs et al. (2008) shows that privatization has allowed governments to distribute land equitably (e.g. Banks 2003, Reid et al. 2008), given pastoralists access to credit, and facilitated productivity improvements through intensification. These benefits have been offset by the risks associated with tighter livestock-environmental coupling. Tighter coupling exposes pastoralists to greater temporal variability. And this is exacerbated by fragmentation because it erodes the ability to buffer variability by moving or expanding their range (Hobbs et al. 2008). Hence, livestock immobility risks trapping over 100 million livelihoods (Davies and Hartfield 2007) into poverty.

In contrast to the majority of the world’s traditional dryland pastoral systems, Australia’s was developed based on a European sedentary, private-property system (most properties are leasehold, but operated essentially as though private). However, as European Australians mature into their variable climate, new pastoral institutions are emerging which facilitate livestock mobility. Fragmentation within Australian rangelands has probably decreased the scale of livestock mobility within enterprises. However at regional (or greater) scales, opportunistic mobility (i.e. nomadism rather than migration) has recently increased. While locally specific and imperfect, the Australian experience is important (McAllister et al. 2006b; Reeson et al. 2008). As global grazing systems move towards sedentary settlement and privatization, livestock mobility in Australia, which is accomplished by trading grazing rights across spatially distributed enterprises, serves to inform international efforts to maintain spatial flexibility in the industrial era.
This paper is a synthesis of a recent body of work which seeks to build a general understanding of responses to resource distributions in arid and semi-arid Australia. The focus here is the use of livestock mobility by Australian pastoralists, which throughout refers to cattle grazers operating in Australia’s arid and semi-arid north. A concise history of this industry is presented first, followed by a framework for generalizing the strategic options available to Australian pastoralists. The system of trading grazing rights is then presented as an institution involving social norms, customary practices and laws. Finally, how mobility fits within the portfolio of strategies for managing resource variability is discussed. In terms of policy, this suggests how interventions may support rather than over-power local institutions.

**Pastoralism in northern Australia**

Hot arid and semi-arid systems worldwide are characterized by high evaporation and low rainfall that varies unpredictably in time and space. In Australia, rainfall variability is confounded by multiple climatic cycles at various temporal scales, including decadal (White et al. 2003). Australian pastoralists generate income by grazing livestock on palatable perennial forage. This resource’s abundance is driven mainly by rainfall patterns, and accordingly forage variability and unpredictability are seen to substantially restrict grazing productivity (Greiner et al. 2003).

Although stock drinking water and money are important resources for the grazing industry, this paper focuses on forage which is the key limiting resource. The capacity of pastoralists to use mobility as a strategy to cope with forage variability is very much affected by land tenure, technology and social networks. These factors are examined across the history of Australian pastoralism, as a basis for understanding its capacity to escape variability not just in space, but also in time.

**Pastoral colonization, pre 1950s**

European pastoralists had settled into most of Australia’s arid and semi-arid north by the 1880s. While early colonizing pastoralists mainly grazed sheep, adaptation to cattle production ensued in less than two decades in most parts (Allingham 1977). The sizes of grazing leases in this colonization era were comparably small by modern standards. However, because European-bred cattle were quite restricted by needing to remain in close proximity to drinking water, particularly in the dry season, vast tracts of land could be controlled by controlling sparse, key resources such as water and feed (McAllister et al. 2006a).

Between 1890 and 1950 government policy, driven by social equity ideals and the desire to legitimize sovereignty (Day 2001, Quinn 2001), sought to populate the grazing lands through land redistributions. The intensity of property subdivisions across Australia’s approximately 5.3 million km² of
rangelands varied regionally. McAllister et al. (2006c) and Stokes et al. (2008) review three contrasting histories. The more remote ‘Victoria River District’ (north-western Australia) remained largely untouched. ‘South-west Queensland’ which was seen as more profitable, was heavily subdivided. Here, for example, Stokes et al. (2008) report a property of 5,670 km² being subdivided into 56 leases. The ‘Dalrymple Shire’ (north-eastern Australia) provides an intermediate case. There, for example, the Allingham family which once operated up to 2,000 km² (Mann 1993) had its holdings reduced to 650 km² (about double the present regional average, Bortolussi et al. 2005). Many newly excised leasehold properties were not a viable size (or in some cases industry, e.g. dairy) and these were often repurchased and incorporated once again into larger extensive cattle enterprises.

