Protected area-people connectivity in Qinling Zhongnanshan UNESCO Global Geopark, China

(中国，秦嶺・終南山ユネスコ世界ジオパークにおける

保護地域と人の結合性)

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Abstract

It has been widely considered that protected areas (PAs) serve as the first line of protecting global biodiversity. Recently, many researchers suggested that popularity of mountain recreation has increased and that a potential for related ecological impacts to the ecosystems of mountainous areas has risen. As of 2018 China is a “mega-diversity” country with 21.02% of the territory as PAs, which include 217 national geoparks. As a world’s leading country of geoparks, China has 37 members of the UNESCO Global Geopark Network. However, most China’s geoparks were designated from the existing national parks or scenic areas; therefore, it is common to see geoparks with more than one title and under the management of many agencies. China has made great progress in nature conservation; however, negative effects of China’s PAs have been indicated as well.

This study aims at exploring the connectivity among different stakeholders of China’s PAs, their perceptions towards PAs and the forest cover change. That is why this study has chosen the Qinling Zhongnanshan United Nations Educational，Scientific，and Cultural Organization (UNESCO) Global Geopark (QZUGG) as a study area. The QZUGG is located in the south of Xi’an city. It is composed of eight different scenic spots, namely, the Zhuque, the Taiping, the Cuihuashan, the Wangshunshan, the Heihe, the Lantian, the Lishan and the Nanwutai. Each of them is either a National Geopark or a National Forest Park. From May 18th, 2017 to June 28th, 2017. 1153 questionnaire surveys were conducted with 164 local residents, 640 on-side visitors, 213 citizens and 136 students (in total 1153 respondents). Four interviews were done with four management officials from the Zhuque, the Taiping, the Wangshunshan and the Cuihuashan (one for each) to detect any significant differences between different groups. For the detection of forest cover change before and after the establishment of

this geopark, a GIS approach was employed. Satellite images of years 2003, 2009, and 2016 were processed and classified into forest and non-forest areas.

Results on the satellite image analysis showed the QZUGG experienced a forest cover decrease from 2189 km^2 in 2009 to 2096 km^2 in 2016. Statistical differences have been found between management officials and other respondents towards entrance fee, parking fee, resource abundance and resource appreciation at a significant level of 0.000, showing that management officials were more satisfied. This study also has found significant differences about perceptions towards the following aspects: opinions on trekking trails construction and planning, on guide maps, on educational service, on nature protection and on the quantity of artificial constructions (p-value ranges from 0.000 to 0.009).

Results of the questionnaire survey showed that most local residents living in or around the QZUGG are engaged in their full-time jobs for the geopark and more than 33% of the respondents' all family members are involved in the jobs there. The respondents reported that more than 60% of their household's total income was generated from the QZUGG. All the respondents in the Wangshunshan scenic spot whose farmland was requisitioned had received some financial compensation; however, none of the Zhuque respondents had been compensated. Some of the respondents from Taiping (26.3%) and a few Cuihuashan respondents (4.7%) reported that they had received financial compensation.

This study has identified gaps among different stakeholders. Eight scenic spots are suggested to strengthen their mutual connection to produce a comprehensive management scheme. In order to eliminate local people's complaints due to the uneven compensation and limited job opportunities, the Geopark should provide sound

compensation plan and more job opportunities in management posts. The geopark should also provide more geo-education to both local residents and visitors. By introducing new and appropriate notion of nature conservation, gaps identified would be bridged in the future, hence, a strong connectivity.

This study presented a new research model by using a concept of connectivity to explore gaps' existence among different stakeholders of the Geoparks in China. This is helpful to organize and analyze complex relationships among many concerned groups.

