International Journal of Sustainable Development & World Ecology

Publication details, including instructions for authors and subscription information:
<http://www.tandfonline.com/loi/tsdw20>

Strategies for the sustainable development of Lugu Lake region

Jingzhu Zhao & Hongyu Jia
Published online: 20 Sep 2010.

To cite this article: Jingzhu Zhao & Hongyu Jia (2008) Strategies for the sustainable development of Lugu Lake region, International Journal of Sustainable Development & World Ecology, 15:1, 71-79, DOI: [10.1080/13504500809469771](https://doi.org/10.1080/13504500809469771)
To link to this article: <http://dx.doi.org/10.1080/13504500809469771>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the “Content”) contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Downloaded by [Research Center of Eco-Environmental Sciences] at 20:06 17 August 2015

Strategies for the sustainable development of Lugu Lake region

Jingzhu Zhao and Hongyu Jia

State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Science, Beijing, China

Key words: Management model, ecosystem services, ecotourism, macro-control, sustainable development, Lugu Lake region

SUMMARY

Lugu Lake region, containing a plateau lake, and the unique matrilineal society of the Mosuo, has become one of the most important areas for ecosystem conservation and cultural heritage protection in China. It is essential to pursue sustainable development in Lugu Lake region. However, rapid increases in the tourism industry have had negative influences on society, the economy and the environment of Lugu Lake region. Extensive concerns have been raised by numerous ecologists, economists and social scientists over recent years. Using systems analysis of major societal, economic and environmental problems, this paper advocates goals for realising sustainable development. A double-layer management model has been developed of regional ecosystem services, composed of natural ecosystem management and macro-control of society and the economy, and has been used to analyse the importance and feasibility of ecotourism development in Lugu Lake region. Constructive management measures and development strategies are then proposed to achieve sustainable development in Lugu Lake region.

INTRODUCTION

The Brundtland Commission defined sustainable development as behaviour that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987). Since then, sustainable development has been given extensive attention by the international community and has become a commonly accepted goal of human development. Regional sustainable development is the foundation for sustainable development at national or global levels, and has become a significant part of development processes in human society (Lu and Liu 1998). Social, economic and natural systems in a region mutually

restrict and promote each other, and constitute a dynamic complex ecosystem (Ma and Wang 1984). The goal of regional sustainable development is to promote harmonious development among regional societal, economic and natural components within the socio-economic–nature complex ecosystem. If this is discordant, major problems may develop, such as a population explosion, resource depletion or environmental pollution. Such problems will ultimately restrict social progress and economic development (Shen and Mao 1999; Cheng and Shen 2000). Therefore, it is important to promote regional sustainable development that integrates development of the

Correspondence: Jingzhu Zhao, State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, 18 Shuangqing Road, Haidian District, Beijing 100085, China. E-mail: jzhao@rcees.ac.cn

regional society, economy and nature, rather than focusing on development of a single sector or aspect (Zhao *et al.* 1999).

Lugu Lake region has become one of the most important areas for ecosystem conservation and cultural heritage protection in China because of its natural landscape, plateau lake and Mosuo matriarchal culture. The area attracts thousands of tourists per year, and recent rapid development of tourism has promoted regional economic development in Lugu Lake region. However, increasing tourist numbers have also had negative consequences for the natural environment and unique culture (Zhong 2002; Yang *et al.* 2003; Li 2004), and threaten sustainable development in Lugu Lake region (Guo *et al.* 1996; Wan and Guo 1997; Deng 2003; Ye 2006).

CRITICAL SOCIO-ECONOMIC DEVELOPMENT PROBLEMS

Poverty

For many years, people in Lugu Lake region had almost no exchanges of culture, information or commodities with the outside world because of the remoteness of the area. Lugu Lake region has few mineral resources or cultivated land resources, and its societal and economic development are poor. Yanyuan County in Sichuan Province and Ninglang County in Yunnan Province adjoin the lake and are some of the poorest counties in China (SCLGOPAD 2006). According to investigations in 2005, apart from the villages of Luoshui and Lige, the annual per capita income in the region was less than 800 Yuan. In addition, impractical policies are also an important reason for poverty. For example, the implementation of environmental protection policies may, to a certain extent, exacerbate poverty in Lugu Lake region because a dynamic relationship among environmental protection, resource utilisation and economic income already exists (Figure 1).

