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‘Storytelling’ Natural Resource Conflict on U.S. Public Lands

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ABSTRACT

Livestock grazing is an extensive and long-standing natural resource use on U.S. public lands that has become extremely controversial in recent decades. In this article, we approach the controversy over public lands grazing as an ‘ontological conflict’ that goes beyond a struggle over different perspectives on nature/reality and involves the ongoing making of different realities/worlds. We bring together historical and ethnographic material from the Tonto National Forest in Arizona in a verbal and visual process of ‘storytelling’ to show how multiple and conflicting imaginations of the public rangelands have emerged and taken on or lost reality over time through multiple, shifting, and often contradictory processes of translation of the relationships among entities in a network that includes humans, nonhumans, discursive and social structures, and social forces. While this approach was originally developed in the context of indigenous studies, it has much to offer in the study of non-indigenous resource conflicts.

KEYWORDS Natural resource conflict; U.S. public lands; livestock grazing; translation; relational ontology; Actor Network Theory

Introduction

Looking out across the rugged, arid, mesquite- and saguaro-studded landscape of the Tonto Basin District of the Tonto National Forest (TNF) in Gila County in central Arizona, it is not apparent to the untrained eye that there is anything for cattle to eat or drink. Drought is a regular occurrence in this mountainous region of highly variable precipitation, and climate change poses an additional challenge as temperatures in the region are projected to increase along with more frequent and longer lasting drought conditions (Garfin *et al.* 2013). But the ranchers with grazing allotments on the TNF see a landscape rich in ‘browse’ that cattle can eat: shrubs like jojoba and ceanothus and beans from mesquite trees. One explained that his allotment is not a ‘grass ranch’, it is a ‘browse ranch’. And ‘the beauty of a browse ranch is it can take a

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drought and survive'. A fourth-generation rancher described his allotment as 'the best watered ranch in the State of Arizona', because he knows the location of myriad live-stock water sources he spent his youth developing. Another, third-generation rancher explained that with these water developments, 'We're not dependent on rainfall ... Because as long as you've got water you can survive. [In] Gila County, [the cattle] go to the browse and they can make a living.' A District Ranger who has been on the TNF for 25 years explained that he could not see:

all the different browse that they utilize until I got into this job, and it was pretty amazing. And not all cows know that. You bring cows from somewhere else, another state or whatever, and they'd go hungry 'cause they don't know what they can eat.

These excerpts are from interviews conducted for a project to improve drought planning for livestock management on the TNF, but ranchers told us that the biggest challenge they face is not drought, but the Forest Service (FS). While they have learned how to live with drought, it is difficult for them to live with the unpredictability of federal management.

In the U.S.A., more than half of the territory of the 11 contiguous western states is public land managed for sustainable multiple-use by two federal land management agencies, the U.S. FS and the Bureau of Land Management (BLM). These agencies are mandated to manage for livestock grazing and also subject to federal environmental legislation such as the 1969 National Environmental Policy Act (NEPA) and the 1973 Endangered Species Act (ESA). Livestock grazing has been an extensive natural resource use on these lands since nineteenth-century Euro-American settlers turned to stockraising as a livelihood strategy after finding U.S. territory west of the 100th meridian too dry for farming (Starrs 1998), and ranching remains significant to the economy and culture of rural communities in the West. Today, the management decisions of those with permits to graze the public lands are subject to agency regulations and policy, while agency decisions are subject to environmental impact analysis and public scrutiny as mandated by NEPA. A Range Staff on the TNF sees a landscape that is a great challenge to manage because:

trying to comply with all the laws and regulations. And that's dealing with endangered species, that's through the NEPA process, there's so much monitoring we're supposed to do to determine what our course of action is and whether we are moving towards desired conditions. We do not have the funding or the personnel to actually accomplish those tasks. And so even though the tasks themselves and the laws and regulations are there for a reason, we just don't have the personnel to actually accomplish the monitoring and tasks needed.

Additionally, in recent decades, livestock grazing on public lands has become extremely controversial. The environmental impact of livestock grazing on the arid to semi-arid Western rangelands has long been debated. However, in the 1990s, a campaign to eliminate all livestock grazing from the public lands emerged among environmentalist groups, initially in the Southwest (Brugger 2009; Stauder 2015). Anti-grazing advocates see these landscapes differently than the ranchers who graze them or the agency personnel who manage them. They see a landscape denuded by livestock grazing, in poor ecological health, with reduced biodiversity, water, and soil quality and accelerated

desertification, which supports a system of ‘welfare’ for public land ranchers (Donohue 1999; Wuerthner & Matteson 2002; Forest Guardians 2004). Anti-grazing environmental organisations have used the legal processes made available by environmental legislation such as NEPA and the ESA to influence federal land management agency decisions regarding grazing.

Each of these groups experiences and understands the reality of the public rangelands differently. Each can point to personal experiences, scientific evidence, federal legislation, and cultural and ethical values that support their version of reality. And each is also confronted with the challenge of negotiating the worlds of the others in their everyday practices. The struggle over whose version of reality is correct is ongoing, passionate, and seems intractable.

Anthropologists and other social scientists have analysed conflicts over natural resources on U.S. public lands primarily through the lenses of political ecology and political economy (Sheridan 2001; McCarthy 2002; Sayre 2002; Brogden & Greenberg 2003; Walker 2003), the politics of identity (Satterfield 2002; Kosek 2006), and more recently, Actor Network Theory (ANT, Stevens 2007). These approaches propose that what is at stake in the conflicts is different perspectives on nature, moral economies, or values, or disagreement about scientific facts, while assuming a singular reality. The persistence of these conflicts, the passionate insistence of antagonists on their version of reality, and the development of an ‘ontological turn’ in anthropology suggest that we might gain insight into the conflict over public lands grazing by approaching it as an ‘ontological conflict’: one that involves ‘the continuous enactment, stabilization, and protection of different and asymmetrically entangled ontologies or worlds’ (Blaser 2009: 11).

This article is based on research conducted by an interdisciplinary team from the University of Arizona which included range (McClaran) and livestock (Sprinkle) scientists, a climatologist, and an anthropologist (Brugger). Our research methods included historical research, surveys, and in-depth interviews with project participants, and participant observation in a series of workshops held between 2013 and 2016. Our analysis incorporates knowledge from climate, range, and livestock science and many years of team members’ experience with conflicts over public land grazing.

‘Translation’ and ‘Storytelling’ in a Relational Ontology

There has been much debate about the significance of the ‘ontological turn’ in anthropology (e.g. Carrithers *et al.* 2010; Holbraad & Pederson 2014; Hazarika 2016). It can be seen as anthropology’s attempt to move beyond analyses based on modernist ontology, which is built on the divide between culture and a singular, existing nature/reality, generates hierarchical binaries, such as human–nonhuman, us–them, and objective knowledge/science–other ways of knowing, and aspires to a universal globality (Escobar 2010; Blaser 2010, 2013, 2016; Hazarika 2016). Translation in modernist ontology is an epistemological process which serves to reproduce hierarchies by translating differences into valid representations of the singular reality, ranked according to how close they come to getting it right, based on modern knowledge (Blaser 2013). By privileging

ontology over epistemology, the ontological turn seeks to consider worlds, politics, and globalities premised on other principles.