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Chapter 1 Introduction

1.1 Research background description

It has been widely considered that protected areas (PAs) serve as the first line of the effort of protecting global biodiversity (Brooks 2004; Chape et al. 2005; Loucks et al. 2008; Rodrigues et al. 2004; UNEP-WCMC 2007). Protected areas (PAs), crucial parts needed by all global conservation strategy (Leung et al. 2015), increased on our planet from less than 1 million km^2 in 1970 to 12.2 million km^2 by 1997 (Zimmerer et al. 2004). Based on this growth rate, Vedeld et al. (2012) predicted that the PAs areas were going to increase to 17 million km^2 (10% of the earths terrestrial environment), spreading out more than 100,000 areas. Mitchell et al. (2008) pointed out that nowadays one-tenth of the surface of our planet is protected area under some certain. However, those are absolutely underestimated figures, as Chape et al. (2005) indicated that there had been already over 100,400 PAs conserving more over 20 million km^2 which accounts for 12% of the earth's terrestrial environment. Herren et al. (2005), on the other hand, indicated that PAs had increased exponentially over 25 years. It can be observed some differences between researchers' estimations which could be explained by different methods adopted in studies (Jenkins and Joppa 2010). PAs have been increasing dramatically in area and number. Especially in recent years, more PAs have been set up globally.

Taking a look at the data from Protected Planet (2017a), within only eight months of 2016, coverage increase was observed in all three types of PAs all over the world, i.e., Terrestrial area including inland waters, Marine areas within national jurisdiction and Global ocean (Table 1.1). This clearly shows a positive sign that people are much more aware of the significance of PAs and they are trying to protect the natural environment

by setting up more and larger PAs around the world.

Table 1.1. Increase in three types of PAs all over the world in 2016

Type	PA coverage (%)		Change in protected area coverage (km^2)
	April 2016	December 2016	
Terrestrial area including inland waters	14.7	14.8	161646.0
Marine areas within national jurisdiction	10.2	12.7	3623637.0
Global ocean	4.1	5.1	3623777.0

Source: summarized based on Protected Planet (2017a).

Furthermore, Protected Planet (2017a) lately reported via their final database update for 2017 that there are already 236,200 PAs covering more than 45 million km^2. Compared to 2016, 4,000 sites and almost 7 million km^2 were added. As of July 2018, this figure increased to 238,563 (UNEP-WCMC, IUCN, and NGS 2018). Those are strong evidences that PAs are increasing very quickly; however, it was found that the geographic distribution of those PAs is not even, particularly the ones with the strictest protection levels (Brooks 2004; Chape et al. 2005; Hoekstra et al. 2005; Soutullo, et al 2008; UNEP-WCMC et al. 2018).

This chapter will brief some relevant information of PAs, recreational activities and their situation in mountains around the world. Also, current situations in China will be described. Furthermore, relationship and conflicts between local residents and PAs, also other users' perception are going to be discussed. Then the research objectives of the thesis will be proposed and the outline as well as structure of the present thesis will be provided.

1.1.1 Global state quo

Nowadays, quite many people would like to enjoy taking a vacation (an example of

recreational use of PAs) or some recreational activities in nature, which is located away from urban areas (Chavez 2000; Drábková and Šišák 2013; Fredman 2004; Watson et al. 2000). Those recreational activities can take various forms; for example, vegetation and wildlife observations, sight-seeing, photography, bush-walking, mountain biking, skiing, horse riding, geo-catching, hiking and camping (Cole 2004; Marion and Leung 2001; Marion and Wimpey 2007; Marzano and Dandy 2012; Patubo 2010; Törn et al. 2009; William and Science 2006; Wolf et al. 2012).

The potential of impacts on the environment also grows while the recreational use of PAs increases. This turns into a concern, because an increasing visitation may cause negative impacts on environment in PAs (Bodoque et al. 2017; Farrell and Marion 2001; Fredman 2004), especially the areas which bare high value of conservation, and are very sensitive to disturbance and take long time to recover (Das and Chatterjee 2015; Patubo 2010; William 2006). Therefore, managers of many natural PAs have to think about how to accomplish their tasks of striking a balance between ensuring nature conservation and providing visitors with desired recreational opportunities (Tomczyk et al. 2017). In heavily visited areas, for example, urban-proximate areas in which wildlife and plants are already threatened, managers have to face this daunting challenge (Hockett et al. 2017).

1.1.1.1 An introduction to Protected areas (PAs)

Protected areas can be broadly regarded as delimited areas which have specific restrictions on human activities, although they can take many different forms or under various titles (Jenkins and Joppa 2010). In 1994, the International Union for Conservation of Nature (IUCN) has defined protected areas in their guidelines as “an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed

through legal or other effective means". Two essential elements of importance have been pointed out by this version of definition; First, what are the protection targets, and second, management is a crucial aspect of this protection (William 2006).