Sensitive ecosystems

The ratio of the watershed area to the water area is only 4.94 (Qin 1993), and the self-cleaning capacity of Lugu Lake's water body is weak. The water can be easily polluted but restoration would be extremely difficult. Soil erosion in Lugu Lake region is relatively low to moderate, at about 200–300 t km⁻²

Figure 1 The dynamic relationship among environmental protection, resource utilisation and economic income

per year (Yunnan Provincial Environmental Protection Bureau 1998). However, soil erosion can be severe if vegetation is damaged because of the poor geological conditions. Over-fishing and irrational development could lead to depletion of the aquatic resources of Lugu Lake. For example, the unique fish species in Lugu Lake, such as *Schizothorax labrosus*, *Schizothorax ninglangensis* and *Schizothorax luguensis*, are on the edge of extinction. In addition, although forests in Lugu Lake region have good cover, their stocks are relatively low and unable to provide desired services, such as timber supply for local use. The insufficient farmland and grassland, and the low productivity of farmland constrain local agricultural development.

Poor education

The unique culture coupled with poverty led to poor education in Lugu Lake region. The nine-year compulsory education has not been implemented everywhere in the region, and the dropout rate for the higher grade students in local primary schools was 52.4% between 1998–2000 (Wu and Yang 2005). It is also difficult to coordinate modern school education with daily life and religious education among families of the Mosuo in Lugu Lake region (Yao 2004). The remote location has restricted information exchange with the outside world. Local people are very conservative and have experienced difficulties in adapting to the rapid development of science and technology.

Imbalanced regional development

Recent economic development in Lugu Lake region is closely related to tourism. For example, the annual income per capita was over 10,000 Yuan

in Luoshui and Lige, but was under 800 Yuan in villages such as Langfang and Shankua. In particular, the annual income per capita was only about 500 Yuan in a Yi village, upstream of the Dayuba watershed in Lugu Lake region, and residents did not have enough money to buy food and clothing (Li 2004). Imbalanced socio-economic development is an important cause of inter-ethnic conflicts or the conflicts among the villages and leads to social instability.

Impacts of tourism development on the local environment and culture

Tourism development can negatively affect the environment. Sewage and rubbish have increased with increases in tourists, leading to more serious problems of non-point source pollution and water quality deterioration of Lugu Lake. In order to entertain more visitors and satisfy tourist needs, local residents over-harvested native fish and have introduced exotic fish into the lake, causing serious depletion of fishery resources and destruction of Lugu Lake's aquatic ecosystems. Tourism development has led local residents to construct many hotels around the lake, which has caused severe damage to the lake shore ecosystems. With tourism development, modern culture has brought impacts on the local traditional culture. Local housing patterns, languages, food, dress and religious practices have changed since tourism was developed in Lugu Lake region (Zhou 2001; Li 2004; Ye 2006).

GOALS OF SUSTAINABLE DEVELOPMENT IN LUGU LAKE REGION

Economic development is a guarantee of harmonious development of the population, resources, environment and economy (National Planning Committee of China 1994). On the premise of promoting development, sustainable development should be guided by the following four principles (Lu and Liu 1998; SDRTCAS 2003):

1. Fairness that ensures that this generation and the next should have equal opportunities for development.
2. Sustainability that ensures the rational use of natural resources and sustainability of the natural environment.

3. Harmony among human societies and between humans and nature.
4. Integrity that promotes integrated development of the socio-economic-natural system at a regional level to meet the basic needs of all people, and provide opportunities for all to achieve a better life.

