

Matching up the complexity of grassland of Inner Mongolia—on the methodology issues

Zheng Yisheng

Institute of Quantitative & Technical Economics, Chinese Academy of Social Sciences, No. 5, Jianguomennei Dajie, Beijing, P.R. China, 100732, E-mail: zhengyishengcass@263.net

Key points : While grasslands in Inner Mongolia have become increasingly important within national discourse. It remain a kind of marginalized area in many aspects. However, if some issues in the undeveloped areas are much more complex to deal with in critical aspects than they were in central area, which is opposite to marginalized area, then the dominant theory and its approaches may encounter difficulties, even though they were previously popular in the central area. Many new researches, especially excellent case studies show that gaps between an oversimplified analytical approach and real-world complexity have resulted in some difficult concepts such as overgrazing and delineating property rights which appear clear but are somewhat puzzling and controversial. Some policies based on these simplified concepts have not reached their anticipated outcomes, or have resulted in new problems. Whether to reject or accept complexity is a critical decision for the improvement of grassland policies at present.

Key words : marginalization, complexity, dis-equilibrium grasslands, traditional knowledge, Household Production Responsibility System, imported theories

1. Introduction

1.1 grasslands in Inner Mongolia : a leader of a marginalized area

For many people working in Beijing, our concern about the grassland arose from the dust-storm of 2000. To some extent, this led to grasslands (especially those in Inner Mongolia) becoming a national issue of ecological importance to the people of eastern China, including those in Beijing. This reflects two key points about the status of grasslands in Inner Mongolia.

On one hand, it seems that grasslands in Inner Mongolia play a leading role in protection of grassland ecosystem within national discourse. In history, many new policies were put into practice firstly in Inner Mongolia among all three main grassland regions of the country (other two are the alpine grasslands of the Tibetan Plateau and the Yunnan-Guizhou mountain grasslands). In recent years, the national government has subsequently given much stronger support to grassland regions in Inner Mongolia, in the form of ecological compensation projects. For instance, the special funds for a project to control wind and sand sources around Beijing and Tianjing area are up to \$4200 million USD by 2006. Policy and its methodology in Inner Mongolia are likely to be followed by other grasslands regions.

On the other hand, however, a wider perspective shows us that the grasslands remain a kind of marginalized area in many aspects. The huge national strategy for "Developing the West" of China covers all three main grassland regions of the country. Many people consider these areas are an undeveloped part of the country and, as such, are to be "developed" mainly by the developed regions of China. By the term of "marginalized area", I want to emphasize the dominant role which the central area (the developed regions) plays in the modernization of the marginalized area (undeveloped regions). This refers not only to material changes such as economic structures and level of technology, but also to spiritual changes, such as ways of thinking and anticipated outcomes based on experiences from in central area. This proposed process of "following the leader" is understandable, and could yield good results in many cases, as the leader is often the stronger one. However, if some issues in the undeveloped areas are much more complex to deal with in critical aspects than they were in these leader areas, then the dominant theory and its approaches may encounter difficulties, even though they were previously popular in the central area.

1.2 The complexity of grassland

In recent years, more and more scholars have pointed out the special features of the socio-ecological system of grasslands and how these differ from mesic areas (e.g. Ellis *et al.*, 1988; Oba *et al.*, 2000). For instance, the Drylands Development Paradigm indicates that sustainable development in drylands is determined by five key features of the drylands syndrome which dominate the dynamics of human-environmental systems. (1) high variability (precipitation is scarce and typically more-or-less unpredictable); (2) low fertility (Many dryland soils contain small amounts of organic matter and have low aggregate strength); (3) sparse populations (Compared to mesic areas, and a few major desert cities notwithstanding, the human populations of drylands are usually sparser); (4) remoteness (more mobile, more remote from markets); (5) distant voice i.e. distant from the centers and priorities of decision-makers. It is also harder to deliver services (Reynolds, 2007). This definition of drylands includes arid, semi-arid, and dry sub-humid areas, in which grassland (that is dry grasslands) form one of the most important parts. These key features frame the special complexity of grasslands as "marginalized areas", rather than mesic, or central areas.