In 2008, IUCN has revised and defined PAs as "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley 2008), which is the new version of definition. The new version of definition is explained phrase by phrase by IUCN as it is the first step (to decide whether a site meets the definition) of applying procedure. This is the prerequisite for determining which category a specific site falls into (Appendix 1).

IUCN (2013) has defined six categories for protections due to the fact that the management objectives are multi-faceted (Appendix 2). Each of the categories is further described under a series of headings, respectively (Solton, et al. 2013), i.e.:

- Primary objective(s);
- Other objectives;
- Distinguishing features;
- Role in the landscape seascape;
- What makes the category unique; and
- Issues for consideration.

However, there are indeed some common objectives to all six protected area categories (Table 1.2) (Dudley 2008). According to IUCN (Dudley 2008), within each of these categories, there may be multiple objectives. For example, in national parks, category II, to preserve species and genetic diversity, to maintain environmental functions and to provide recreational opportunities are the primary objectives. There are some

secondary objectives, i.e., scientific research, wilderness protection and the protection of natural and cultural features, which are considered to be compatible with the development of these PAs.

Table 1.2. Common objectives of all categories of PAs

All protected areas should aim to:	All protected areas should also aim where appropriate to:
1. Conserve the composition, structure, function and evolutionary potential of biodiversity;	1. Conserve significant landscape features, geomorphology and geology;
2. Contribute to regional conservation strategies (as core reserves, buffer zones, corridors, stepping-stones for migratory species etc.);	2. Conserve significant landscape features, geomorphology and geology;
3. Maintain diversity of landscape or habitat and of associated species and ecosystems;	3. Conserve natural and scenic areas of national and international significance for cultural, spiritual and scientific purposes;
4. Be of sufficient size to ensure the integrity and long-term maintenance of the specified conservation targets or be capable of being increased to achieve this end;	4. Deliver benefits to resident and local communities consistent with the other objectives of management;
5. Maintain the values for which it was assigned in perpetuity;	5. Deliver recreational benefits consistent with the other objectives of management;
6. Be operating under the guidance of a management plan, and a monitoring and evaluation programme that supports adaptive management;	6. Facilitate low-impact scientific research activities and ecological monitoring related to and consistent with the values of the protected area;
7. Possess a clear and equitable governance system.	7. Use adaptive management strategies to improve management effectiveness and governance quality over time;
	8. Help to provide educational opportunities (including about management approaches);
	9. Help to develop public support for protection.

Source: summarized based on Dudley (2008).

1.1.1.2 Protected areas in mountainous landscape

Any places where mountains are present can be thought of a mountainous landscape

(Worldatlas 2019). Mountains are one of the major geographical landforms in our environment. Mountains' prominence distinguishes themselves from the other landforms (Lew and Guosheng 2015). There are many definitions of mountains (Price 2015). For example. to be defined as mountainous, a place has to have an altitude which varies by at least 300 m over a radius of 7 km (Blyth et al. 2002). If applying this definition to digital terrain models, it can be found out that 27.5% of the total land area of the Earth is mountains (Blyth et al. 2002) (Table 1.3).

Table 1.3. Mountainous landscape percentage by regions

Continent/region/earth	% of the earth's total land area	% of the earth's mountainous land area	% of continent/region/earth that is mountainous
Antarctica	9.2	15.6	46.7
Eurasia*	32.7	44.4	37.3
North America*	16.5	17.5	29.0
South America	12.0	8.4	19.2
Africa	20.4	10.5	14.2
Australia and Southeast Asia	10.4	3.6	10.4
Total	100.0	100.0	27.5

Source: prepared based on Blyth et al. (2002).

Note: * Eurasia excludes southeast Asia; North America includes Greenland.