Successful pastoralists on these early, vast enterprises understood both temporal and spatial climatic variability (Condon 2002, Durack 1967, Hardy 1969). However, transporting cattle by foot was slow and had high opportunity costs (e.g. time, money, livestock mortality). Furthermore, particularly in the early stages of the cattle industry, local markets were all but non-existent and any movement of stock, even if motivated by accessing variabilty, tended to be based on movement toward a market more than tracking forage conditions. Long chapters of the Australian cattle industry are dominated by cycles of stock build-up in good times, followed by mass mortality and land degradation when poor conditions followed (Lewis 2002).

Utilization of ‘the long paddock’, a public, common-pool stock route through grazing systems used for walking cattle, is anecdotally cited as an example of early pastoral mobility. In reality, because long paddocks were common property they received no improvements and were generally underutilized. Hence, these stock routes formed a refuge or a store of forage that could be called upon in desperate times, making this more a form of temporal buffering than large-scale mobility.

While the capacity of early pastoralists for regional-scale mobility was hampered by the high costs of moving stock across space, the capacity for enterprise-scale mobility was aided by the vastness of individual enterprises and the uneven grazing across them. Uneven grazing left a store of forage in the ungrazed parts of properties. This on-enterprise store allowed pastoralists the option of localized mobility within properties, in times of drought.

Industrial era pastoralism, post-1950s

Around the 1950s, the Australian government’s practice of resuming, subdividing and redistributing properties essentially ceased. The legacy of resumptions, while regionally variable, was a fragmented system with high-value land (mainly coastal) excised from the grazing landscape into higher-valued production. Since that time, production input costs have increased more quickly than livestock prices. In the 1970s, poor climate and economic conditions combined to force a pulse of adaptation (McAllister et al.
2006a) and degradation (e.g. McKeon et al. 2004). Adaptations saw labour inputs fall and grazing intensity increase, with a more even distribution of grazing across properties (Stokes et al. 2006; Stokes et al. 2008).

Both pre-1950 resumptions and subsequent land-use intensification diminished the natural temporal buffering capacity of enterprises. Of course inherent variability remained high, so with natural buffering capacity decreasing, other coping strategies became comparatively more feasible. While the spatial units of land tenure have changed little since the 1950s, there has been a trend for enterprises to consolidate land by purchasing additional properties (Stokes et al. 2006). Even though fragmentation eroded spatial connectivity (Stokes et al. 2006), consolidation is not driven by the desire for re-connection. In some cases consolidation is in response to economies of scale, but in most cases it is based on succession planning (i.e. planning to provide viable businesses for future generations of family members). Saying that, there is anecdotal evidence to suggest that when pastoralists seek to acquire additional properties, spatial climatic gradients inform their decision making.

Recent communication technologies (Ash and Stafford Smith 2003) have made it more feasible to convert pastoral resources into other income streams (e.g. online stock-market trading using the internet) and advances in nutritional science have improved supplementary feeding options in poor conditions. Both developments make temporal variability coping strategies more feasible. From a mobility perspective, transport costs have decreased considerably in the past 30 years as large cattle trucks can now move cattle quickly out of whole regions (or states) in drought conditions (Figure 1). This, coupled with increased land-use intensity, has driven an increase in livestock mobility across large scales as discussed below.

**Figure 1.** Cattle loaded for long-distance transportation.

(Credit: Adam Liedloff 2004)
Today, Australia’s arid and semi-arid north is dominated by extensive grazing enterprises on large-leasehold properties (regional medians vary between 62 and 2,862 km², Bortolussi et al. 2005). Since the 1990s, government policy has trended towards fostering multiple uses of grazing lands, with an increasing focus on Aboriginal and environmental values (Hunt 2003).