General goals

Through management of ecosystem services and development of ecotourism, relations among tourism development, protection and exploitation of natural resources and ethical culture will be harmonised to promote the development of society and the economy, protect the natural environment and culture and achieve the sustainable development in Lugu Lake region.

Phased goals

The short-term (before 2010) goals of sustainable development in Lugu Lake region are as follows: establish a practical plan for socio-economic development and environmental and ethical cultural protection of the region; environmental quality will be improved, local sewage and garbage will be properly handled, non-point source pollution will be effectively controlled, lake water quality will be stabilised at class I national quality standard for surface water (GB3838-2002), river water quality will be effectively monitored and controlled, forest cover will be increased and soil erosion controlled; the local traditional culture, especially Mosuo culture, will be effectively protected; ecotourism, mainly natural landscape and cultural tourism, will be developed rapidly; and local society and the economy will be gradually improved.

The intermediate to long-term (before 2020) goals of sustainable development in Lugu Lake region are as follows: protection of the culture, customs, traditional lifestyles and villages of the Mosuo matriarchal society; protection of natural landscapes and restoration of natural environments; construction of a tourism base with appropriate disposal systems for sewage and garbage so that no sewage flows into the lake; barren hills and slopes in Lugu Lake region will be eliminated and forest coverage will reach 60% thus effectively controlling soil erosion; Lugu Lake region will be a

world cultural heritage site, and the whole region will be protected as a hot spot for researchers and ecotourists; and harmonised development of regional society, economy and nature will be achieved and will promote the all-round development of surrounding regions.

ECOSYSTEM SERVICES MANAGEMENT

Ecosystem services are the benefits people obtain from ecosystems (Millennium Ecosystem Assessment 2003), and are the material basis of mankind’s survival and socio-economic development (Daily 1997; Costanza *et al.* 1997; Ouyang and Wang 1999; Zheng *et al.* 2003; Millennium Ecosystem Assessment 2005). Maintaining and improving the capacity of ecosystem services is a basic guarantee for realising the goals of regional sustainable development. Management of ecosystem services is an active method to maintain and improve the capacity of a region’s ecosystem services.

Ecosystem services

Ecosystem services include provisioning, regulating, supporting and cultural services (Millennium Ecosystem Assessment 2003). Because of the plateau lake and the unique matriarchal culture of seven ethnic groups, cultural function values, including high research value, unique cultural history and aesthetic value of the scenery are very important for ecosystem services in Lugu Lake region.

Model of ecosystem services management

There are two main issues in regional ecosystem services management. The first issue is management of natural ecosystems. Some management measures are used to adjust the natural ecosystems, to protect the life-support systems and biodiversity, and to ensure that ecosystem services and biological resources are not depleted by human activities; thus realising the long-term sustainability of the region (Boyce and Haney 1997; Maltby *et al.* 1999). The second issue is a macro-control of human behaviour, namely, promoting sustainable utilisation of ecosystem services and regional sustainable development by regulating behaviour of those using ecosystem services. Thus, a double-layer management model can be established in Lugu Lake region. This management model (Figure 2) is composed of natural ecosystem management, such as maintenance, restoration and reconstruction of natural ecosystems, and the macro-control of the social economy, such as planning, investing and decision making in regional development.

Figure 2 shows that a balance can be maintained between the natural ecosystem and the socio-economic system to ensure sustainable supply of ecosystem services through ecosystem management. We analysed the impact of socio-economic development on the ecological system to promote harmonious development of both socio-economic and ecological systems, and to achieve sustainable development by the macro-management of planning, investment and decision making in regional development.