There are 197 out of world's 237 countries which have mountains on their territories (IUCN 2019). Mountains and areas around them are the home to approximately one-fourth of human population (Price 2015) and nearly half of these people live in the Asia/Pacific region (Anon 2008). They exert indirect impact on more than half of life the world's human-kind (Slaymaker and Embleton-Hamann 2015). Körner and Ohsawa (2005) estimated that mountains hold 32% of PAs, 9345 PAs covering about 1.7 Mkm^2. Furthermore, in 2018, mountainous areas represent 138 sites inscribed on the World Heritage Sites List, which is approximately 12.6 of the 1092 sites on the list (UNESCO World Heritage Centre 2018).

Mountain regions house half of the global biodiversity hot spots (Kohler et al. 2010) and are a vitally significant ecosystem (Cater 2015). Increasing attention in science has been paid to mountains (Viviroli et al. 2007). For centuries if not millennia, mountains have been very important for people at very broad scales, from reginal to intercontinental because of the following reasons (Price 2015):

- sources of food;
- sources of valuable minerals and precious stones; and
- places of great cultural importance.

Many researchers hold similar point of views. For academic reasons, mountains are important because they are of scientific significance and provide environmental process and functions (Körner 2003). In a sense of cultural aspect, mountains also have their importance for those people who live within them or places nearby because of the long association they have had with mountains (Nepal 2002; Woodwell 2004). For many communities living in mountainous areas, they see mountains as the highest and most sacred values and beliefs of culture and traditions (Bernbaum 2006; Chen 2015; Kollmair et al. 2005; Shen et al. 2012).

Mountains are also significant from a perspective of environment. Mountain catchment areas are the place where the bulk of terrestrial water supply either in the form of rain or snow. Precipitation in the form of snow in mountains can be stored for a long period of time which in turn melts as constant water supply to rivers and streams (Viviroli et al. 2007; Weingartner and Pearson 2001). From this aspect, mountains have been described as the water towers of the world because they are actually headwaters of many rivers (Viviroli et al. 2007).

Mountains are important for world's remaining natural biological diversity as well as

much of it is found in mountainous areas. Those areas are often featured with high endemism of species because of the rapidly changing climate situation related to increasing elevation (Körner and Ohsawa 2005). The development of unique ecosystems occur in mountains which provide significant environmental function and services (Hamilton et al. 2004).

Although they are giants of nature, mountains could be in danger. Projects planned for the future, for example, construction of roads, dams, pipelines, mining and other development projects, threated about 25% of the mountainous regions of the whole world (Watchtower Online Library 2005). Moreover, mountains can be exerted some negative impacts by a range of human activities. For example, excessive use of resource like water for hydroelectricity, forests for firewood, grassland for stock grazing; natural landscape for development of recreational activities such as hiking, camping, skiing and horse riding have been documented (Hamilton et al. 2004; Ng et al. 2018; Törn et al. 2009).

1.1.1.3 Recreational activities in mountainous PAs

Mountainous areas, including those within the scope of PAs attract many recreational activities participants (Leung and Marion 1999; Pickering and Buckley 2003). Mountain-based tourism usually includes outdoor recreational activities. During winter seasons, snow-based recreational activities are commonly popular in resorts (William 2006). Hiking, bush walking, mountain biking and camping are undertaken the most in mountains (Barros et al. 2013; Marzano and Dandy 2012; Ng et al. 2018). Some researchers have recently suggested that mountain recreation and tourism have seen an increasing trend; hence, the potential for related ecological impacts to the ecosystems of mountainous areas has risen (Geneletti and Dawa 2009; Godde et al. 1999; Nepal and Chipeniuk 2005). This growing trend of visitation to fragile mountain parks and

summits is very important to sustainable management of visitor use (Monz et al. 2010).

No matter what forms they take, recreational activities can produce certain impact on the environment which are often negative leading to unfavorable changes to the environment of nature (Deng et al. 2003; Dixon et al. 2004; Kidd et al. 2015; Marion and Wimpey 2017; Marzano and Dandy 2012; Tomczyk et al. 2016). Some previous research has documented the different forms of those negative impacts, i.e., soil compaction and erosion, trampling on vegetation, wild life disturbance, water pollution, aquatic impacts, visitor crowding and use conflicts (Barros et al. 2013; Monz et al. 2010; Newsome et al. 2012), which could lead to unacceptable changes in resource conditions as well as the visitor experience, i.e., plants and animals' population decrease, crowding and visitors' conflicts. Acute negative impacts can be taken place in areas where rare and sensitive ecosystems are found, and high-density use is going on (William et al. 2015). Those negative impacts could grow from local scape to a degree of widespread because visitation to many PAs increase (Fredman 2004; Marion and Leung 2004). There are some factors which can contribute to those impacts of recreational activities in amount and degree. Cole (2004) indicated that amount of use, type of use, timing of use and the resilience capacity of the disturbed areas are often determinant factors. It is essential to understand the relationships between those factors (William 2006).