In summary, opportunistic livestock mobility has been a constant theme in the history of Australian pastoralism – yet it has never really been more than a secondary consideration. This contrasts with the central role which mobility, including opportunistic nomadism and migration between wet and dry season bases, played in shaping Australian Aboriginal responses to variability in the same regions (Berndt and Berndt 1981, Stafford Smith and Cribb 2010, Veth et al. 1990). However, while mobility is becoming more constrained globally, in the modern Australian pastoral industry its prominence is on the rise. In this system with private-property style land tenures (very secure and long leases) and comparatively strong governance, mobility beyond the enterprise scale has emerged as part of the strategic mix as pastoralists seek to manage risk.

**Coping with resource variability**

This paper frames opportunistic livestock mobility within a portfolio of strategic options that pastoralists employ in seeking to manage risk associated with variability. While the focus here is on how pastoralists deal with variability in forage, variability is a feature that underpins arid and semi-arid systems more generally (Stafford Smith 2008). For example, the functional types of plants and animals are a legacy of underlying arid and semi-arid variability (Stafford Smith and Morton 1990). Accordingly, the responses of pastoralists to variability can be seen as an extension to the coping mechanisms observed across most parts within these systems.

Stafford Smith and McAllister (2008) built on a body of ecological literature (e.g. Noy-Meir 1973, 1974) in order to categorize the range of strategies used to spread resource use. This framework is built up from plant and animal systems, but applicable to pastoralists (and other human systems). Part of this framework is re-presented here to contextualize mobility’s role amongst other pastoralists’ strategies (community or multi-livestock species strategies are not discussed here).

Table 1 shows five broad categories of variability coping mechanisms (Stafford Smith and McAllister 2008). At the most basic level, plants are clearly most limited in their capacity to buffer variability. While the location of some stands of trees moves gradually across the deserts, this process is generational and far too slow and incremental to represent mobility. Generally, because of the high cost of converting and storing energy, spatial buffering strategies should be favoured over temporal (McAllister et al. 2009). However, plants, limited by their physical incapacity to move in a timely
fashion, favour a range of temporal strategies. The majority of species are either *ephemerals* (short-lived annuals, e.g. forbs) or *in-situ persistents* (long lived, deep-rooted, e.g. River Red Gums). While plants tend to have a single dominant variability coping strategy, some plants clearly use a range. For example, bi-annual grasses generally behave as *ephemerals*, but where there are a sequence of good years, can act as perennials (*in-situ persistents*). The range of strategies open to animals is broader than that of plants. For animals, drinking water limitations have impacted on evolutionary life histories, but do not necessarily limit animal life (Stafford Smith and Morton 1990). Food is the limiting resource for which buffering is required, and there is a variety of arid and semi-arid food sources. While some wildlife species in Australian arid systems are opportunistic, particularly those which feed on aquatic

<table>
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<tr>
<th>Strategy description</th>
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<tr>
<td>In-situ persistents</td>
<td>Survive variability by investing in infrastructure to spread resource collection over vast areas, but without moving in space. The plant analogy is to harvest sparse resources through extensive root systems. Animals can defend large home ranges or maintain extensive social networks. Pastoralists likewise can maintain vast grazing areas and/or maintain conservative stocking rates.</td>
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<td>Refuging persistents</td>
<td>While generally, arid and semi-arid systems are highly variable, they are nonetheless heterogeneous. Hence one survival strategy is to specialize into areas less prone to variability. Watercourses and run-on areas are obvious niches. But this strategy is confounded by spatial scale, so an alternative is to look for smaller niches by becoming very small. For pastoralists just becoming small is not a realistic option (there are ‘living areas’ needed to make a living, Caltabiano et al. 1999). Also the most productive niches have been excised from grazing systems.</td>
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<td>Ephemerals</td>
<td>Pulse-reserve systems typify drylands; inactivity in poor times is compensated for by rapid growth in resource pulses. Short-lived, opportunistic annuals are an extreme example in the plant world, as are aquatic ephemeral systems for fauna. Pastoralists smooth their resource use by converting offtake in good times into money.</td>
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<td>Exploitors</td>
<td>Grazing regions tend to have animal populations which are constrained by the capacity of key resources (non-equilibrium, Illius and O’Connor 1999). Hence in these regions, in pulses of resource availability forage and lower trophic levels may be abundant enough to draw in resource users from more productive systems. Birds that feast in arid aquatic systems show this best (e.g. Dorfman and Kingsford 2001).</td>
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<td>Nomads (mobility)</td>
<td>While for a given spatial scale, arid systems are more variable than most non-arid systems, the degree of variability decreases with spatial extent (Roshier et al. 2001). Hence, movement across space can spread resources for animals and humans. Agistment networks are presented as the case of modern mobility in industry pastoralism.</td>
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productivity (e.g. nomadic birds, Dorfman and Kingsford 2001), the majority are surprisingly stable. At some scale animals tend to employ the full range of strategies in Table 1. Birdlife, such as cormorants, migrate (nomads) into pulses of aquatic productivity and breed opportunistically (ephemerals) (e.g. Kingsford 1995). Mobile Red kangaroos (nomads) are predominately confined to drainage lines (refuging persistents) while their reproductive activity responds to pulses in forage (ephemerals) (see Edwards et al. 1994, Norbury et al. 1994, Southgate et al. 2007).

