

MODELING THE HYPERREAL DIMENSION WITH THE GAP-BURDEN METHOD™: SOCIAL-ECOLOGICAL CHANGE IN THE LARAMIE RANGE, WYOMING AND THE ASYMMETRY OF TIME

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ABSTRACT: *Fieldwork in the Laramie Range, Wyoming demonstrated that state structure supports productivity within a discourse that perpetuates stable Wyoming environments. These notions are supported by neo-Hegelian interpretations of space and time, in which time is dominant, continuous and bears a heavy weight in space. Thus, the natural process that describes Wyoming's history describes a competitive economic space in which the change in the spatial organization from a real space to a rational space (settling the American Range) may be described as a struggle between history and hyperreality. Over time, this struggle within and with the Western Range, especially to meet production demands, took a heavy toll on the competitive sustainable ability of the social-ecology that may be examined in light of transgression-tensility and geopiety. Transgression-tensility describes the ecological function by which human-environmental change occurs according to natural selection as the cultural connection between nature and society, geopiety, is tested within a social-ecological context at the hyperreal scale in which global change occurs. This study examines the way in which this social-ecological narrative develops based on the integrity of these indicators and the way that changes in settlement pattern reflect the topography of time and the hyperreal dimension. The Gap-Burden Method™, introduced in this paper, may be used to monitor the battle for thresholds of regime change and expose temporal asymmetry through the use of geopiety and transgression-tensility as indicators. Land holding histories along the Laramie River, Wyoming (Town and Range 26_65) and Western explanative narratives were examined to give insight.*

Keywords: *The Gap-Burden Method™, Regional change, Hyperreality, Social-ecological models, Range ecology*

INTRODUCTION

The range was green from the summer rains. Cattle fed gently on new sprigs of grass, the fences were newly repaired and the corn tassled in the sunsets. Dusty pickups wound their way through the dirt roads of the Wyoming back country. Livestock prices were up and the town pools were filled with the sounds of laughing children, while fathers discussed repair costs and mothers planned school events. Goshen County, Wyoming (elevation 4900 feet), set east of the Laramie Mountain Range (Figure 1), is home to livestock fairs and golden mares, broncobusters and what some say are the best cowboys in the country. The land is one of ponderosa pine forest, silver sagebrush, coyote willow, Canada wild rye, needle and thread, Western wheatgrass and Sandberg bluegrass (Stubbenieck et al., 1997; Van Bruggen, 1992). Growing seasons are short and cool for crops over most of the area above 7,000 feet above sea level and water availability is a problem at the lower elevations (Knight, 1997).

Grazing is the most predominant land use, within Goshen County, a form of mixed pastoral/agricultural system common to mountain grassland settings (Bennet, 1969; Galaty and Johnson, 1990).

Implications for Coupled Natural and Human Systems

Fieldwork in the Laramie Range demonstrated that state structure codifies and supports "productivity" within a discourse that perpetuates a stable Wyoming environment, according to notions of stability based on the ideals of the dominant class. These notions are supported by a neo-Hegelian interpretation of space and time, largely unexplored in the literature. Within Hegelian philosophy, time is dominant, continuous and bears a heavy weight in space; akin to Nietzschean themes of eternal return (see Derrida, 1978). Thus, the economic process that describes Wyoming history describes a competitive economic space in which the change in the spatial organization from a real space to a rational space (settling the American Range), an

environmentally driven space to one of political-economic forces and bounded rationality, placed great pressure on the citizens and residents of the space. This phenomenon is indicative of not only Wyoming and the Laramie Range, but the American West as well, for Europeans as well as Native Americans. Crossing the thresholds of ecological resilience (Finlayson and McCay, 1998), legitimately expressing self-determination, freely explicating intimate economic choice and survival are inexplicably connected to political-economic power and natural resource bases. Over time, the coupled natural and human systems of the American West struggled dialectically within and with the Western Range as well as larger scales of influence and this is evident in settlement patterns that may be examined as a matter of sustainability and social-ecological robustness (Anderies et al., 2004; Groffman et al., 2006; Walker and Meyers, 2004; Worster, 1992). This paper examines the way in which this human-environmental change occurred in the Laramie Range, Wyoming as real space and social behavior became rationalized according to the competitive sustainable ability of the region's social-ecology within the context of natural hyperreal (Baudrillard, 1994; Perry, 1998) driving forces of global change. This work endeavors to reach a better understanding of coupled natural and human systems through the examination of social-ecological carrying capacity (Brush, 1975) and state and transition ecological models (Dublin et al., 1990) for range management purposes within the hyperreal context.