Actually, those changes and impacts to some degree are inevitable from recreational use of the environment. Monz et al. (2010) pointed out that visitors' behavior is the dominant factor to govern the intensity and proliferation of those negative impacts. Therefore, managers are often faced with influencing visitor behavior to achieve resource protection and visitor experience provision objectives (Kidd et al. 2015). Indeed, it is quite common for many managers of protected areas to face the challenge and task of balancing the contradiction of delivering social and economic benefits while

preserving the PAs' natural characteristics (Kazmierow et al. 2000; Pickering 2010).

1.1.1.4 Local residents and visitors in PAs

Even though some PAs including natural parks are located in remote wilderness, many rural communities either had been living there well before the establishment of these PAs or have resettled due to the designation. Additional population also could be attracted to move to those PAs (Buta et al. 2014). For example, in Africa and Latin America, it may not be surprising to notice that high population growth has happened along PA' borders (Wittemyer et al. 2008). This can be explained by the park-focused integrated conservation and investment made by international donor agencies for rural development (Balmford et al. 2003; Scholte 2003; West et al. 2006a). Many local people depend on natural resources such as forest in PAs, which plays a significant role in their livelihood, rural areas in particular. In Lao People's Democratic Republic, there are approximately 80% people living in rural areas who are dependent heavily on natural resources for their basic needs and subsistence (Gynecol 2005).

Tourism is one of the largest economic sectors, creating job opportunities, driving exports, and generating prosperity across the world. Its contribution to global GDP is about 10.4% and it is growing faster than the other economic sectors, (WTTC 2018). Figure 1.1 shows tourism's contribution to global GDP and job opportunities.

As the important components of international tourism's industry, nature tourism and ecotourism, which are widely thought of as a growing segment of the tourism market, are enjoying a booming trend in both national parks and other PAs (Deng et al. 2003; Schägner et al. 2018). As indicated by Balmford et al. (2015), 8 billion nature tourists and ecotourists paid their visits to global PAs in 2015.

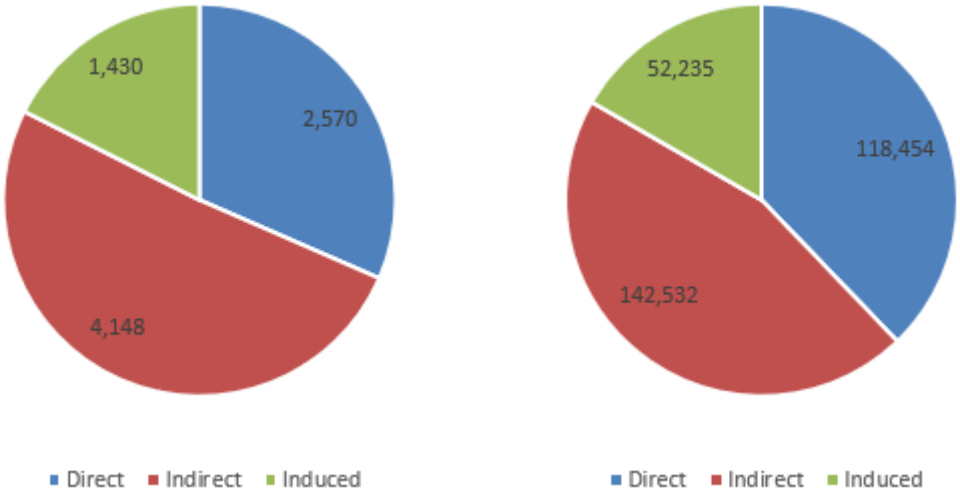

Figure 1.1. Breakdown of total contribution of tourism to Gross Domestic Product (left) and employment of the world (right), 2017; GDP in billion USD; number of employments (in thousand). Source: WTTC 2018.