Modern industrial pastoral enterprises are part of complex adaptive systems which link markets, organizational structures, institutions and non-market valuations of the environment (Gillson and Hoffman 2007, Reynolds et al. 2007). Australian pastoralists are rich by international standards (Boone et al. 2008) and accordingly the resources consumed by the individuals who run these enterprises contain a diversity of durable and non-durable items, including luxury goods. This synthesis focuses on the resource which constrains pastoral enterprises – available palatable perennial forage. For this resource, pastoral enterprises have used each of the strategies in Table 1.

- **Ephemerals**: Historically, cattle enterprises in northern Australia operated with minimal management. While modern land-use practices have been transformed by technological and land tenure developments, peak–trough cycles in enterprises that are so tightly interlinked with variable rainfall are unavoidable. While it is unlikely that livestock (particularly breeding stock) are allowed to die, stocking rates ebb and rise in response to poor and favourable conditions. Stock reductions are normally achieved by selling, but when drought and poor prices coincide then major land degradation episodes can occur (McKeon et al. 2004; White et al. 2003). Another ‘ephemeral’ option is supplementary feeding during poor conditions so that stock numbers do not crash, though the trade off is that profits are eroded by the feed costs.

- **In-situ persistents**: Variability can be avoided by running stocking rates conservatively enough such that livestock numbers can be maintained even in drought. The result is consistent income through good and bad climate conditions. This approach may yield a greater return per beast compared to more intensely grazed systems (Macleod et al. 2004), but to provide the income levels needed to support families, this strategy requires the home range (i.e. enterprise size) to be sufficiently large.

- **Refuging persistents**: Pastoral land-use intensification, largely due to technological advances such as fencing, water points and new cattle breeds, has led to a more even utilization of forage across grazing enterprises. This has reduced the systems’ natural drought buffering capacity (Walker et al. 1987). Areas which were once refugia, providing a store of forage for poor times, are now grazed with increasing regularity. This has increased the impact of climatic variation and essentially removed the option of persisting within enterprise-scale key resources.
Exploiters: Moving cattle in and out of the rangelands is now not economically feasible because productive parts of the landscape have been generally excised from the grazing landscape. Opportunistic mobility to ‘exploit’ rangeland pulses are thus limited because negligible extensive grazing occurs outside of these areas (and likewise migration in and out of rangelands is also limited).

Nomads (mobility): Cattle can be moved to other parts of the rangelands in response to patchy rainfall patterns. Technologies like trucks and road infrastructure have revolutionized this form of mobility in the past 30 years. This is the focus of the subsequent section.

Mobility in a fragmented pastoral system: The Australian agistment practice

Agistment is the practice of temporarily moving livestock from one pastoral enterprise with deficit forage, to another pastoral enterprise with more forage than it requires. The market incentives for agistment are based on the agistee (landholder) receiving payment for grazing the agistor’s livestock. Hence, agistment is the trading of grazing rights between pastoral enterprises. Trade occurs between spatially distributed enterprises and, as discussed below, the pattern of forage availability can be exploited as a strategy to cope with the variability of forage.