One strand of the ontological turn draws on posthumanism and ANT to propose an ontology in which reality emerges from a heterogeneous assemblage/network of human and nonhuman agentive entities, and the dynamic relations among entities are more fundamental in conceptualising how reality is constituted than the entities themselves (Blaser 2014, 2016; Di Giminiani and Haines 2018). In this strand, translation, drawing on the sense of 'to move from one place to another', is an ontological process of recruiting entities into the network by creating these relationships (Callon 1986; Latour 1987, 1999; Stevens 2007; Blaser 2010). Richardson & Weszkalnys (2014) suggest the ontological turn in natural resource anthropology can help 'interrogate the logics that perpetuate natural resource exploitation' (2014: 6) and that studying natural resource making ethnographically can contribute to cross-disciplinary debates about how to achieve more sustainable management. We, thus, seek to gain deeper insight into the dynamics of the conflict over public lands grazing (beyond ranchers versus federal land management agencies versus environmentalists) by considering which human and nonhuman actors might be connected in a public lands grazing network and the nature of the relationships among them and to consider what politics and sustainable management mean in the context of heterogeneous networks that overflow the stable categorisations of modernity (Blaser 2014).

A second strand of the ontological turn emerged from the convergence of political ecology and studies of the relational ontologies of indigenous peoples in Latin America (Escobar 2010; Blaser 2013; Di Giminiani and Haines 2018). It begins from the premise that multiple worlds/ontologies exist and seeks to understand difference on its own terms and to provide a glimpse of the conditions of possibility for the emergence of other, 'nonmodern' globalities. This strand has shed light on natural resource conflicts involving indigenous peoples; in this article, we explore its potential in a 'modern' setting (although Bruno Latour 1993 reminds us we have never been modern). Similarly, political ecology was initially developed and used in 'Third World' settings before its value in 'First World' settings was recognised (McCarthy 2002; Walker 2003). With respect to conflict over public lands grazing, this approach has the potential to help antagonists better understand each other's worlds and to find ways to transcend solutions based on the 'best available science', the existence of a 'common world' all can agree on, or 'reasonable politics' based on whose perspective on reality is most correct (Blaser 2016).

Using the concepts of 'relational ontology', 'translation', 'imagination', and 'storytelling' developed by Blaser (2010), and adding a visual component, we bring together historical and ethnographic material from the TNF to show how multiple imaginations of the public rangelands have emerged and taken on or lost reality over time through different and often conflictive translations of the relationships among entities in a network that includes humans (cattle ranchers, FS personnel, environmental organisations, recreationists, researchers); nonhumans (climate, plants, cattle, ecosystem processes); discursive and social structures (government, ideas of governance, science,

public perceptions), and social forces (imperialism, capitalism, population growth, market forces, globalisation).

Blaser's (2010) relational ontology combines the two strands of the ontological turn to conceptualise how different realities can coexist. It begins from the assumption of an interconnected, ever-changing network of human and nonhuman entities and proposes that 'translation' is an ontological process of making reality by giving meaning to the connections among them. Blaser provides a diagram that distinguishes between translation in a modernist versus a relational ontology (2010: 151). **Figure 1** shows a modified version. The left side illustrates translation in a modernist ontology as a mechanism for establishing equivalence between different cultural representations (A, B, C, A') of an assumed singular existing reality. Which are considered accurate depends on the power to enforce knowledge claims (Callon 1986; Blaser 2010). A is considered an accurate representation because it is authorised by modern knowledge. B and C are also considered accurate because they can be translated into terms consistent with A, whereas A' cannot be translated and must be marginalised to maintain the consistency of A. This is translation as the modernist knowledge production practice first presupposed and later critiqued by sociocultural anthropology (Asad 1986; Ingold 1993; Hanks & Severi 2014; Gal 2015).

The right side of **Figure 1** shows translation in a relational ontology, drawing on concepts from ANT. ANT proposes that scientific facts are produced and stabilised by

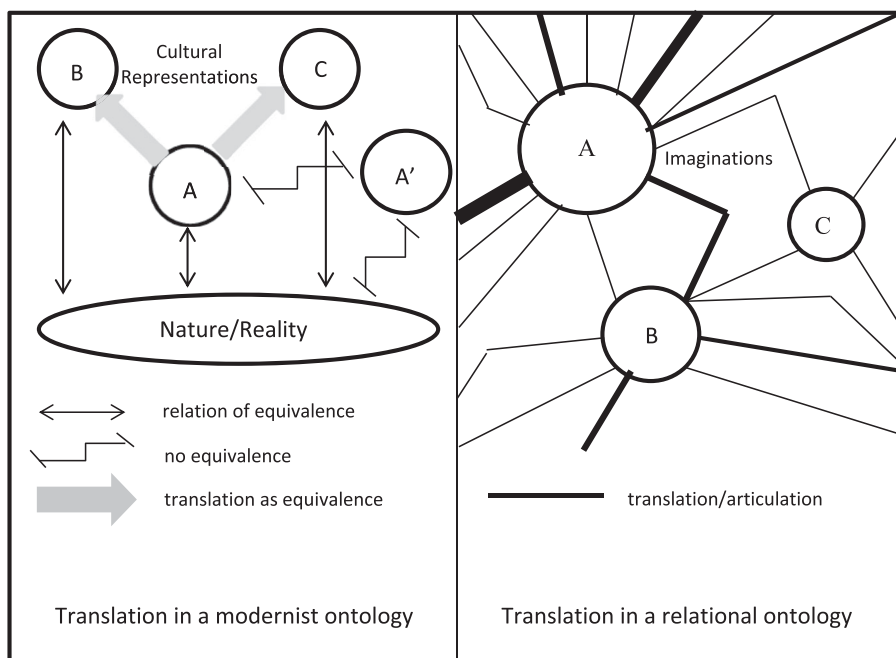


Figure 1. The two versions of translation (adapted from Blaser 2010: Figures 1 and 2, 150–151).

creating and maintaining a network of relationships among human and nonhuman entities which all have agency in the process ('actants'). In ANT, translation is the process of recruiting entities into the network by creating those relationships (Callon 1986; Latour 1987, 1999; Stevens 2007). A sufficient number of relevant entities linked into a stable association form a 'knot' and the relationships among entities in such a chain collectively produce meaning, which is stabilised as references to these relationships circulate through the chain. A knot that remains stable over time creates a fact (or 'factish' to indicate that 'what exists' is the ongoing effect of processes on translation). Facts have 'historicity': that is, the existing relationships that form them help shape facts created in the future. Both humans and nonhumans are capable of translation, although only humans are endowed with intentionality and pursue interests (Richardson & Weszkalnys 2014; Müller 2015). The agency of some nonhumans is made intelligible through humans who act as their spokespersons (Latour 2005). In our study, ranchers, rangeland scientists, and environmentalists all act as spokespersons for the needs and limits of rangeland forage species, however, they offer different translations. While ANT is often critiqued for neglecting the effects of power, Callon (1986) emphasises that translation is inherently a power struggle and its outcome indeterminate. For example, different actors may translate entities in different ways to construct conflicting facts. Or actors may attempt translations that assign roles to entities and enlist their support in enacting these roles, but their translations may fail because the entities refuse the roles assigned to them.