1.1.1.4.1 Perception of local residents and visitors

It is suggested that there is a dynamic and complex relationship exiting among tourism, local livelihood and nature conservation (Njole 2011; Nyaupane and Thapa 2006). Environmental and ecological perceptions of different users are also complex, which should be understood (Imran et al. 2014). Degree of success or failure of sustainable conservation planning is dependent on the perception and attitudes towards PAs (Durrant and Shumway 2004; Faasen and Watts 2007; Kim and Daigle 2012; Lewis 2006). This is because active participation of local communities is needed when including local development into environmental conservation (Gerhardinger et al. 2009; Gillingham and Lee 1999; Hiedanpää 2005; Xu et al. 2006). Furthermore, some researchers pointed out that public perceptions, needs and preferences should be considered when making any evaluation to produce and enhance the planning process (Bennett and Dearden 2014; Priskin 2003). Roca et al. (2009) indicated that it is valuable to comprehensively understand local communities and residents' perception

towards PAs and their management, which can lead to a better management of environment and sustainable tourism.

Quality of visitors' experience can be influenced by environmental degradation (Deng et al. 2003). For example, litter issues, tree damage and severe tree-root exposure are commonly perceived by visitors (Leung and Marion 2000). Recreation types, the objective of different user groups and resource management can decide the judgement of visitor to be good or bad (William et al. 2015).

1.1.1.5 Conflicts between local residents and PAs

It is of value to understand the relationship between people and PAs in order to achieve an effective management, gain support from community for conservation initiatives, maintain social wellbeing, and promote tourism and recreation development (McCleave et al. 2006). From a historical perspective, PAs have always been regarded as lonely islands where biodiversity conservation is conducted, and little or no connection and relationship exiting between them and nearby humankind (Buta et al. 2014). In some PAs in Tanzania, local people are excluded and denied their access and rights to those areas (Vedeld et al. 2012). Some more recently done studies acknowledged that collaboration, involvement and support of local people can lead to successful management of PAs (Barkin and Pailles 2014; de Beer and Marais 2005; Marzano et al. 2012).

However, the conflicts between protecting and access to natural resources are inherently inevitable. Although this situation is even acute in developing countries in particular since their need for natural resources to support rapidly growing population is increasing (Allendorf et al. 2007; Nagendra et al. 2006). Under such a circumstance, local people often think of natural conservation as legal constraints rather than

economic opportunities (Shemweta and Kidegesho 2000). People living in proximity to PAs also can experience some negative impacts, such as damage or loss of crops and livestock, deprivation of resource access, even injury and death happen to them (DeFries et al. 2010a). People who are prohibited from the access to grazing lands in PAs or other resources can also cause negative attitudes (Schelhas et al. 2002; Tessema et al. 2010).

1.1.2 UNESCO global geoparks

Geoparks are regarded as an innovation for the protection of nature and geoheritages, and the pioneers in the development of geotourism by Farsani et al. (2011). They also stated geoparks not only help develop geotourism but also create job opportunities, economic activities and bring especially rural regions additional sources of income. This is because both European Geoparks Network (EGN) charter and Global Geopark Network (GGN) regulations require all geoparks to be established in rural areas (Zouros 2003).

1.1.2.1 Definition of geopark

United Nations Educational, Science and Cultural Organization (UNESCO) clearly defines a global geopark as:

UNESCO Global Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development (UNESCO 2017).

It took a long period of meetings and discussions to create the definition of geopark because appropriated characteristics, structure and function must be taken into thorough consideration (Zouros 2000). The geoparks should not just consider sites of geological significance, and the whole geographical setting of the region should be included (UNESCO 2017; Yang et al. 2011). It is crucial to protect and preserve natural heritage

resources, especially in the areas where exhibition of the natural evolution of the Earth exists (Leman et al. 2008).