Figure 2 Management model for regional ecosystem services

ECOTOURISM IN LUGU LAKE REGION

Ecotourism

Since 1983 when Ceballos-Lascurain first proposed the concept of ecotourism (Zhong and Xiao 2000), ecotourism has been widely used in regional tourism planning. It is usually linked to sustainable development initiatives, protected area conservation efforts, regional and community development strategies and tourism improvement approaches in the developing world (Stone and Wall 2003; Gao 2005). Ecotourism combines environmental responsibility with generation of local economic benefits that will have both a development impact and serve as conservation incentives (Wunder 2000). Ecotourism development can promote regional economic growth and increase funds for natural resource management and environmental protection (Boo 1990). Furthermore, by providing educational opportunities in nature and culture to tourists and local residents, ecotourism can raise tourists' eco-environmental values and awareness of eco-environmental protection, so as to advance protection of the eco-environment and ethnic culture (Ross and Wall 1999; Slinger 2000; Stone and Wall 2003).

Status quo of tourism development

Tourism development of Lugu Lake region has been rapid for over a decade. The number of tourists has increased from 36,000 in 1992 to 409,000 people in 2004, and income from tourism increased from 1.16 million Yuan in 1992 to 126.8 million Yuan in 2004 (at current prices). Although the number of tourists and the income from tourism have both undergone tremendous growth, the quality of tourism has not advanced significantly. Ecotourism in Lugu Lake region has three major weaknesses. First, most tourists visit only for sightseeing tours and stay for a short time, usually no more than one day. Second, tourism activities are monotonous, mainly sightseeing, rowing and attending Guozhuang dancing, an ethnic dance show in the evening. Third, Mosuo culture is not well presented to tourists because it is mysterious so most tourists did not understand it and only seek novelty. In addition, rapid development of tourism, particularly tourist numbers, has had many negative effects on local society, culture and the natural environment while bringing considerable income to the local community.

Importance and feasibility of ecotourism

In Lugu Lake region, because of its geographic remoteness and inaccessibility, there is little exchange of materials, culture and information with the outside world, and less interference in the natural landscape from human activities. The natural ecosystem and Mosuo traditional culture need to be preserved through high-quality ecotourism, which includes natural and cultural ecotourism (Ye 2006). Ecotourism could provide a means of using ecosystem services of Lugu Lake region synthetically and continuously. For example, the beautiful natural scenery is the result of regulating ecosystem services, such as soil and water conservation, water storage, climate regulation and waste treatment, and supporting ecosystem services, such as biodiversity preservation and O₂ release. Cultural services provided by the ecosystem, such as cultural diversity, the Mosuo society and scientific research, are significant cultural landscapes. Provisioning services can supply food and raw materials for tourists and local residents.

The local residents should be the main recipients of the benefit of ecotourism development so as to accelerate community participation in ecotourism. To advance community participation in ecotourism development, it is necessary to take the following measures: constituting a special department to receive residents' opinions and consultations that is responsible for organising resident training in tourism to enable their participation in tourism planning and policy making; providing business and employment opportunities to achieve sharing of economic benefits; training Mosuo guides; developing high-efficiency agriculture and setting up craft factories to supply the food and tourism merchandise to the area.

STRATEGIES TO ACHIEVE SUSTAINABLE DEVELOPMENT IN LUGU LAKE REGION

According to the critical problems of socio-economic development and goals of sustainable development in Lugu Lake Region, some constructive management measures and development strategies are proposed to better implement ecosystem service management and improve the ecotourism industry, and so achieve regional sustainable development.

Defining and strengthening planning

To meet the needs of both socio-economic development and ecological protection in Lugu Lake region, it is essential to establish a scientific management mechanism for protection and exploitation. Based on 'prevention first, integrating prevention with control, comprehensive protection and sustainable development for sustainable utilisation,' in accordance with relevant national laws and regulations, scientific planning should protect the unique cultural resources of the Mosuo and the natural and biological resources associated with the lake. Integrating protection of the regional environmental and tourism landscape, focusing on water pollution prevention of Lugu Lake and protection of the Mosuo culture, it is important to make detailed plans and constitute protection measures to prevent uncontrolled building and development in the region.