This research proposes to explore coupled natural and human systems through the study of transgression-tensility, the ecological function, by which the author hypothesizes, natural selection and subsequent social-ecological change occurs, and

geopiety, a term borrowed from geography that describes the cultural connections between nature and society. The study differs fundamentally from previous research in coupled natural and human systems from Land-Use/Land-Cover Change (LUCC) (Gutman et al., 2004), environmental history (Soule and Lease, 1995) and social-ecological models (Gimblett, 2002) due to the inherent logic that is based on the organic tensility found within social-ecological processes, quantifiable empirically within the social-ecological landscape in the cultural connections and relations between objects and subjects in the natural world, and mappable through the exposures of the hyperreal dimension and geometric dynamic found, *in-situ*, through field work. This difference is significant because of its pioneering approach from cultural geography and social ecology that enable the researcher to deconstruct the conditions of the human experience as an ecological process from within the nature-culture borderland, which conforms to Western environmental ethic, and prescribe an environmental management that matches the appropriate sustainability paradigm. This intersection becomes the narrative that is a continuous and natural process, the meeting place between history and hyperreality at which structure and agency are both consumed, and can be modeled at a local, regional and global scale with Geographic Information Systems (GIS) (Manspeizer, 2006) or other socio-ecological heuristic.

Included in the research plan are three parts: (1) an examination of regional historical survival strategies and geopiety through discourse analysis of experiential novels from the Northern Great Plains, (2) an analysis of local land pattern change from historical maps and documents of Goshen County, Wyoming,

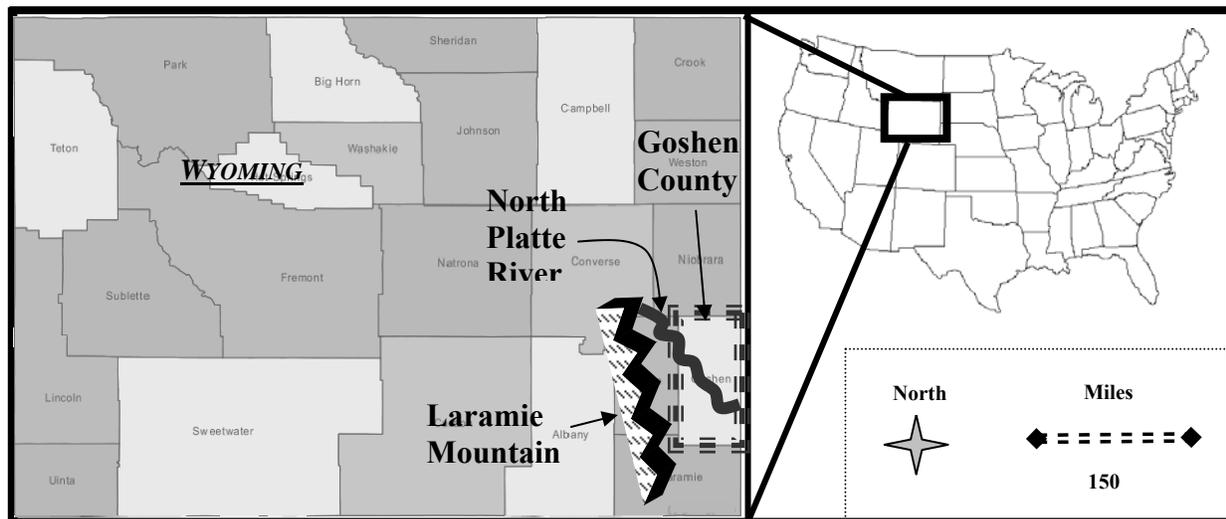


Figure 1. The Laramie Mountains and North Platte River in relation to Goshen County, Wyoming (dotted outline).