In Blaser's relational ontology (Figure 1, right side), 'translation' is the process of struggling and negotiating to create 'articulations' or mutual accommodation between the interconnected entities in the network (ANT's 'chains of entities'), in such a way that they become entangled in a mutually reinforcing exchange of meaning or 'vital energy' (ANT's 'circulating reference', Blaser 2010: 32) and 'imaginations' (ANT's 'knots') emerge. The degree of reality ('fact'-ness) that an imagination may acquire depends on the number and stability of the articulations that constitute it and on how the vital energy that these relations generate circulates in the subnetwork that they form. The stability of the circulations that sustain imaginations is fragile in the face of intended or unintended contestations and continued successful translations are needed to produce and sustain them. In the right side of Figure 1, A, B, and C are 'imaginations' emerging from translations that created articulations (denoted by lines connected to A, B, and C) among the interconnected entities in the network and circulate vital energy among this subnetwork. A is more real than B or C because it has more and more energetic articulations (denoted by thicker lines).

Blaser's 'storytelling' is a 'nonmodern' knowledge production practice that traces the interconnections between entities. Rather than seeking to put forward an accurate representation of reality, it seeks to intervene in the making of reality by tracing the processes of translation through which reality is made. Using this approach, Blaser (2010) traces the transformation of three imaginations that mark the ongoing shift from modernity to globality: from Indians, Nature, Progress to Indigenous Peoples, Environment, Risk, suggesting that 'storytelling globalization' can disrupt dominant narratives of globalisation and provide a glimpse of 'the intramodern conditions of possibility for the

emergence of new and newly visible stories of the significance of the present moment' in terms of globalisation (2010: 8).

For our 'storytelling' of a public lands grazing conflict, we were attracted to the possibilities that the diagram on the right side of [Figure 1](#) offered for visually illustrating the complexity and dynamics by which multiple imaginations of the public rangelands have emerged and taken on or lost reality over time. We use the schematic on the right side of [Figure 1](#) to illustrate the public rangelands network, represent entities in the network with images, and the articulations among them with single or bi-directional arrows indicating which entity is acting on the other. To illustrate how different imaginations take on or lose reality over time, we use figures that show the state of the public rangelands network at successive points in time ([Figures 2–4](#)). As a new entity becomes part of the network, we introduce it in the text in italics followed by a description of the image that represents it in square brackets. In each figure, there are two images in the centre outlined in black which represent two different imaginations of the public rangelands. Imagination A on the left is a world in which the public rangelands are not a resource that can support livestock grazing; Imagination B on the right is a world in which they are. To simplify the figures, we focus on only two imaginations, but others can also emerge (we mention one below). The relative size of the images indicates their relative reality.

We begin with an abbreviated genealogy that tells how two imaginations of the public rangelands began to emerge in the late nineteenth century and brings us to the state of the public rangelands network circa 1960. We continue with snapshots of the network in 2000 and 2015, years chosen to show significant changes that had occurred. In the following sections, we describe the network at these successive points in time and trace the processes of translation that have led to this state of the network and the relative reality of Imagination A or B.

Our 'storytelling' also shows how the making of natural resources on public lands is closely tied to the making of the U.S. federal government. Drawing on Foucault (1991, 2007, 2008), we argue that imaginations of public lands grazing reflect shifts in how rule is exercised and legitimated by the modern state and the new forms of governmentality and conceptions of citizenship that have arisen during this shift. Finally, we suggest that this approach can be used to disrupt the dominant modernist narrative of natural resource management which relies on top-down, expert-led approaches that critics claim have led to many failures (Blackmore 2007; Armitage *et al.* 2008; Muro & Jeffrey 2008), and to point the way towards more sustainable natural resource management.

The Public Rangelands Network Emerges

What we refer to as 'the public rangelands' are primarily located west of the 100th meridian where the *climate* [[Figure 2, image of climate zones of the U.S.](#)] is too dry for non-irrigated farming and precipitation is highly variable. This territory began to acquire reality for Euro-Americans subsequent to its acquisition by the U.S. federal government [[Figure 2, great seal of the United States](#)] in the 1803 Louisiana Purchase. 'Public domain' is the name given to territory acquired by the federal government through

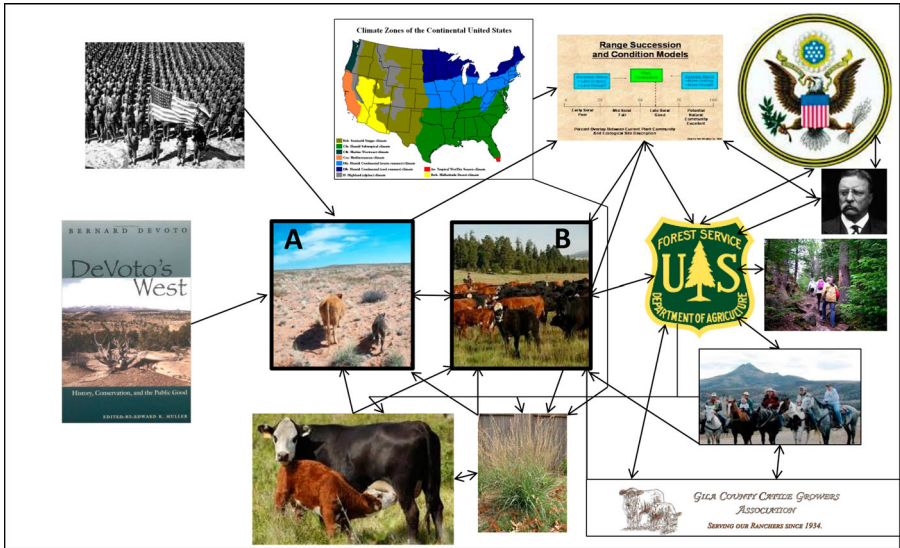


Figure 2. The network circa 1960.

cession by the original 13 colonies when it was created in 1781, or subsequently from foreign powers or native peoples. Although native peoples inhabited this territory, Euro-American settlers saw it as ‘vacant’ because the former’s view could not be translated in a way that was consistent their understanding of land as private property. To establish control over this territory, the new federal government immediately began passing a series of laws designed to encourage settlement of the public domain lands by providing for their orderly conversion to private ownership. Brugger (2009, 2014) argues that the young federal government was initially operating according to what French philosopher/historian Michel Foucault (2007) referred to as the principle of sovereignty, which seeks to impose sovereign control over a territory and a collection of subjects within it and is expressed in laws. The laws passed by Congress were informed by an imagination of a nation of small farmers, based on the Eastern experience. For example, the 1862 Homestead Act specified an amount of land Eastern legislators believed workable by a single family: 160 acres. Territory west of the 100th meridian was initially seen as ‘desert’ (Brugger 2009; Sayre 2017), until early settlers discovered its ability to produce abundant forage for livestock [Figure 2, image of cow and calf]. Typically, they homesteaded 160 acres near water, ran their livestock on the surrounding unregulated public domain land, and were unacquainted with the characteristics of vegetation in an arid to a semi-arid climate where precipitation was highly variable. This set up the conditions for what Garrett Hardin (1968) called a ‘tragedy of the commons’, but is today understood as a ‘tragedy of open access’, that played out over different timeframes throughout the arid West (Sayre 1999; Stevens 2007; Brugger 2009; Stauder 2015).