Controllability and observability are concepts from engineering science, which are also used broadly by many scholars and policymakers as their working principles. It is expected to find a stable, general, computable, simple cause-result relationship

between ecological and economic variables (i.e. observability). Meanwhile, it is expected to have such tools to directly improve the situation of grasslands through policy and projects within a limited time-frame. It is especially anticipated to seek a critical variable which is the dominant factor for the changes of grassland and that can easily be shown in figures or an index (i.e. controllability). Although these expectations can get many support when we conduct research and policy making work in the mesic, or central areas, most of them have been formalized as classical theories of ecosystem, they are facing many challenges when these theories are applied in grassland areas. Unfortunately, in many cases, response to this situation is the neglect on complexity of grassland ecosystem.

Gaps between an oversimplified analytical approach and real-world complexity have resulted in some difficult conceptions which appear clear but are somewhat puzzling and controversial, among which overgrazing is the key conception.

Overgrazing has been considered as the main reason for grassland degradation and this assumption is supported by statistical figures that show continued increase in the livestock population (Zhu *et al.*, 1981; Li, 1997; SEPA, 1997-2005, 2007). Moreover, almost all countermeasures to restore degraded grassland are to alleviate overgrazing. In the following part, we will discuss two kinds of overgrazing hypothesis. The first one is the popular logic of the conception of overgrazing, which is shown in Figure 1. The second hypothesis is trying to explore the first one in detail based on some problems appeared in the implementation of present policies.

2.1 Simple overgrazing hypothesis

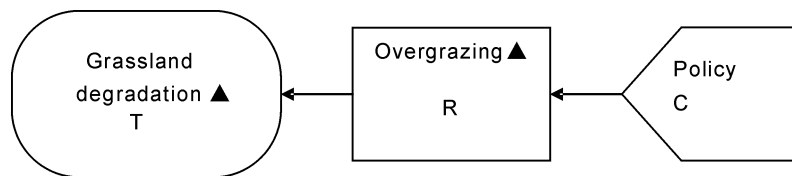


Figure 1 Simple overgrazing hypothesis. Here ▲ means statistical figures is available.

Note:

- (1) T is grassland degradation. Generally it is showed by aggregated areas of degraded grassland.
- (2) R is cause of grassland degradation. Overgrazing is taken as the primary man-made cause for grassland degradation. The statistical figures of increase of livestock population (x) are the most obvious variable related to grassland degradation. For $T = R(X)$, $dF(X)/dx < 0$, the methodology of regression looks very obvious and credible.
- (3) The reason for overgrazing is considered to be a "tragedy of the commons" or short-sight of herders.
- (4) C is policies to correct short-sighted behavior of herders. It includes: to limit livestock numbers to an "equilibrium level", ecological immigration, and to transfer more responsibility for grassland protection to herders through the Household Production Responsibility System (HPRS). This formula has become so popular in practice in the control of grassland degradation because it is very easy to understand and find solutions, that is to say, simplicity is probably one reason why this hypothesis is so popular.

2.2 A more complex hypothesis

While "overgrazing" is still important in the new hypothesis, it is neither the sole considerable variable in explaining degradation nor such a general conception. Instead, we try to answer the following questions: Are different kinds of degradation caused by different causes? How does overgrazing cause degradation? What factors result in overgrazing? And how?

In Figure 2, we collect some ideas of scholars to build a more complex hypothesis.

(1) T : Degradation

T1 :Reversible degradation exists especially in the areas with the characters of non-equilibrium ecosystem in which situation of grass mainly depends on rainfall. It should not be confused with the really serious degradations which are not all the most obvious surface changes in grassland.

T2 :Non-reversible degradation or it is hard to be reversed. Such as large scale of nature change, e.g. about one tenth of lakes has dried up in recently 30-40 years and caused degradation of the grass ecosystem around which. Toxicity of pollution in industrial and mining activities may change the chemical and physical structure of soil and the biodiversity of ecosystem.

(2) R : Causes of degradation

R1 :We need more research work about how much the impact of natural factors is attributed to degradation of grassland.

R2 :There is few research papers about how much the impact of the different activities of mankind is attributed to degradation in grassland.

R21 :Agriculture development in grassland has not only decreased grassland, but also decreased the average quality level of grassland since best grassland has become farm areas (Nehe 2002).

R22 :Some factories of manufacturing industry are moved from the eastern provinces to the West including grassland region with heavy pollution. Mining is developing rapidly.