Intensifying protection of the Mosuo culture

The Mosuo culture is unique and should be effectively protected by adopting some of the following measures: respecting the self-development of Mosuo culture; establishing a museum and protecting villages and environment to ensure normal self-development; enhancing research for the protection and development of Mosuo culture through collecting and analysing data, including tangible and intangible cultural information, so as to improve the protection, development and inheritance of the Mosuo family structure, marriage patterns, dance, arts and festivals; strengthening civil education of Mosuo culture through appropriate courses at local primary and secondary schools. The Mosuo should be enabled to acquire education and training in their traditional culture and become heirs to their cultural heritage so as to prevent this rare culture from declining or disappearing.

Improving environmental protection and biodiversity preservation

Environmental protection should include protecting water quality and terrestrial ecosystems, and rational use of ecosystem services in Lugu Lake region. Water quality protection requires control of

non-point source pollution, appropriate disposal of domestic sewage and garbage, monitoring water quality of rivers flowing into Lugu Lake, and prohibiting motor vessels on the lake. Terrestrial ecosystems protection requires protecting and restoring the lakeside zone, returning some farmland to forest and grassland, and planning reasonable land use. Biodiversity protection places strong emphasis on taking relevant measures to protect unique species such as *Schizothorax luguahuensis* and *Ottelia acuminata*, protecting wetlands to attract birds and paying attention to the ecological importance of native trees.

Implementing adaptive ecosystem management

Adaptive ecosystem management (AEM) is the process of monitoring the effects of implementing management plans to ecosystems, the responses of ecosystems to management activity, and adjusting management plans and goals in accordance with the effects and responses, to protect native ecosystem integrity and achieve regional sustainable development (Holling 1995; Vogt *et al.* 1997). Because human understanding of nature is imperfect, there will be some uncertainty in ecosystem management (Lee 1993; Ludwig *et al.* 1993). AEM is well suited to managing ecosystems when there is uncertainty regarding how they respond to management actions (Holling 1978; Walters 1996; Prato 2005).

The implementation of adaptive ecosystem management in Lugu lake region contains the following steps. First, to identify management objectives, namely, to identify the size and border of Lugu Lake region. Second, to analyse the status and problems of regional socio-economic–natural ecosystems. Third, to implement ecosystem service evaluation and ecosystem function regionalisation. Fourth, to propose management goals, formulate and implement the corresponding management plan and relative measures and regulations. Fifth, to monitor and evaluate results of the implementing management plans and their influence on socio-economic–natural ecosystems in the region. Sixth, to adjust relative management goals according to responses of the socio-economic–natural ecosystems to management activities. Finally, to implement adaptive accommodation of

management plans, means and goals according to emerging problems in the management process so as to reduce uncertainties in ecosystem management.

Promoting community and public participation in management

Community participation in management (CPM), under the guidance of experts, relies on knowledge, understanding and responsibility to their own nationality and personal involvement of local residents. CPM is helpful in raising local awareness of the value of traditional culture and promoting initiatives to protect traditional culture. In particular, CPM could play crucial roles in protection and development of intangible cultural entities. Community and public participating in management will reveal and clarify any problems in socio-economic development and environmental protection and help in formulating and implementing management plans, policies and programmes acceptable to the communities.

Establishing an ecological compensation mechanism

It is essential to establish and develop ecological compensation mechanisms for residents in Lugu Lake region. Establishing an ecological compensation mechanism will help to resolve problems such as external non-economic problems of ecosystem services and unbalanced distribution of the benefit from tourism resources.

Strengthening overall cooperation of Lugu Lake region

As Lugu Lake region intersects two provinces, Yunnan and Sichuan, there are two respective management organisations in the region. Because of this administrative partitioning and lack of communication mechanisms between the two sides, policies and management systems are inconsistent in the region. Therefore, close cooperation among related management departments of the two provinces is essential for regional social and economic development, tourism resource exploitation, and eco-environmental protection. At

present, in order to establish cooperation between the two sides of Lugu Lake region, measures such as strengthening strategic coordination, information exchange, effective cooperation mechanisms and exploiting cooperation channels should be adopted.