As reports of the initial success of early settlers articulated with western migrants' desire to own land and the federal government's efforts to establish control over its Western territory, Imagination B began to emerge. After the Civil War, it increasingly drew migrants and speculative capital from the Eastern U.S. and Great Britain westward, the latter providing abundant credit for them to expand livestock herds quickly (Sayre 1999, 2017). When the federal government began to renew interest in the remote and arid Arizona Territory, soldiers and other explorers brought back accounts of perennial grasses [Figure 2, image of *sideoats grama* grass] that grew stirrup high, creeks that were lined with trees from bank to bank, and what appeared to be an ideal climate (Croxen 1926). To further its sovereign imperative, the federal government's policy was to subdue hostile Indian tribes and remove them to reservations, which provided more vital energy to Imagination B, attracting more settlers to Arizona Territory. The federal government also supported the building of railroads, bringing still more settlers, providing access to distant markets, and making vast amounts of land available for purchase by 'cattle barons' who stocked them with huge herds (Abruzzi 1995). The lure of 'free land, free grass, free water, and nearly free cattle' (Sayre 1999: 251) and 'the international scale and invariable demands of capital flowing into the region' (Sayre 2017: 7) fuelled a 'cattle boom' in the Southwest. While there were less than 40,000 cattle in Arizona Territory in 1870, 21 years later there were over a million and a half (Sheridan 1995).

By 1891, most of the grass was short or had been replaced by annuals and shrubs, the ground was trampled hard, gullies had started forming, and the creeks were little more than gravel bars. In the Tonto region, the cattlemen themselves were among the first to notice and warn against overstocking (Ellison 1968; Sayre 1999). Imagination B was based on a mistranslation of the relationships between climate, the native vegetation, and livestock. Under the constant, heavy livestock grazing demanded by capital, the native vegetation refused to play the role assigned to it. As this translation unravelled, Imagination A began to emerge. When severe drought occurred, a regular but unpredictable actor in Southwest rangelands, it translated the overstocked, deteriorating rangelands into ecological collapse and the decimation of cattle herds, and increased the reality of Imagination A.

In this section, 'storytelling' offers insight into how Imagination B emerged as a result of articulations among disparate entities – the sovereign imperative of the federal government expressed in its policies of disposal of the public domain, Indian removal, and support for railroad-building; the pull of Euro-Americans' imagination of the frontier (Farragher 1994); the abundant native grasses; the mild climate and the success of early settlers – rather than being an already existing reality that was unknown until 'discovered' by Euro-Americans. It also brings into focus how contingent events and translations at different physical and temporal scales articulated to give Imagination A reality. The federal government's drive for sovereignty which existed at national and century scales contributed to the emergence of Imagination B at a national scale which attracted more settlers; then the co-occurrence of the availability of 'free grass' on the unregulated public domain which had existed at a regional scale and millennial scale, capital from British imperialism which existed at an

international and multi-century scale, and settlers' lack of experience with the climate at individual and decadal scales, translated into a tremendous increase in livestock numbers at a regional and decadal scale. When the native vegetation refused the role of unlimited resource assigned to it in Imagination B, the interconnections between climate, vegetation, and livestock numbers at the regional scale began to translate into deteriorating range conditions, and Imagination A began to emerge. Severe drought at a regional and multi-year scale translated deterioration into ecological collapse and a transformation of the landscape that was visually unmistakable and widely decried at the national level, and Imagination A surged into reality. Absent any of these interconnections – for example, the influx of capital at the time when settlers were still inexperienced – would Imagination A have become real?

The Network Circa 1960

By the end of the nineteenth century, Imagination A increasingly gained reality as it articulated with rising concern over deforestation and water supplies. By this time, most areas of the West had been settled and the region had achieved a population density of more than two people per square mile, which prompted the Census Bureau to declare the frontier officially closed in 1890. The federal government's drive for sovereignty and its contribution of vital energy to Imagination B diminished. No longer 'vacant', the public domain came to be seen as possessing 'resources', which were threatened by uncontrolled development and unruly citizens, and the federal government began to take on the role of managing both. A different imagination of the federal government began to emerge as the mode of rule shifted to what Foucault (2007) calls 'security'. Security seeks to ensure 'the welfare of the population' by managing the relations between 'men and things', including 'the territory with its specific qualities, climate, irrigation, fertility, etc.', so that the nation prospers (Foucault 1991: 93). Security governs through discipline, which is exercised on the bodies of individuals and operates through power relations that are diffused throughout society, embedded in processes of spatial arrangement, surveillance, ordering, and normalisation, and produces both the distinctive institutions of modern nation states, such as schools, factories, and bureaucracies, and docile subjects.

The passage of the 1891 General Land Law Revision Act, which authorised the president to set aside forest reserves from the unreserved public domain lands, was a harbinger of this shift. Other such laws followed. Land withdrawn in these ways became known as the public lands rather than the public domain, and soon necessitated the creation of bureaucracies, such as the U.S. FS [*Figure 2, Forest Service emblem*] in 1905, to manage them. *Progressive ideology* [*Figure 2, image of Teddy Roosevelt*] arose during the same period, articulating with and serving to legitimise this mode of rule. It promoted rational and scientific management of resources in order to, in the words of Gifford Pinchot, the first chief of the FS, provide 'the greatest good for the greatest number' (Hays 1999).

Imagination A articulated with the principle of rule of security, Progressive ideology, and the bureaucratic need for standardisation to give rise to *rangeland science* [*Figure 2,*

diagram of Range Succession Model]. The latter emerged through the attempts of agency scientists to develop, through controlled experimentation, general principles for rangeland management that could be applied throughout the nation and provide scientific authority for federal land management agency policies (Briske *et al.* 2011; Sayre *et al.* 2012). The expectation that the federal land management agencies could revitalise and protect forage resources on the public rangelands through scientific management began to revitalise Imagination B. The FS as manager of rangelands challenged the power of local ranchers and the place-based practices they had developed, and many contested the translations of this new entity in the public rangelands network (Rowley 1985; Stauder 2015). The critique that policies developed elsewhere should not be applied on their ranch is one that ranchers still repeat today.

Rangeland science coalesced around the Range Succession Model, derived from a theory of plant succession developed by Frederick Clements early in the twentieth century (Briske *et al.* 2011; Sayre *et al.* 2012). Clementsian theory assumed that plant communities were in equilibrium with static soil and climate conditions unless disturbed by exogenous drivers, such as livestock grazing. When a disturbance was removed, plant communities would resume a predictable progression to recovery to their pre-disturbed condition. This theory and its associated methods of vegetation measurement made it possible to calculate forage values and stocking rates based on the assumption that results obtained at the scale of experimental plots translated linearly to larger scales and could be averaged over time and extrapolated into the future. This translation of the relationship between climate, vegetation, and livestock grazing gave the agencies a clear goal which relied on the premise that proper grazing management could restore rangelands to their pre-settlement condition. It articulated with the subnetwork described in the previous paragraph to contribute new vital energy to the reality of Imagination B, albeit with a new meaning: the public rangelands are a resource that can support livestock grazing if properly managed using rangeland science.

However, new entities in the network contributed to the continuing reality of Imagination A. Even with greatly reduced livestock numbers and new management techniques, the public rangelands were slow to recover, refusing the role that rangeland science envisioned for them. In addition, around mid-century *public perceptions* [Figure 2, *image of the book DeVoto's West*] began to play a role in making the reality of public land livestock grazing. In the late 1940s, Western historian Bernard DeVoto published a series of articles on public land livestock grazing in *Harper's Magazine* that depicted the West's degraded rangelands as proof of ranchers' greed and power (DeVoto 2000). These articles had a powerful impact on Easterners' imagination of the public rangelands and still echo in the rhetoric of anti-grazing environmental organisations today.