Wyoming, (3) the development of a GIS based Gap-Burden model that will help to define the principles and processes by which transgression-tensility, geopiety and human-environmental change interact. The Gap-Burden Method™ is a new contribution to human geography and social-ecological modeling, and is derived from notions developed in ecology that ecological states and transitions between states may be studied as spatial-temporal progressions by which thresholds break and regimes change due to the tensile stresses on the system according to a natural selection and verified according to social discourse and expressions of geopiety. This addresses the call from ecology and geography (e.g. Gimblett, 2002; Groffman et al., 2006; Gutman et al., 2004; Walker and Meyers, 2004) to continue to seek an understanding of human and natural system processes by intentionally situating this research model in the no-man's land between culture and nature specifically in order to monitor the tensile stresses of human-natural processes within a temporal framework. This study spans over 150 years of human involvement with the Northern Great Plains, dating from early pioneer periods through the present, and aims to demonstrate the way in which regime sequence may be correlated with the integrity of the social-ecological structure, the political and social discourse, predicted through the monitor of the change in transgression-tensility and geopiety and managed with landesque capital.

CONTENT

The struggle to meet expectations and desires by the smallholder, and the ensuing existential battle, may be traced back to the nexus between history and hyperreality. The hardships and difficulties of life on the Range and the struggle for geographic self-control express themselves in terms of population demographics and personal narratives. Books, such as: "Dakota: A Spiritual Geography", by Norris (1993), "The Meadow", by Galvin (1992), "Windbreak: A Woman Rancher on The Northern Plains" by Hasselstrom (1987), "This House of Sky: Landscapes of a Western Mind" by Doig (1978), "The Trampling Herd" by Wellman (1961), "Pioneering in Texas and Wyoming – Incidents in the Life" by Shaw (1931), "The Day of the Cattleman" by Osgood (1929), and "Sheep: Life on the South Dakota Range" by Gilfillan (1929), begin to describe this struggle from an existential and ecological perspective. These narratives themselves explicate the historical demographics as they appear in the

landscape over time. The difficulties that force abandonment and the wealth that encourages and draws immigration as described in these narratives are replayed continuously throughout the Western Range and throughout history. The hopes, expectations and disappointments are heart rending and inspiring, history becomes defined by the very social expectations presented. This paper attempts to bridge state and transition ecological models (Dublin et al., 1990) with range management by arguing that failure of social-ecological systems, associated social-ecological thresholds of regime change and subsequent social-ecological state transition may be predicted and prevented (Anderies et al., 2004; Finlayson and McCay, 1998; Groffman et al., 2006) using the proper indicators, such as key historical informants, and a more participatory development.

Investment in either the existing social-ecological state or another social-ecological state may be viewed through the ideological and within a geography of the mind, although this process continues through the real landscape, where it gains a compassion and form. Intention is cultural, and compulsory has been replaced by voluntary with the birth of the Enlightenment, although there still exist dominant cultural ideologies and even a renewed interest in the positive aspects of ideology (Cloke, 1997; Manspeizer, 2006). Thus, forms of landesque capital (Blaikie and Brookfield, 1987) may be viewed as investments in specific geopiety or envisioned landscapes (Manspeizer, 2007) and examined with regard to the social-ecological carrying capacity (Brush, 1975), and the efforts of the social-ecological system to construct ideological strategies (Anderies et al., 2004). Within the nature-culture border, landesque capital is given some form by dominant structural influences and personal agency, although the omnipotence of nature and totalizing aspects of culture reveal hyperreality's (Baudrillard, 1994; Perry, 1998) true topography and dynamic. This paper begins to politely examine this process through spatial and temporal analysis of changes in land holdings along the North Platte River, Wyoming, Town and Range 26_65, from 1920-1960 (Wyoming State Archives) using transgression-tensility and geopiety as the indicators of social-ecological system robustness within a management framework that encourages landesque capital. Management of the Range in conjunction with the relevant indicators calls for a recognition of nature as well as the incorporation of structure and agency as a natural form in order to promote sustainable landesque capital.