Snapshot

Little published empirical data exists on the extent and patterns of agistment in Australia’s northern rangelands. A snapshot is provided by Reeson et al. (2008) and McAllister et al. (2005), drawing on a dataset of 14 semi-structured interviews with pastoralists in the cattle-grazing dominated rangelands of north-eastern Australia (26–29 July 2004, Dalrymple Shire). A draft analysis of these data was later circulated amongst rangelands experts across various Australian regions and organizations who concluded that the broad bias of the agistment market is consistent across all of Australia’s northern rangelands (Reeson et al. 2008). The following is a summary of the key results, with the percentages in brackets relating only to the representation within the 14 semi-structured interviews (McAllister et al. 2005).

- Multiple objectives drive pastoral enterprises to seek to agist their stock, including drought mitigation (69 per cent), strategic stock building to stock future planned land purchases (31 per cent), and a sense of social obligation. Many instances of agistor activity relate to multiple drivers.
- Multiple objectives drive pastoral enterprises to accept agistment cattle on their enterprise. The motivation is generally economic, but the reason for having excess forage varies, including sequencing of land and stock acquisition, with new land being unstocked due to delays in purchasing
stock (31 per cent), taking advantage of unexpected or patchy rainfall (23 per cent) and strategic designation of land to generate agistment fee cash-flows (15 per cent). Many instances of agistee activity relate to multiple drivers.

- While the cost of agistment is a function of distance, the greater the distances cattle are moved, the greater the chances that the destination region is experiencing different (presumably better) conditions. There is a view that cattle need to be moved at least ‘200 km’ in order to take advantage of landscape and climatic heterogeneity. Hence there is a trade off between the costs and benefits of increasing the distances over which cattle are agisted.
- Agistment agreements are based on trust, with most pastoralists relying predominantly on hand-shake or verbal agreements (46 per cent), or written but not legally binding agreements (31 per cent). Far fewer rely on legally binding agreements (8 per cent).

The data presented in Reeson et al. (2008) and McAllister et al. (2005) suggest that while agistment spreads resources use over space, its primary driver is the need for flexible business models. The data also highlights the largely informal nature of agistment. The specifics of individual agistment agreements vary in terms of the roles of each party (i.e. who checks water supplies, provides supplementary feeding, monitors and moves cattle, etc.). A major issue with the informal nature of agreements is that the roles of the agistee and agistor are not clearly defined and differing expectations may lead to conflict. While spatial resource buffering is only a partial driver of agistment within the pastoral industry, amongst a broad range of options for spreading resources over time (supplementary feeding, converting resources into cash for storage, see above), the agistment market is the most feasible option for livestock mobility across large scales.

While agistment is an economic market (Reeson et al. 2008), many of the agreements in this market have been based on handshake agreements or on written agreements that are not legally binding. There are social norms which relate to acceptable practice in agistment agreements and agistment networks are overlain with kin and social networks (Yiheyis Maru, pers. comm). Agistment thus facilitates livestock mobility using a combination of social norms, customary practices and law. Accordingly, the market is best understood from a social-ecological institutional perspective.

Agistment as an institution

Perevolotsky (1987) argued that reciprocal altruism will evolve where variability of resources is sufficiently high. These ideas are supported by theoretical modelling (McAllister et al. 2006b). Traditional rangeland institutions have certainly evolved in response to variability in resources (Niamir-Fuller and Turner 1999). These are also shaped by their broader contextual settings, including the formal institutions which govern land use and tenure.
Rangeland tenures worldwide are most conveniently categorized as either common-pool (or open-access) or private, but it is acknowledged that real systems are never strictly at either extreme (e.g. Banks 2003; Behnke 1997). Pastoralism in Australia tends heavily toward the ‘private’ end of the spectrum. The trends towards co-management of lease-holder enterprises complicate this classification along the scales of governance. Agistment creates ‘fuzzy’ boundaries around enterprises (see Goodhue and McCarthy 2000 for examples of fuzzy boundaries).