Imagination B experienced setbacks on the ground during *World Wars I and II* [Figure 2, *image of soldiers at attention*] when the federal government directed the FS to increase stocking rates to supply meat and wool for the war effort (Rowley 1985). With the economic and demographic shifts that took place after World War II, *recreation* [Figure 2, *image of hikers*] became an increasingly significant use of the public lands and a new entity in the network. The Multiple-Use Sustained-Yield Act of 1960 ensured that the 'multiple uses' of national forests would be treated equally and would include

timber, wildlife, range, water, and outdoor recreation in combinations that would best meet and serve the needs of the American public. As ‘new’ resources emerged on the public lands and came to vie with existing timber and forage resources, how the agencies decided the ‘best’ combination was often determined by which of the spokespersons claiming to represent the needs and limitations of each resource wielded the most power.

Focusing on the public rangelands network in the Southwest, the TNF was created in 1905 to protect the watersheds of the Salt and Verde Rivers. Range conditions slowly improved on the Tonto under FS management (Arnold 1944; Alford 1993) and Imagination B became more real. *Local ranchers* [Figure 2, image of ranchers on horseback], many of whom were (and still are) descendants of original Euro-American settlers in the region, strongly identify with their pioneer heritage and the frontier values of independence and self-sufficiency. In this way, the frontier continues to contribute vital energy to Imagination B long after it was officially declared closed. Over generations, these ranchers have gained experience and knowledge of their particular ranches and manage them to be productive for their descendants, which also adds vitality to the sub-network supporting Imagination B. In the face of federal regulation of public lands grazing, local ranchers formed the *Gila County Cattle Growers Association* [Figure 2, GCCGA logo] in 1934 to represent their interests, and began to take a role in creating and maintaining relationships and articulations that would sustain the reality of Imagination B in the region: for example, with local and national elected officials. In Figure 2, Imaginations A and B are equally real. Imagination B has been revitalised since 1900, but Imagination A retains reality due to the public rangelands’ refusal to respond to rangeland science and the emergence of new entities in the network.

The ‘storytelling’ in this section illustrates the historicity of imaginations and provides insight into why seemingly outdated perceptions of reality persist. ‘Storytelling’ also illuminates how imaginations and entities in the public rangelands network change over time. As an imagination takes on reality, it can alter articulations among the entities in the subnetwork producing it and even the entities themselves. For example, the increasing reality of Imagination A altered the federal government’s relationship with the public rangelands and informed a shift in the mode of rule. The federal government in the network circa 1960 is not the same entity it was in 1900. Nor is Imagination B of the public rangelands the same because the ‘new’ federal government and other new entities in the network are creating new articulations that contribute to its reality. We see that entities in a network are never static; they are always changing as they act and are acted on by other entities.

The Network Circa 2000

The network changed significantly with the advent of the environmental movement in the U.S. in the 1960s and legislation that provided environmental organisations with a legal framework they could use to pursue their objectives through litigation and articulated with the principle of security as the mode of rule (Figure 3). Beginning in the 1990s, some environmental organisations launched a campaign to eliminate livestock

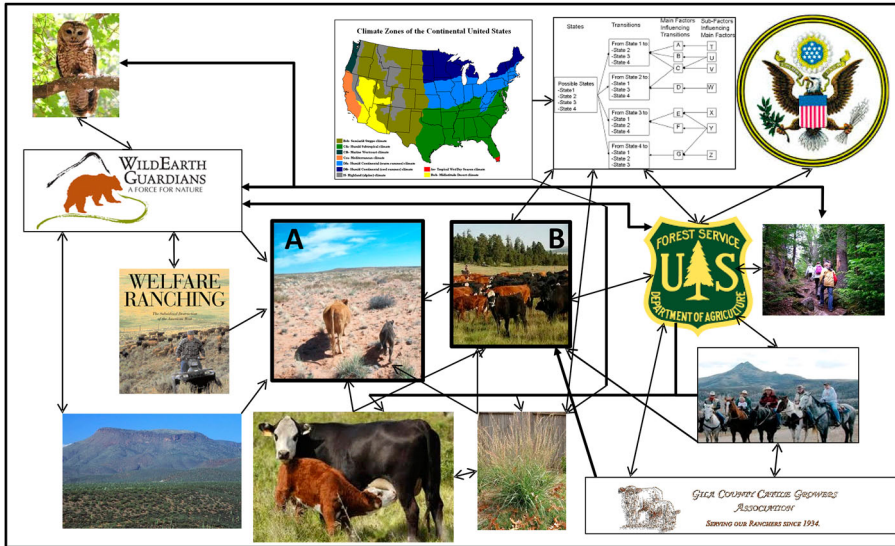


Figure 3. The network circa 2000.

grazing on the public lands, *anti-grazing campaign* [Figure 3, WildEarth Guardians logo]. Their translations revitalised Imagination A by recalling the ecological disaster that occurred at the turn of the nineteenth century, drawing on the Range Succession model to claim that the public rangelands could fully recover if livestock were removed, ‘cherrypicking’ scientific studies that supported their claims, appealing to a national audience unfamiliar with the arid landscapes of the public rangelands, and creating other reinforcing articulations. Some examples of the latter are: representing public land ranchers in a negative light, for example, as ‘Welfare Ranchers’ [Figure 3, image of book by Wuerthner & Matteson 2002]; representing public land ranching as economically unviable; using the presence of *endangered species* [Figure 3, image of Mexican spotted owl], to force reduction or elimination of grazing in areas that provided habitat for these species. An example of ‘cherrypicking’ is a study done on the TNF which contrasted an area inaccessible to cattle on *Dutchwoman Butte* [Figure 3, image lower left] with a nearby grazed area (Ambos *et al.* 2000). The study showed that the ungrazed area had greater grass species diversity and canopy cover of grasses and herbaceous forage species, which the author translated as evidence of the negative impacts of livestock grazing. The translations of anti-grazing environmental organisations also articulate with the desire of recreationists to avoid evidence of livestock grazing when recreating on the public lands. They also serve to justify their existence as defenders of the public rangelands and to create a concerned public who support them financially.

However, anti-grazing advocates’ view that livestock grazing is damaging public rangelands and their condition will improve when it is removed ignores developments in

rangeland science since the 1980s (Brugger 2009; Sayre *et al.* 2012; Sayre 2017). The inability of the Clementsian paradigm to account for observed vegetation dynamics led to the development of a new, non-equilibrium paradigm in rangeland science and the state-and-transition model [Figure 3, diagram of *State-and-Transition model*]. In this model, the extreme variability of arid and semi-arid rangelands is recognised, more than one stable state of vegetation composition can exist, and disturbances can cause transitions between them. Reversing changes is not a simple matter of removing or reducing disturbance, but may require active management. It has been suggested that federal agency management based on Clementsian rangeland science is the reason that western rangelands are not more productive today (Sayre *et al.* 2012). So instead of making Imagination B more real, the agencies might actually have been realising Imagination A. Rangeland science is not the same entity it was in the network circa 1960: it can no longer provide a general set of principles and a singular goal for managing rangelands and comfortably articulate with security as the federal government's mode of rule. It also changed the meaning of Imagination B because rangeland science alone cannot determine the best way to manage the public rangelands. To realise Imagination B, rangeland managers began to turn to 'adaptive management', an iterative 'learning by doing' approach to improving resource management based on developing goals and management actions designed to attain them, monitoring the outcomes, and adapting management actions and goals based on outcomes (Sayre *et al.* 2012).