Geopiety, a term from cultural geography (Manspeizer, 2006; Tuan, 1976; Wright, 1966) that describes connections and feelings toward place, is

discernible through the discourse and cultural materialism that is produced during the culture-nature struggle. The survival narratives mentioned earlier (Doig, 1978; Galvin, 1992; Gilfillan, 1929; Hasselstrom, 1987; Norris, 1993; Osgood, 1929; Shaw, 1931 and Wellman, 1961), give us a good beginning to understanding the politics and economics of struggling for survival within and with the Range as well as the struggle with others for control of the Range. These stories are themselves externalities (diamonds), mined during the struggle for survival, sovereignty, success and self-preservation from within the no-man's land between culture and nature. When Archer Gilfillan (1929) describes the South Dakota winter as, "when the mercury sinks until it drops out of the bottom of the thermometer...and then freezes up so that the baby can play marbles with it, that's cold!" or Kathleen Norris (1993) notes that, "the fact that one people's frontier is usually another's homeland has been mostly overlooked", we gain a tremendous insight into range geopiety. Discourse analysis and human geography benefit by recycling these gems of geopiety into the academic political economy, thereby demonstrating our respect and honoring other's efforts. In turn, this article politely contributes an idea from ecological theory and a way that we may use the wealth of personal narratives that over a century of novel writing has left to our generation.

Transgression-tensility describes the function by which coupled human and natural systems develop over time according to natural selection; transgression refers to the advance of one ecological object in relation to another ecological object and tensility refers to the mechanics by which this occurs. This function is based upon concepts that the social-ecological system is analogous to a dynamic geometric structure with inherent natural stresses and explications that may be measured and modeled as social-ecologies meet social-ecologies (Holling, 1973). Transgression-tensility functions emphasize the nexus (thresholds) between ecological agents as the point of contact and the most crucial area of study because they give important clues to processes of natural selection. Measurement of such relative variables as Archer Gilfillan's stamina or inability to survive cold weather events or Kathleen Norris' ability or failure to deal with her guilt as an occupation power are examples of these nexus and are often difficult to quantify. This paper makes steps toward recognizing geopiety as a stress related variable and calls for its incorporation as an important indicator of social-ecological system robustness (Anderies et al., 2004). In this way, social-ecological states and transitions (Berkes and

Folke, 1998; Dublin et al., 1990; Groffman et al., 2006; Walker and Meyers, 2004) may be examined as products of social-ecological robustness in light of the nature-culture struggle as the connections between nature and society are tested. As social-ecological landscapes develop over time they accumulate residual mass through the development of social-ecological patterns and effort is required in order to alter existing production systems and land-covers or conquer new ones (Manspeizer, 2006). The outcome of these regime-threshold battles between nature and society shape the emergent property as dominated by either nature or society within the context of hyperreality and history.

ANALYSIS

Within one small region in the Laramie Range, Goshen County Wyoming, small-holders (Netting, 1993) struggle to produce livestock. This production, and the change in land-tenure over time, is evident in the way that the landscape changes over time. Two components (Figure 2) were utilized to give insight to the mediation between historical and hyperreal forces in the development of human-environmental relations in the Laramie Range: (1) a geopiety discourse analysis study of literatures that describe experience in the Northern Great Plains, (2) a transgression-tensility landscape study of the change in a sample number of land parcels in Goshen County, Wyoming from 1920-1960. Together, both components were used within The Gap-Burden Method™, a mixed quantitative and qualitative methodological framework, in order to derive a quantitative value by which an understanding of regime change could be established. Stable cultural landscape states and land holding patterns from historical map data (1920-1960) from the Wyoming State Archives in Cheyenne (Figure 2) were digitized and analyzed using GIS. This sample study of Goshen County land tenure change shows that the number of land parcels increased by 100% between 1920 and 1940 and then decreased by 17% between 1940 to 1960 (Figure 3). Geographers and specialists in human-environmental change describe these changes from a number of perspectives (see Gimblett, 2002; Gutman et al., 2004) that inevitably attach causal explanation to the change. The Gap-Burden Method™ proposed in this paper describes a new alternative to existing approaches in Land-Use/Land-Cover and global change studies and addresses shortcomings, namely the failure to correctly reach the causal roots of change and the