The question of whether the transaction costs associated with agistment are a worthy investment is somewhat rhetorical. Most pastoral enterprises in the Australian rangelands are family owned and anecdotally it appears that even where family-owned enterprises own multiple properties (Bortolussi et al. 2005), agistment in response to biophysical conditions at some point is the norm (see Reeson et al. 2008 for discussion). This indicates that the transaction costs including stock transportation, agistment fees and any monitoring costs, are less than the benefits of escaping variability through mobility. Reeson et al. (2008) also point out that because the market is not regulated, legal and other organizational transaction costs are minimal.

From an institutional perspective on managing complex adaptive rangeland systems, agistment violates some principles for sound design. Principles for robust institutional design in social-ecological systems call for clear boundaries around resources (Anderies et al. 2004, Ostrom 1990). For an agistment interaction, the resource is the forage bounded by the agistee’s property (or paddock). And while grazing rights and property boundaries are clearly defined by law, the social norm is to accept uncertainty in the loss in stock condition and mortality (Reeson et al. 2008). Further there are inconsistencies among the expectations of whether any livestock not in the agreement are permitted to graze the agistee’s property (or paddock). Such issues complicate (or violate) the institutional requirement for clear rights to ‘harvest’ resources.

Robust institutional design also calls for effective monitoring and effective conflict resolution and sanctions (Anderies et al. 2004, Ostrom 1990). In agistment networks, monitoring is variable, often limited, and sometimes nonexistent. Because agreements are generally informal, sanctions are also of an informal social nature rather than financial (though social sanctions can be very powerful in many regions). When conflicts arise, a complete breakdown of relationship seems more likely than resolution.

There is substantial conflict in the agistment market and this is also related to institutional design. Not only is monitoring not always adequate, but because the rules for behaviour are more often informal, there are asymmetries in expectations. This indicates that while agistment is a developing institution, it has not developed to the point where the rules and social norms are understood consistently amongst participants. Through the pastoral industry’s links to the ever changing global economy, it may be hard for locally specific social norms to mature. Hence, Reeson et al. (2008) building on theory
(McAllister et al. 2006b), suggest that there is scope for intervention into the agistment market. This must focus on supporting the informal rules rather than replacing them. For example, standard agreements could be drafted to encourage agistees and agistors to declare what they believe their rights and obligations to be in an effort to bring conformity to the ‘rules’.

It appears that the conflict in the market also acts to generate very strong ties based on reciprocity of trust. Agistment interactions which leave both parties happy are highly valued by pastoralists. In such cases, both parties invest in and maintain these relationships. As mentioned above, agistment and social networks are overlain, and it seems plausible that many strong friendships have been built on successful agistment experiences rather than the other way around.

**Interaction with alternative time-based strategies**

For many grazing enterprises, agistment is the only feasible option for practising mobility at large scales in the extensive, modern Australian cattle industry. While McAllister et al. (2009) argue that employing a diversified range of strategies to cope with resource variability (in either time or space) is needed to manage risk, there is evidence that true mobility is presently used as an act of desperation. True mobility here is defined to exclude agistment activity that is a strategic business decision rather than a response to resource variability. Personal experience, including conducting the interviews reported by McAllister et al. (2005) and Reeson et al. (2008), indicates that mobility is a last-resort response to poor climate conditions. Often temporal responses, such as supplementary feeding and selling off stock to market, are attempted in preference.

The fundamental driver, variability, which drove Aboriginal people to move in space, and which still drives wildlife movements, is still a strong feature of the Australian rangelands. Mobility is playing an increasing role in managing these landscapes. This increase has been driven by pastoralists’ utilization of new technologies, though subsidized by government funding of road infrastructure which cannot be justified on economic grounds. Most government interventions tend to promote ephemeral approaches. For example, the Farm Management Deposits scheme effectively subsidizes individual pastoralists to save when times are good. On the other hand schemes that assist pastoralists through droughts are damaging because they dampen negative feedbacks which would otherwise discourage high, overly optimistic stocking rates (Stafford Smith 2003). While acknowledging that in drought governments have also subsidized agistment, much more could be done to enhance spatial connectivity across pastoral landscapes.