Despite ongoing developments in rangeland science, by 2000, the success of the translations of anti-grazing environmental organisations had strengthened the reality of Imagination A over Imagination B (Figure 3). Meanwhile, ranchers, cattle grower associations, and federal land management agencies continued to contest the translations of anti-grazing organisations and work to realise Imagination B. Each of these groups has altered their practices to try to avoid litigation and negative representations.

Both Imaginations A and B envision a role for the federal government in managing the public rangelands. However, another imagination of these lands has emerged since 1976, when Congress finally declared in the Federal Land Policy and Management Act (FLPMA) that the remaining public domain lands would be retained in federal ownership and officially ended the policy of disposal. In this imagination, the federal government is not a legitimate actor. The passage of FLPMA touched off the 'Sagebrush Rebellion', an attempt among state and county governments and rural citizens in the West to take back local control of the public lands. The 2014 standoff at the Bundy ranch in Nevada, when BLM officials attempted to impound the cattle of rancher Cliven Bundy who had refused to pay his federal grazing fees for over 20 years, and the 2015 occupation of the Malheur National Wildlife Refuge in Oregon by armed anti-government militants who included two of Bundy's sons, are recent attempts to create new articulations that will infuse energy into that alternate imagination.

The 'storytelling' in this section provides insight into how the emergence of a new entity in the public rangelands network created multiple and reinforcing articulations among translations that were powerful enough to destabilise the those creating Imagination B. The translations of anti-grazing advocates succeeded, despite greatly improved

conditions on the public rangelands over the past century and a new paradigm in rangeland science, because they built on the historicity of Imagination A and the intuitive appeal of Clementsian rangeland science and created many additional reinforcing articulations. These included the legal framework provided by NEPA and the ESA; the economics of public land ranching; widespread support for the environmental movement; urbanisation and the increasing disconnect of the American public with agriculture; and increasing recreation use of the public lands. Representing ‘storytelling’ visually also encouraged thinking about the impact of powerful entities on the practices of those less powerful. For example, we initially drew a one-way arrow from the anti-grazing organisations to ranchers to represent the former’s negative representations acting on the latter. Then we recalled the ways in which ranchers had responded: by representing themselves as ‘the real environmentalists’ or ‘stewards of the land’ and by highlighting the positive environmental impact of their practices. Research also shows that ranchers value the lifestyle ranching affords more than its economic return (Gentner & Tanaka 2002). These practices and values disrupt the anti-grazing organisations’ translation, suggesting the arrow should be a two-way arrow.

The Network Circa 2015

In this section, we draw on our current research on the TNF to illustrate the micropolitics involved in processes of translation and consider the reality of Imaginations A and B today (Figure 4). Some translations described in this and the previous section both

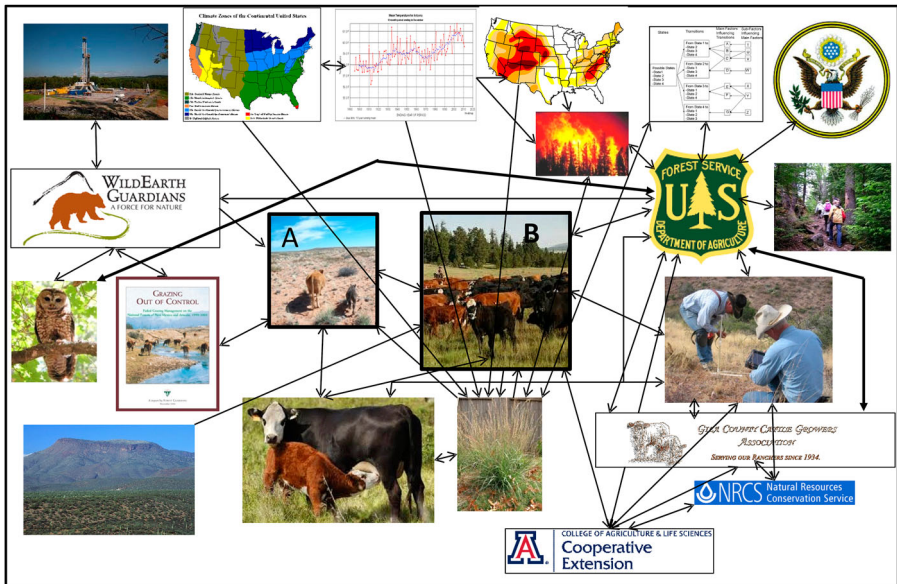


Figure 4. The network circa 2015.

contribute to and reflect another shift in the mode of rule of the American State, from security to neoliberal governmentality (Brugger 2014). According to Foucault (2007, 2008), neoliberal governmentality is a form of security in which state power is limited by the principles of a market economy, emphasis is placed on sustaining economic growth, and individuals are free to pursue their own welfare by exercising their entrepreneurial abilities. Translations in the public rangelands network that illustrate this shift include economic arguments that represent public land ranching as economically unviable and identify more valuable use of the public rangelands: tourism and recreation, conservation, and energy development; defunding federal land management agencies; shifting funding from the FS Range programme to programmes that generate more income, such as recreation, or battle threats to security, such as fire; and devolving rangeland monitoring to consultants or private individuals. The federal government in the public rangelands network circa 2015 has both shaped and been shaped by these translations.

In 2000, anti-grazing organisations increased their translation efforts in Region 3 National Forests (Arizona and New Mexico). They determined that the FS was out of compliance with many requirements of the ESA and filed a series of lawsuits across Forests to force compliance (Forest Guardians 2004, now WildEarth Guardians). This challenge to the articulations between the FS, the ESA, and livestock grazing had the potential to reduce or eliminate grazing on many allotments. The organisation won many of lawsuits, appealed adverse decisions, and won several of the appeals. They also circulated more energy into existing articulations with public perceptions. Between 1999 and 2008, 70 of Forest Guardians' 114 press releases (61%) had 'grazing' in the title or were related to these lawsuits. Their translation of the relationship between ranchers, cattle, and rangeland ecosystems was reflected and reinforced by the titles and cover photos of publications released during this period: for example, *Grazing Out of Control: Failed Grazing Management on the National Forests of New Mexico and Arizona, 1999–2003* (Forest Guardians 2004); *Western Wildlife Under Hoof: Public Lands Livestock Grazing Threatens Iconic Species* (Salvo 2009) and *Ponderosa Pine in Peril: Assessing Public Lands Livestock Grazing in Ponderosa Pine Forests* (Stade and Salvo 2009). Their media campaigns also portray the FS as irresponsible or ineffective in enforcing environmental laws. This concerted campaign injected a great amount of vital energy into the interconnections animating Imagination A in the Southwest.