natural hyperreal context in which impact on the environment occurs (Gutman et al., 2004; Manspeizer, 2006). The Gap-Burden Method™ is a heuristic that may be used to overcome this quagmire by capitalizing upon the natural play between history and hyperreality through calculation of the spatial-temporal gap between stable social-ecological states and the burden necessary to change from one social-ecological state or regime to another.

Multiple gap-burden values (GBV) were derived from the land parcel data and used to calculate a gap-burden index (GBI) that describes a change in landscape over time. These results were then checked against the information gained from the historical experiential narratives in an effort to place the land parcel change analysis within a framework that helps to explain the results. The Gap between the stable cultural landscapes of the study (palimpsests) and the Burden to reach these states, according to the transgression-tensility data may be understood as a quantifiable measure that will indicate the effort and difficulty in the transition and change. For the purposes of the test case in this paper, $\delta_{(landscape)}$, the change in social-ecological balance or GBI, is calculated through comparison of the slope of the regression lines as the number of land

parcels change over time multiplied by a geopiety variable.

$$\text{Gap-Burden Index (GBI)} = \frac{(\text{Burden}_{(Gap 1)})}{(\text{Burden}_{(Gap 2)})} * \text{Geopiety}_{(nature-society)}$$

In the case of 1920 to 1940 the slope equation $y=15x$ equals $300.0_{(time-parcel-units)}$, while from 1940 to 1960 the slope equation $y=-5x+35$ or $-65.0_{(time-parcel-units)}$, (Figure 3). A constant of 1.0 was used to represent the geopiety factor in this test case according to a qualitative measure of political deliberation found in the local narratives. When normalized, the results indicate that 5.615 times more burden is evident during the 1920-1940 gap than the 1940-1960 gap. In other words, there is evidence of 5.615 times more change during the first period than the second with the land parcel data used. Additional data may reveal that this discrepancy may be due to alternative outlets within an open system, such as the number of cattle produced or other cultural outlets, although field work and discussions with local ranchers indicated that this was an accurate proxy, along with the geopiety analysis, to calculate burden.

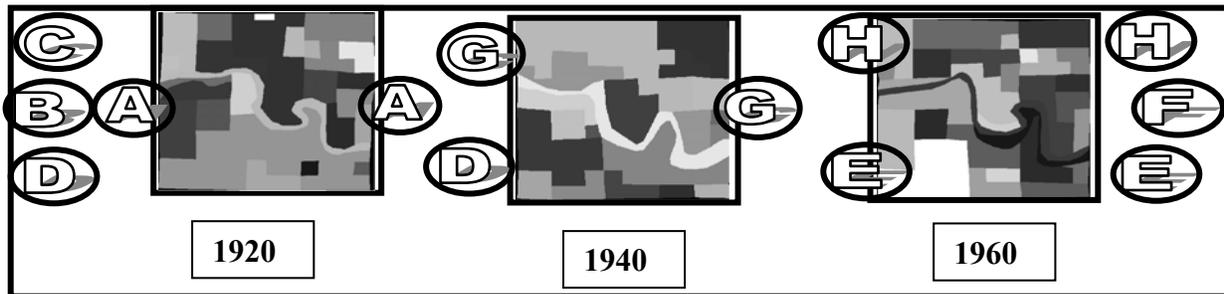


Figure 2. Change in land holdings along the North Platte River, WY (WY State Archives, Cheyenne) depicted chronologically along with the geopiety study ([A], Gilfillan (1929); [B], Osgood (1929); [C], Shaw (1931); [D], Wellman (1961); [E], Doig (1978); [F], Hasselstrom (1987); [G], Galvin (1992) and [H], Norris (1993)).