R23 :The impact of Livestock husbandry on grassland is not equal to the impact of overgrazing. Livestock husbandry causes degradation in three ways.

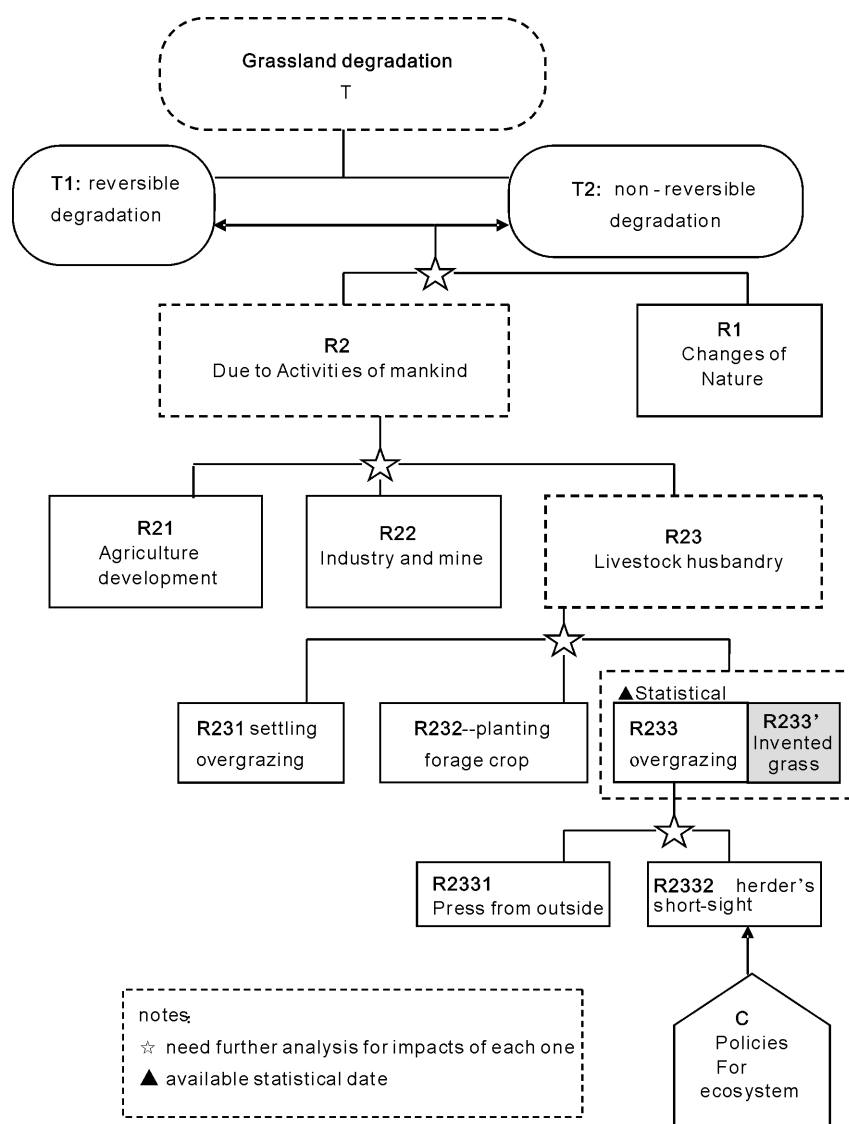


Figure 2

R231 Settlement of herders could create a new kind of overgrazing "distribution overgrazing" (Zhangqian2007) .Some scholars call "settlement overgrazing" .

R232 Planting forage crop in very dry grassland may create sustainable negative effect to grassland ecosystem .

R233 and R233' :Some scholars pointed out that "overgrazing" showed by statistical figures (R233) needs to be analyzed further .They found that the livestock population relying on grassland-based energy sources in Inner Mongolia actually decreased after 1990 , and did not lend support to an overgrazing hypothesis . The critical point is that the statistical data do not describe the "net" livestock grazed on natural grassland , which is more relevant to grassland degradation ,but also include those livestock that rely on energy inputs from outside the grazing system (R233' in figure2 ,we may call "invented grass") . This includes cases ,for example , where herders to buy forage from cropping areas to maintain their herds during natural disasters . This has been especially common after curtailment of traditional movement of livestock to other places to avoid disasters . (Dalintai et al . , 2007)

Notice that in many cases , **R231** , **R232** and **R233** are closely interacted .