Meanwhile, the embattled FS struggled to maintain the translations that realise Imagination B. On the one hand, environmental regulations articulate with the FS mandate to realise Imagination B; on the other, they make it more difficult to achieve because they impose a heavy burden on FS staff to analyse the environmental impacts of proposed agency actions. The litigation of anti-grazing organisations ties up FS personnel and resources and affects how they negotiate their work. FS personnel spend more time in the office fighting lawsuits and crafting NEPA documents that will decrease the potential for litigation and less time on the ground doing the work necessary to manage resources in compliance with environmental legislation. A TNF Range Staff explained the situation this way:

What ends up happening is, there's this extreme and this extreme. So you have the cattle ranchers over here and you have the environmentalists over here and you have the Forest Service in the middle. ... [speaking as if an environmentalist]: 'So you're in your office and you're not out monitoring and we're going to sue because you haven't monitored, but you can't monitor because you're inside answering our questions.' And so what they want, the best for the land, they're not getting because we're stuck behind a computer now, and maybe they see that. Maybe that's their goal is to keep filing lawsuits against us so we can't manage and then we have to pull cows off because we're not managing. I don't know.

Additionally, in recent decades, the FS has been hit by funding and staffing cuts and much of the funding it still has is used to fight wildfires, the frequency, extent, and severity of which have been increasing at a rapid rate in recent decades. A blog post by Secretary of Agriculture Tom Vilsack (2015) shows the shrinking FS staffing levels (from 18,000 dedicated to management and 6000 to fire in 1998, to 10,000 and 12,000, respectively, in 2015) and the increased percentage of the FS budget going to address wildfires (from 16% in 1995 to 48% in 2015). The articulation between reduced funding and increased fires subtracts vital energy from the subnetwork that realises Imagination B.

More recently, WildEarth Guardians has shifted its focus to issues more directly affecting the places people live and their daily lives. For example, while their 'Top Priorities' still include 'Grazing Permit Retirement', as of 30 September 2015, only 2 of their 87 press releases for 2015 were related to livestock grazing on public lands. The majority focused on other Top Priorities: Get the Frack Out, Keep it in the ground (coal), and Carnivore Protection. This shift reduces the vital energy animating Imagination A. It is also in keeping with Willow's (2015) argument that, while the prevailing 'topology' of North American mainstream environmentalism initially placed humans apart from and above the environment, the contemporary movement appears to be approaching a more inclusive vision that admits humans as an integral part of it. In addition, in 2011, the organisation arrived at an historic settlement with the U.S. Fish and Wildlife Service (USFWS), the agency responsible for enforcing the ESA. They agreed to limit legal action to get species listed as endangered for six years in order to free up the time and resources USFWS needed to actually do the work needed to list species (Arnold 2011). This, together with their shifting focus, suggests that, under less pressure from anti-grazing organisations, federal land management agencies may be able to supply more energy to realising Imagination B.

Climate change [Figure 4, graph of increasing average temperature in Arizona], a new entity in the network, complicates this prospect. The Southwest has already experienced warming of over 1°C since the middle of the twentieth century, and temperatures are projected to continue to increase up to 3–6°C by this century's end. Spokespersons for the climate say that a warming climate translates to more frequent, longer lasting, and warmer drought conditions in the Southwest, as well as to the dramatic increase in wildfires in the American West, noted above (Garfin *et al.* 2013). But it is impossible to predict the cumulative and evolving impact of the warming and drying in the Southwest on livestock forage species (Garfin *et al.* 2013). A warming climate poses new challenges for ranchers and FS to realise Imagination B.

In 2002, a nonhuman entity played an unexpected role in shifting the vital energy circulating in the subnetworks animating Imaginations A and B in the Tonto region. The worst drought since record-keeping began hit the region and the TNF Supervisor judged that continued grazing posed a threat to drought-stressed vegetation and made a blanket decision to remove all livestock from the TNF, regardless of the condition of individual allotments. This dealt a devastating blow to ranchers who had nowhere else to graze their livestock, could not afford to feed them hay, and would have to sell their herds when cattle prices were low during the drought. In addition, they lost the genetics and behaviour of their herds, which they had built up over generations to be best adapted to thriving on their particular landscape. In ranchers' translation of cattle, which is supported by extensive research, they are not simply creatures of instinct, but active learners who are taught what, where, and how to graze by their mothers (Provenza 2003). It would take ranchers decades to rebuild their herds and they would have to buy new stock when prices were high after drought. Because of the high spatial and seasonal variation of precipitation in the Southwest, even during a drought some allotments on the TNF had received enough to produce ample forage for their livestock. A group of ranchers contested the destocking order and eventually won. But most were forced to sell.

The GCCGA played a crucial role in how this event unfolded. Representatives of the GCCGA flew to Washington D.C. to confront FS leadership and protest the destocking. Subsequently, a meeting was held in Globe with the Chief of the FS, Dale Bosworth, and Tonto staff and permittees. Among the outcomes was a Memorandum of Understanding between the TNF and the GCCGA that recognised the need for ranchers to keep a 'core herd'. Additionally, the *Natural Resources Conservation Service* [Figure 4, logo of the NRCS], which provides funding for building infrastructure to support ranching on state, private, and tribal land, expanded their Environmental Quality Incentives Program to support projects on public land. The new programme was piloted on the Tonto NF in 2004. This made it possible for ranchers who had destocked to repair the infrastructure that had deteriorated while they were not ranching and to develop additional watering sites for their herds to better control where they graze.

According to a District Ranger, the strength of the GCCGA in the region is unique:

The Gila County Cattle Growers Association, and even the Arizona Cattle Growers Association, are just united in a very strong way and they have really determined that our policy and our practices are something that they are *going* to understand, they're going to learn, and then they're going to figure out how to fix it or work around it, or use it to get things done. And I don't see that anywhere else. That seems to be unique here.

The GCCGA's translations have been successful because it has the strong support of ranchers and has worked diligently to create and maintain articulations among other entities in the network: NRCS, the FS, and University of Arizona Cooperative Extension (UACE).

The 2002 drought acted as a 'crisis event', a period of abrupt change with the potential to instigate political support and buy-in for institutional change (Medema *et al.* 2014). The 'storytelling' approach illuminates how an entity that typically causes

hardship for ranchers by depleting forage and water for livestock grazing, unexpectedly empowered them. This crisis event drew new entities into the public rangelands network and generated a proliferation of new translations and articulations among them which have the potential to contribute to the reality of Imagination B. In 2015, many ranchers on the TNF were still recovering from the destocking, gradually restoring their herds, and working to get NEPA clearance for on-the-ground range improvements to prepare for the next major drought. But this event remains in their collective memory and in the institutional memory of the TNF as an event neither wants to see repeated and continues to circulate vital energy into Imagination B.

Another entity that has played a greater role in realising Imagination B since 2000 is UACE. It maintains a system of County Agents who reside in the counties and Specialists on campus who carry out the Cooperative Extension System's mission of 'taking knowledge gained through research and education and bringing it directly to the people to create positive changes' (<http://nifa.usda.gov/extension>). In 2001, Jim Sprinkle, then Area Cooperative Extension Agent for Animal Sciences in Gila County, responding to ranchers' and land management agency personnel's expressed needs for training in *rangeland monitoring* [Figure 4, *image of ranchers monitoring*] started the Reading the Range (RTR) programme. The programme's objectives were to provide training in range monitoring to ranchers and agency personnel, establish demonstration ranches with technical support, use the data to assist in management, and provide training for the NEPA process (Sprinkle 2015). Initially, there was some resistance to the programme from TNF staff, but in 2004, two staff members asked Sprinkle to compile RTR data to assist one of the above-mentioned lawsuits filed by Forest Guardians. The data contributed to the lawsuit being dropped and resistance faded. The RTR Program grew from less than 100,000 acres of ranches enrolled in the programme in 2001 to 1.5 million acres in 2014. It helps to promote Imagination B by articulating rancher and FS perceptions of range conditions with scientifically sound monitoring data. A rancher we interviewed explained how science has augmented his local knowledge and changed the way he sees the land:

I was actually the very first ranch that Jim Sprinkle started the range monitoring program on. So I have data collected for the last, I think, 13 years now. Monitoring brought to the forefront where your range conditions are the best and the worst. I mean it gave you a little more eye-opening fact of where your cattle actually congregate, what they use the most, and everything. ... I mean I kind of knew before just by range experience, but when we started monitoring we started seeing the difference. It didn't become so apparent to the eyes as it did by reading the grasses.