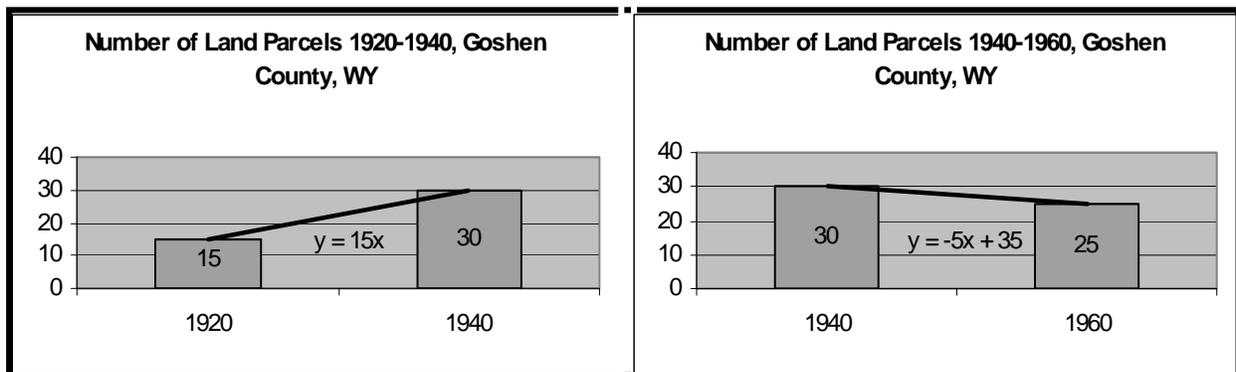


Figure 3. Comparison of the slopes derived from regression analysis based on a sample number of land parcels between 1920 –1940 and 1940-1960 in Goshen County, WY (Data from the Wyoming State Archives, Cheyenne).

RESULTS

The results of The Gap-Burden Method™ in the Laramie Range indicates that space becomes rationalized in asymmetric waves (Horwich, 1992), or according to an ecology of disequilibrium (Behnke and Scoones, 1993), with overlapping periods during which this rationalization is contested and challenged by real space. The reinforcement of traditional work-ethic, geopiety and land-use values (Manspeizer, 2007) did assist, as a form of landesque capital (Blaikie and Brookfield, 1987), to construct a social-ecological framework (structure) to reproduce through time and through these asymmetrical/hyperreal driving forces of change to maintain sustainable social-ecological abilities. Yet, this historical narrative, as a form of normative morality becomes entangled within the waves of a reactive pragmatic hyperreality, these intimate values are battered against realities and the driving forces of change, and a new state emerges from the process of transgression-tensility (Figure 4). The GBI and $\delta_{(landscape)}$, quantified above, represents a view into the dimension within which these processes occur and indicate that the change in settlement pattern, recorded in the change in land parcels and geopiety discourse, does parallel the hyperreal transect (Figure 4). The material manifestations of these processes, such as change in land-parcels and expressions of geopiety, enable the indifferent deconstruction of the constituent components of landscape dynamics

without their disintegration and allow a construction of hyperreal cartography. In the case of the Laramie Range, the results of The Gap-Burden Method™ demonstrate that initial efforts by the pioneer settlers through 1920 in the Laramie Range succeeded in settling the range and cross the threshold of ecosystem resilience (Finlayson and McCay, 1998; Knobloch, 1996; Merchant, 1989) to push the social-ecological regime past the threshold to the 1940 state in which society dominated nature (Figure 4b). Subsequently, the residual power of landscape and a reactive nature succeeded to pushing the social-ecological regime past the threshold in favor of nature to the 1960 state in which nature dominated society (Figure 4d). This concurs with information from the narratives that describe more efforts against the environmental hardships pre-1940 and more efforts against the social hardships post-1940 (e.g. Galvin, 1992; Gilfillan, 1929; Norris, 1993; Osgood, 1929; Shaw, 1931).