CONCLUSIONS

The beauty of the natural landscape of plateau lakes and the unique Mosuo traditional culture are important for regional sustainable development in Lugu Lake region. To achieve this, it is important to exploit, use and protect the natural landscape and Mosuo traditional culture in a rational way. In Lugu Lake region, poverty, the fragile eco-environment, poor education, imbalanced regional development, and impacts of tourism development on the local environment and culture are the main problems for current local social and economic development. Therefore, implementing regional ecosystem services management and developing ecotourism will not only promote regional socio-economic development but also protect the eco-environment and ethnic culture, so that they can play important roles in achieving regional sustainable development. In addition, in the complex process of implementing regional sustainable development, measures such as perfecting regional development planning, intensifying protection of the Mosuo culture, improving eco-environmental protection and biodiversity preservation, implementing adaptive ecosystem management promoting community development and public participation in management, and establishing ecological compensation mechanisms, could help to set clear development goals and promote regional coordinated and balanced development of society, the economy and nature in Lugu Lake region.

ACKNOWLEDGEMENTS

This study was supported by the Chinese Academy of Sciences (KZCX3-SW-438), the National Natural Science Foundation of China (No 70325002) and the Social Welfare Research Programme of the Ministry of Science and Technology of the People's Republic of China (No. 2005DIB3J002).

REFERENCES

- Boo E. *Ecotourism: the potentials and pitfalls*. Washington DC: World Wildlife Fund; 1990
- Boyce MS and Haney A. *Ecosystem Management: Applications for Sustainable Forest and Wild Life Resources*. New Haven CT: Yale University Press; 1997:3–37
- Cheng SK and Shen L. The strategy for regional sustainable development in the Qinghai–Tibet Plateau. *Resources Science* 2000;22(4):2–9
- Costanza R, d’Arge R, de Groot R, *et al*. The value of the world’s ecosystem services and natural capital. *Nature* 1997;387:253–60
- Daily GC. What are ecosystem services? In Daily GC (ed.), *Nature’s Services: Societal Dependence on Natural Ecosystems*. Washington DC: Island Press; 1997: 1–10
- Deng QY. The example of Lugu Lake for harmonious development of culture, environment and economy of ethnic peoples who live beside plateau lakes. *Journal of Guangxi University for Nationalities* (Philosophy and Social Science) 2003;25(2):35–9
- Gao J. Ecotourism: regional sustainable development strategy and practice. *Tourism Science* 2005;19(6): 67–71
- Guo LX, Wan Y, Lin JP, *et al*. The effect of construction of a protective region on the natural-social-ecological system of Lugu Lake. *Yunnan Geographic Environment Research* 1996;8(1):37–49
- Holling CS. What barriers? What bridges? In Gunderson LH, Holling CS and Light SS (eds), *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. New York: Columbia University Press; 1995:3–34
- Holling CS. *Adaptive Environmental Assessment and Management*. Chichester: John Wiley; 1978
- Lee KN. *Compass and Gyroscope: Integrating Science and Politics for the Environment*. Washington DC: Island Press; 1993
- Li J. The influences of ecological changes in villages on ethnic cultures: studies on villages around Lugu Lake. *Thinking* 2004;30(2):98–102
- Lu ML and Liu WG. A study on regional sustainable development theory. *Geographical Research* 1998; 17(2):131–7
- Ludwig D, Hilborn R and Walters CJ. Uncertainty, resource exploitation, and conservation: lessons from history. *Science* 1993;260(17):17–36
- Millennium Ecosystem Assessment. *Ecosystems and Human Well-being: Synthesis*. Washington DC: Island Press; 2005
- Millennium Ecosystem Assessment. *Ecosystems and Human Well-being: Assessment framework*. Washington DC: Island Press; 2003
- Ma SJ and Wang RS. Social-Economic–Natural Complex Ecosystems. *Acta Ecologica Sinica* 1984; 4(1):1–9
- Maltby E, Holdgate M, Acreman M and Weir A. *Ecosystem Management: Questions for Science and Policy*. London: RHIIR; 1998
- National Planning Committee of China, National Science and Technology Committee of China. *China’s Agenda 21: White-book of China 21st Century Population, Environment and Development*. Beijing: China Environmental Science Press; 1994
- Ouyang ZY and Wang RS. Ecosystem services and their economic valuation. *Chinese Journal of Applied Ecology* 1999;10(5):635–40
- Prato T. Bayesian adaptive management of ecosystems. *Ecological Modeling* 2005;183:147–56
- Qin BQ. Analysis of the influence of climatic change on inland lakes. *Scientia Geographica Sinica* 1993; 13(3):212–19
- Ross S and Wall G. Ecotourism: towards congruence between theory and practice. *Tourism Management* 1999;20:123–32
- SCLGOPAD (State Council Leading Group Office of Poverty Alleviation and Development). *The list of 592 key counties for poverty alleviation and development*. http://www.cpad.gov.cn/data/2006/0831/article_2758.htm; 2006
- SDRTCAS (Sustainable Development Research Team, Chinese Academy of Sciences). *Strategic Report: China’s Sustainable Development, 2003*. Beijing: Science Press; 2003:37–9
- Shen YM and Mao HY. The systematic study of theoretical problems on regional sustainable development. *Progress in Geography* 1999;18(4):287–95
- Slinger V. Ecotourism in the last indigenous Caribbean community. *Annals of Tourism Research* 2000;27:520–3
- Stone M and Wall G. Ecotourism and Community Development: Case Studies from Hainan, China. *Environmental Management* 2003;33(1):12–24
- Vogt KA, Gordon JC, Wargo JP, *et al*. *Ecosystems: Balancing Science with Management*. New York: Springer; 1997
- Walters CJ. *Adaptive Management of Renewable Resources*. New York: Macmillan; 1996
- Wan Y and Guo LX. Crisis factors and control approaches for the special natural–social ecological system of the Lugu Lake area. *Resources and Environment in the Yangtze Valley* 1997;6(3):211–15
- World Commission on Environment and Development. *Our Common Future*. New York: Oxford University Press; 1987