As part of RTR, between 2001 and 2005, Jim Sprinkle and others collected data at the Dutchwoman Butte site mentioned in the previous section. They compared it to a similar, closely located site on a ranch with a long-term management plan (Sprinkle *et al.* 2007). The timing of the research was such that it spanned the severe drought of 2002. Results showed that perennial grass abundance dropped precipitously on the ungrazed Dutchwoman Butte during the drought and was replaced by annuals, but to a much lesser extent on the nearby grazed site. Nor did the grasses recover as

much on Dutchwoman Butte as they did on the grazed site. The authors suggest that these results indicate that good range management may help vegetation recover from drought. This is a different translation of the relationship between climate, vegetation, and livestock than that offered by anti-grazing advocates' interpretation of previous research at Dutchwoman Butte, and supports Imagination B rather than Imagination A. It also articulates with recent critiques of rangeland science as it developed through controlled, small-scale experimentation without taking the human dimensions of management and policy into account (Briske *et al.* 2011; Sayre *et al.* 2012).

When ranchers and the FS collaborate in rangeland monitoring, it also contributes to building relationships that differ from the landlord-tenant or impersonal bureaucratic relationships that often prevail. Fernandez-Gimenez *et al.* (2008) argue that monitoring together builds cooperation, communication, and trust internally and gives credibility and legitimacy to the results externally. A FS employee we interviewed confirmed that this was the case with RTR: 'One of the things that I have seen since I came to the Tonto that I think is the most important going forward have been the relationships that I've seen built on the Reading the Range program.' He added that Jim Sprinkle's relationships with ranchers and the FS and his academic affiliation give 'credibility' to the data and motivate FS buy-in to RTR.

In this section, 'storytelling' illuminates the ways in which one entity can create multiple simultaneous translations that interfere with each other. For example, the federal government translates the FS as managing the public rangelands as a resource that can support livestock grazing. It has also reduced the funding that enables the agency to accomplish that at a time when wildfire claims a larger share of that funding. The first translation articulates with the principle of rule of security; the second with neoliberal governmentality. 'Storytelling' also shows how different natural resource realities are made by translating entities in different ways. Cows translated as instinctual and interchangeable consumers of grass can be removed by the FS. Translated as active learners and discerning consumers of a variety of forage plants, cows were able to contest the former translation. It became possible for the FS to imagine a 'core herd' that deserves protection and for cows to transform FS policy. 'Storytelling' at the local scale reveals the micro-processes of translation in which human entities in the public rangelands network engage: the intentional and interested everyday practices, negotiations, and relationship-building that create and maintain articulations and ongoing successful translations. Creating new relationships more, and more stable articulations among ranchers, rangeland scientists, the FS, GCCGA, NRCS, and UACE, who each have Imagination B as their goal, increases the potential for a mutually reinforcing exchange of energy among them that can contribute to its realisation. Our research project also aims to strengthen these relationships and to help ranchers and agencies co-develop the tools they need to improve drought planning, goals they themselves identified (Brugger *et al.* 2013). However, ongoing successful translations are needed to maintain the reality of Imagination B in a future where the severity of drought is expected to increase and it is impossible to predict the impacts that climate change will have on livestock forage species.

Conclusion

Blaser (2013) considers the question, are multiple worlds a fact or just a heuristic? Do ranchers, FS Range staff, environmentalists, and sagebrush rebels live in different worlds, or is it just good to think as if they did? Some anthropologists might say they live in different worlds because of the very different ways they engage with public rangelands (Ingold 2000). Ranchers are constantly out on the same piece of range, learning the nooks and crannies where cattle might hide, the runnels and hollows where water might flow and pool, and where and when different plants grow after it rains. They see variation in vegetation from year to year. They come to know the characteristics and habits of different animals in their herds. They need to perceive like cows and grass, but also like the FS. Anti-grazing environmentalists seldom live in the rural communities adjacent to public grazing lands. They experience the landscape and the livestock grazing it intermittently and their perception is shaped by what they think the landscape should look like. FS range personnel fall somewhere in between. Initially, their perception is shaped by the landscape they came from, the training they have received, and the demands of their position. As they remain in the same District, spend time on the landscape, and interact with ranchers, their perception begins to shift, and they learn to see what the ranchers see. At the same time, because they must contend with the legal challenges of anti-grazing advocates, it is influenced by what the latter see. Based on our experience approaching conflict over public lands grazing as an 'ontological conflict', our responses to these questions are we do not know, and yes.

We found that using both verbal and visual processes of 'storytelling' to explore the processes of translation through which different imaginations of public lands grazing emerge and persist, even as they interact, intermingle, contradict, and shape each other, compelled us to think in ways we were not accustomed to and generated insights that would otherwise not have emerged. In particular, 'storytelling' over time brought out the historicity of imaginations, the indeterminacies of processes of translation, and the dynamic potential inherent in a network, as entities emerge and change, translations succeed, shift, or fail, and vital energy circulating in one subnetwork unexpectedly transfers to another. Recognising contingency pushes us to consider 'worlds otherwise' if things had happened differently. 'Storytelling' over time also sheds light on the intractability the conflict over public lands grazing. In addition to the existence of multiple worlds, each successive snapshot of the network shows that the number of entities and the density of interconnections increases, thus increasing the amount of complexity and indeterminacy in processes of translation.

By concerning ourselves with translation as reality-making, we also resist privileging one perspective on reality over another because it is more 'correct' and avoid the modernist argument that the conflict could be resolved if only we had more and better science. With respect to rangeland science, Sayre (2017) argues that rangelands have so far eluded its attempts to model them because of their complexity, variability, and unpredictability, which are a result of interactions among ecological and human processes operating simultaneously at different physical and temporal scales. Although science is not able to settle many questions about rangelands, scientists' assessments

of rangelands, ‘when deployed through governments and international programs can have dramatic and disastrous effects for communities and landscapes’ (2017: 213), as happened when livestock were removed from the TNF in 2002.

Finally, our ‘storytelling’ suggests an approach to managing the public rangelands that takes the worlds of different actors seriously. Such an approach would acknowledge the multiplicity of entities in the public rangelands network, the agency of nonhumans, and the existence of multiple worlds. It would aim to engage as many of these entities as possible in a collaborative learning process (Blackmore 2007; Armitage *et al.* 2008; Muro & Jeffrey 2008) in which, rather than striving to discover a ‘common ground’, participants could use the visual ‘storytelling’ process described in this article to trace the translations that create their different worlds and to co-develop actions that are ‘homonymic’: that is, they address different worlds simultaneously (Blaser 2016: 565).

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