(3) R233 :Causes for overgrazing

R2331 :Economic pressure from outside

Firstly , Part of increase of livestock is due to raising livestock by non-herder encouraged by local government which suffered

from financial pressure and depended .

Secondly , While herders benefit in many aspects from policies and projects encouraging building bases for preventing natural disasters and importing grass from outside , the cost of such way has being increased rapidly and even become heavy burden on herders .

Thirdly , it is very difficult for herders to get loan from banks . Moreover , commercial banks withdrew from grassland regions in the reform of monetary system . The fragility of husbandry industry (e . g . need sustainability of productive female Livestock) and the failure for herders to get support from insurance institutes have created great opportunity for usurers .

R2332 : Is short-sight of herders the main cause of overgrazing ? Many scholars agree that it is not herders but policies that has mainly caused overgrazing . A 5-years-case study estimated contributions of each factor to degradation : overgrazing due to herder's short-sight behavior agricultural is much less than overgrazing due to planting forage crop (encouraged by policy) . (Dalintai2005)

(4)C : Policy

While the complex hypothesis needs more evidences to be confirmed or refuted , it is enough to show the differences from the simple one . Firstly , besides overgrazing , the other reasons for degradation should be studied . Secondly , overgrazing could not be certainly attributed mainly to short-sight of herders . Thirdly , It is very difficult or impossible for a policy focusing only on herder's short-sight (**2332** in Figure 2) to challenge degradation (**T** in figure 2) in such of high variability Inner Mongolia grassland . Fourthly , More policy issues should be considered over to deal with degradation (i . e . besides R2332 , we should consider over the causes of R21 , R22 , R231 , R232 , R2331)

3 . Some academic efforts considering complexity in the study of Chinese grassland areas

Some policies based on these problematic conceptions have not reached their anticipated outcomes , or even have resulted in new problems , such as herder bankruptcy and recession in the animal husbandry industry . To a large extent these problems can be attributed to rejecting rather than accepting , complexity such as : to prefer to replace multi-factor issues with one single or main factor which relates to the simple design of a policy/project , to rely on a static , rather than a dynamic understanding of the social-ecological system , and to pay too much attention on rapid changes rather than to fundamental changes which require observation over a long period of time etc .

A significant tendency in academic research on grassland issues in recent years has , in my view , been the emergence of more efforts to considering the complexity of grasslands in different disciplines . Here are some examples .

3 .1 Grassland is not a case where principle of economics can easily be applied to

Traditionally , privatization and government control have been regarded as solutions to the tragedy of overuse of common property resources (Hardin , 1968 ; Olson , 1965) . Household Production Responsibility System (HPRS) was designed and implemented in Chinese grassland areas with the intent to avoid the tragedy of commons . HPRS has sought to allocate delineated grassland user-rights to individual household as a unit of grassland holding and management . This policy is very significant , but is not the panacea which some had hoped it could be . Surveys in the grasslands of Xilingol , in Inner Mongolia by Li Wenju *et . al .* (2007) document many pitfalls , especially considering the special social economic and natural character of these grasslands .

They emphasized that it was very difficult to promote privatization of grassland in Inner Mongolia in practice . Both the division of livestock and the contracted allocation of grassland were promoted at the beginning of 1980s and combined as the policy of HPRS . However , the division of livestock in 1985 proceeded much faster than the allocation of grasslands , which was finally formally completed in 2000 . It is this gap in policy implementation of HPRS that actually caused the true "tragedy of the commons" and led to significant grassland degradation (Bao , 2003) . Many case studies have documented over-exploitation of grassland in the process of contracting out these resources (Yang *et al .* , 2004 ; Kalina *et al .* , 2000) . Li and her colleagues concluded that privatization , without effective management and resource distribution , is clearly not always an effective way to prevent natural resource degradation . The complexity is that for an open access or unregulated regime , the privatization program could be efficient only when a set of conditions exist regarding enforcement costs , defined property rights and markets which are all largely absent in contemporary China . In fact , we can find more examples in the work of Ostrom (2007) and Ho (2007) . Moreover , the scales of both temporal and spatial have significant influence on the selection of property rights institutions of natural resource management .