**Fostering mobility**

Institutions dominate human-decision making, and their role in natural resource management is well recognized (Agrawal 1999, Mehta et al. 1999,
Institutional settings combine both formal (legal) and informal elements (social networks and norms, customary practice). The informal rules and social norms embedded within institutions are critical because these better equip institutions to meet locally specific requirements. Social norms are created and shaped not just in response to resource issues (like forage variability). Broader formal institutional settings are also influential. Pastoral mobility in Australia is facilitated by an institutional setting which, while based on market economics, is largely informal and constructed on trust.

While social norms are a critical aspect of any institution, social norms are flawed (Ostrom 1998), and hence so are the institutions within which social interactions are pivotal. Further, because social norms develop in response to multiple drivers, the chances that the scale of a social institution will match the scale of a natural resource issue are limited. Finally, communications and transport infrastructure have a role in connecting society, so inappropriate infrastructure can distort social institutions.

Pastoral enterprises in northern Australia generate income indirectly from forage. However, modern pastoralists rely on a vast diversity of resources. They can earn off-enterprise income. They can also store resources in the form of monetary investments, biasing pastoralists towards spreading resource use across time. Alternatively, opportunistic livestock mobility is used by pastoralists to manage risk by spreading resource use across space. During the past 30 years, as transport costs have decreased, it has become more feasible to move livestock long distances. To facilitate this, new social norms surrounding opportunistic mobility have developed.

Even though social institutions are bottom-up processes, top-down drivers can effectively create the conditions needed for bottom-up institutions to emerge (Sobels et al. 2001). This means top-down policy drivers have a role in correcting or creating institutions to deal with and target natural resource issues. While mobility is increasingly feasible for pastoralists in industrialized countries, issues of accountability, trust and knowledge asymmetries (Reeson et al. 2008) all contribute to mobility through agistment as being used a last resort in responding to variability.

In the rangelands of Africa and Asia, many practitioners are calling for a re-focus towards supporting mobility to improve rural livelihoods (Barrow et al. 2007). There is a corresponding argument in Australia that natural resource policy should seek outcomes by understanding local institutions and working to appropriately strengthen them (McAllister et al. 2006b). For opportunistic mobility, policy should seek to remedy mistrust and knowledge deficiencies which impact negatively on local institutions. For example, standardized agreements could be encouraged. These would provide legal protection and, more importantly, force parties to engage in a discussion about what outcomes and actions they expect from the agreement. This would elevate the practice of using agistment beyond that of a last resort response to drought, to a more genuine, quality-assured mechanism for scaling up access to variable resources. In the face of resource variability, for pastoralists, plants
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and animals alike, risk is best managed using a portfolio of the coping strategies discussed in Table 1 (McAllister et al. 2009). The reduction in risk that can be achieved using a portfolio of, for example, ephemeral and mobility based coping strategies, is powerful only when they are used more or less interchangeably rather than with one as a fall-back plan.

While Australia can learn from traditional institutions elsewhere about the perils of ignoring local institutions (Barrow et al. 2007), its experiences serve to inform future adaptation globally. In many developing countries, traditional institutions which support mobility are being eroded by government policies which promote privatization, sedentary settlements and intensification of grazing (Niamir-Fuller and Turner 1999). This transition from nomadism to sedentary grazing is associated with a range of positive outcomes for locals which relate to an increase in services. However, the corresponding lack of livestock mobility poses potentially very serious environmental as well as culture risks. The Australian experience serves as a unique case study of mobile pastoralism. The presence of mobility in a system which was developed from the outset with sedentary, private-property ideals, reinforces that mobility is an efficient response to variability. This is a fundamental observation regardless of wealth or development. The Australian case also gives hope that, as industrialization changes grazed drylands globally, spatial consolidation of service provision and wealth need not prohibit livestock mobility and its cultural and environmental benefits.

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References


LIVESTOCK MOBILITY IN ARID AND SEMI-ARID AUSTRALIA