CONCLUSION

Landscape itself drives the process of restructuring the cultural composite within which the ecological story occurs and within Goshen County, Wyoming the land-work ethic reinforces the expectations of generations as they battle with the Range. This rhetoric itself has consequences on

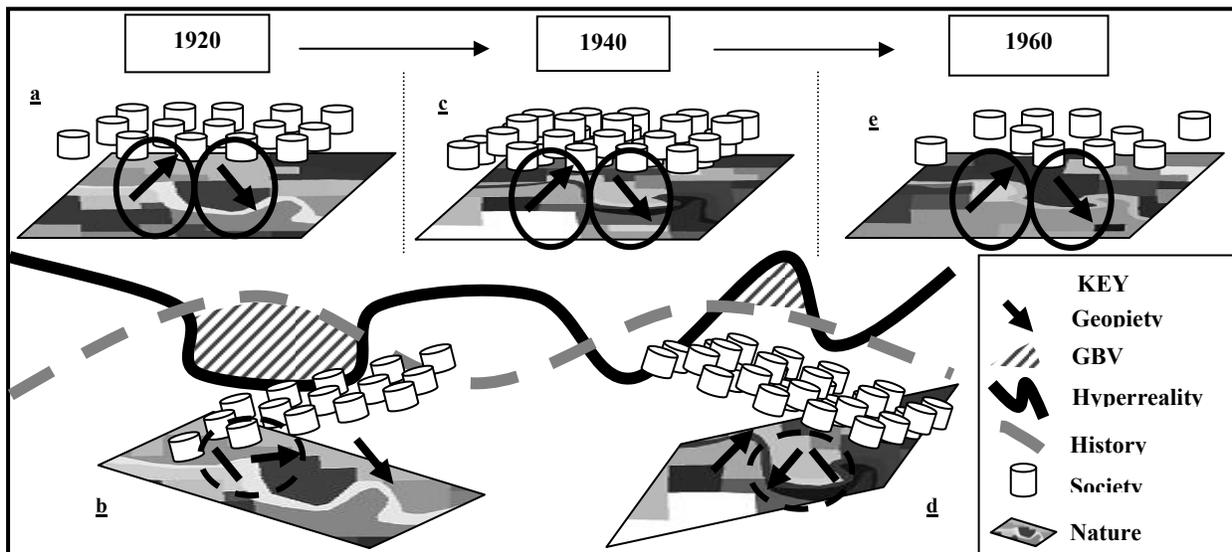


Figure 4. A regime change estimate model of the Laramie Range, from 1920-1960 (a-e), demonstrated through state and transition social-ecology with approximated hyperreal and historical transects. Note the geopiety connections (black arrows) show both connection between society to nature and nature to society, broken in transitions b and d. Also shown are the significant time-parcel-units (hatched areas) within the GBI.

social-ecological mediation that are only being discovered today. These impacts include shifts in species abundance due to ungulate grazing, denser woodlands and forest in the uplands due to fire suppression, periodic locust invasions, fragmentation of forest landscapes due to deforestation and wildlife shifts due to secondary growth on abandoned land (Knight, 1997). The Gap-Burden Method™ used in this paper demonstrates promise and contributes through the indifferent deconstruction of landscape change over time and because it is willing to assimilate structural influences, agency and hyperreal scales as au-natural parts of a continuous natural historical process in which humans participate. The scale at which human-environmental change actually occurs is both massive and intimate and the sparse data is a reflection of the difficulty to identify actual in-situ manifestations of hyperreal scale processes (Baudrillard, 1994). Nonetheless, The Gap-Burden Method™ proved well in recording these phenomenon, thereby helping to advance our understanding of historical development within a hyperreal/asymmetric context for Range Management purposes (Behnke and Scoones, 1993; Heitschmidt and Stuth, 1991; Westoby et al., 1989) as well as for other applications, including as a forecasting tool for market, geopolitical, medical and risk analysis.

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