- Wu XR and Yang D. Analysis and research on reasons for Mosuo children discontinuing their studies. *Journal of Southwest China Normal University* (Humanities and Social Sciences) 2005;31(4): 90–3
- Wunder S. Ecotourism and economic incentives — an empirical approach. *Ecological Economics* 2000;32: 465–79
- Yang YF, Shen Y and Ye W. Some thoughts on tourism development of Lugu Lake. *Journal of Yunnan Normal University* 2003;23 (suppl):122–6
- Yao JL. An investigation and problem analysis of types of elementary education of the Mosuo people in Lugu Lake area. *Journal of Research on Education for Ethnic Minorities* 2004;15(4):22–7
- Ye W. *Value Dimensions of Tourism Planning: Ethnic Cultures and Sustainable Development of Tourism*. Beijing: China Environmental Sciences Press; 2006:91, 161–2, 186–7
- Yunnan Provincial Environmental Protection Bureau. *Report on Environmental planning of Lugu Lake watershed*; 1998
- Zhao JZ, Liang XY and Zhang XD. System analysis on the definition of sustainable development. *Acta Ecologica Sinica* 1999;19(3):393–8
- Zheng H, Ouyang ZY, Zhao TQ, *et al.* The impact of human activities on ecosystem services. *Journal of Natural Resources* 2003;18:118–26
- Zhong LS and Xiao DN. Ecotourism and its planning and management, a review. *Acta Ecologica Sinica* 2000;20(5):841–8
- Zhong ZX. Verbal literature and folk customs in Mosuo villages around the Lugu Lake region. *Journal of Hubei Institute for Nationalities* (Philosophy and Social Science) 2002;20(2):1–11
- Zhou HS. *A region of no fathers and no husbands*. Beijing: Guangming Daily Press; 2001