Dr . Zhang Qian's case study in Xilingol Prefecture in Inner Mongolia sought to link the applicability of HPRS to the character of natural resource : heterogeneity . Similar to Holling's ecological study (1992) and taking water resource as an example , she constructed a multi-scale framework based on water resources distribution . This system contains three levels of analysis ; the macro-scale (the whole of Xilingol Prefecture) ; the mezzo-scale (from 25 sq . km . to hundreds of sq . km .) and the micro-scale (of around 10 sq . km .) . She found that the root of unfulfilment of the HPRS objectives is the unconformity of using equilibrium ecosystem theory to micro-scale (grassland of a herder) which is a non-equilibrium ecosystem with high resource heterogeneity .

3 2 Questioning the imported truth

In the book *The Evolution Of the Institution System And Nomadic Civilization* (Aorenqi ed .2006) , a group of scholars from the Inner Mongolian Academy of Social Sciences encouraged modern readers to respect and reflect on the history of the historical Mongolian grassland nation . Mongolian herders had traditionally used grassland-based animal husbandry as their material base , and the eco-culture which arose from it through social practice , as their conceptual base . In dealing with the problem of changes in vegetation caused by fluctuating precipitation , Inner Mongolian herders had traditionally sought to lessen grazing pressure and to adjust their utilization of grassland resources in space-time through nomadic grazing . In this way they adapted to the inner mechanisms of a climatically-controlled and non-equilibrium ecosystem . The work reminds us of the importance of this local environmental knowledge (LEK) , and also of local economic knowledge .

Someone questions the importing of truth to understand and manage the Inner Mongolian grasslands from three aspects : firstly , he points out that the mainstream theory which is currently guiding our utilization and management of grassland resources relies on adjusting livestock carrying capacity that is , controlling grassland degradation by decreasing the number of livestock which graze on each unit of grassland (Dalintai 2005) . This conception came from mainstream of American grassland theories originating in the work of Clements . These were imported into grassland science in China by Mr . Wang Dong . Wang's edited works on the *General Introduction to Grazing* (1952) and *The Science of Grassland Management* (1956) were the first textbooks on grassland management published in China . For several decades , Chinese research on grassland science developed and was conducted on the basis these theories . However , this adoption and application overlooked the fact that these theories derived from research into equilibrium grasslands and were unsuited to the temperate and arid Mongolia plateau . Secondly , the land contracting system , which benefits millions of farmers in the central part of China , was also imported and applied to the Inner Mongolia grassland . Thirdly , the blind introduction of improved varieties of livestock and pasture species has caused unanticipated changes in the ecosystem . These invading species may displace local species , causing great destruction to the natural and related systems , and result in land degradation . There are many lessons from the implementation of aerial sowing and the introduction of improved varieties to replace local goats .

3 3 Case Study : the value of methodology of sociology

While many economists worry about the challenges and appropriateness of applying simple modeling to complex grassland issues , rural sociologists , such as Professor Wang Xiaoyi , (Wang , 2006 , 2007) have sought to document the actual situation of specific grassland and herding communities through rich description and use of comprehensive case-studies .

The case study approach is borrowed from anthropology/ ethnography and aims to discuss issues on the basis of actual communities and their contexts . It recognizes that it is essential to situate problems within the specificity of their contexts . The case study also provides a comprehensive way to study a social phenomenon by identifying and analyzing the interactions between various factors at the micro-level . Finally , the case study is a fact-oriented study which focuses on the internal logic behind phenomena . People often mistakenly consider a case study as only a case , which cannot reflect on the overall facts and cannot be generalized . This is a misunderstanding . Case studies are an effective way to identify or derive a more general logic . A successful case study is not just relating a story , but has deep explanatory and exploratory value . Chairman Mao referred to this way of finding new knowledge and overcoming simplified discourse as "dissecting the sparrow" .

4 . Conclusion

At present , grassland degradation in Inner Mongolia is drawing attention worldwide . More and more scholars in China have been using different disciplinary approaches to determine patterns in this degeneration and to propose sustainable development approaches , including related policies and projects , since 2000 . These new ecological-economic policies will be so influential for the future of grassland regions in China that we must ensure that they reflect the complexity of various grassland contexts . This can be facilitated by adopting diverse local responses to diverse local realities . This requires significant involvement of local herders , local government and researchers in discussing , designing and monitoring locally appropriate approaches to grassland management and to adapting their practices based on findings .

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