Geoparks philosophy can date back to the mid-1980s (Chen 2013), but the geoparks' philosophy has developed rapidly over the past decade (Xiao et al. 2018). Geopark is thought to be a groundbreaking concept, because it sets up a frame for a region's sustainable economic development as a prerequisite to the conservation strategy (Mc Keever and Zouros 2005). Geoparks are different from national parks as geoparks are intended to improve human development (Figure 1.2), which is in accordance with their goals (Farsani et al. 2011).

Now, three Geoparks' formal social scientific networks are functioning, i.e., UNESCO Global Geoparks Network (GGN), European Geoparks Network (EGN) and the Asia Pacific Geo-heritage and Geopark Network (APGGN). The concept of Geo-tourism and Geo-sciences have been introduced to geoparks by them (Farsani et al. 2014).

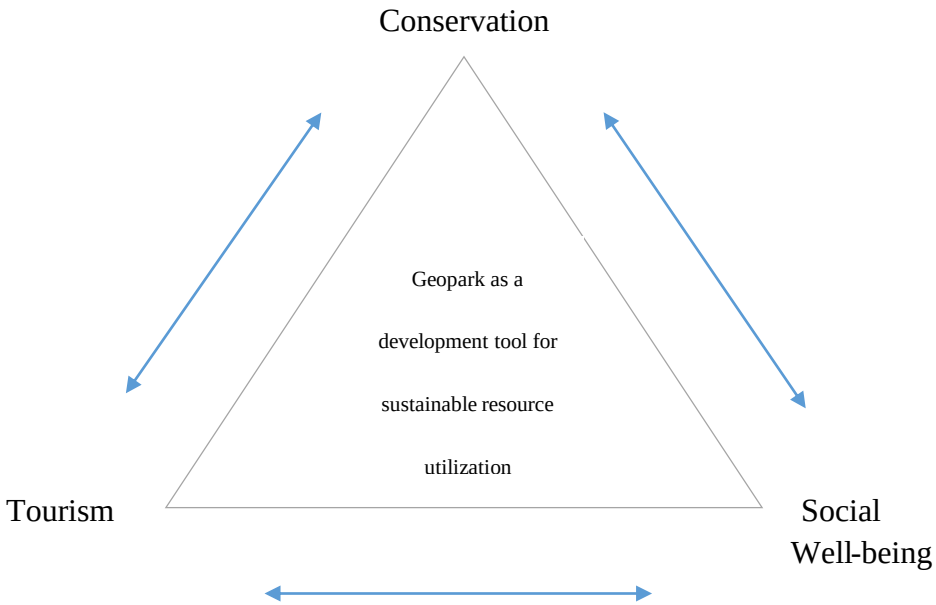

Figure 1.2. Geoparks and the components. Summarized based on Komoo (2010) and Halim (2011).

1.1.2.2 Difference from the national park system in North America

It has been a long history in the United States of America and Canada to primarily use national parks system to protect public land. Therefore, there are few areas which are classified as geoparks in North America (Nowlan et al. 2004). This system depends on the exclusion of development to conduct natural heritage protection. However, geoparks do not exclude inhabitants in and around the area. Geoparks are specifically intended to carry out sustainable development in order to improve the quality of local people's life (Boys 2012).

1.1.2.3 Comparison to UNESCO World Heritage Sites

UNESCO established the list of World Heritage Sites in 1972 for the reorganization of the natural and cultural sites of "outstanding universal value" (Arnberger et al. 2012). For many regions, the list of World Heritage Sites is an admittance with so high a standard that is too exclusive for them to be listed. Geoparks, all liked within one international program, in many ways share many similarities with World Heritage Sites (Nowlan et al. 2004). Geoparks acknowledge sites which are of either regional or national significance of geological or cultural heritage. Geoparks also take into consideration of the whole area rather than the sites of geological or cultural significance only. As such, by concentration on the interaction between economic and conservation efforts, geopark system actually brings a new dimension to the purpose of World Heritage Sites (Geoparks 2015).

1.1.3 China's situation

China is a large country with a vast territory and broad sea area. Within China's domain, a vast range of plant, animal, and micro-organism species, and diverse ecological complexes can be found. Thus, China is regarded as one of twelve "mega-diversity" countries (Zhao 2009). It is important not only for China but also for the entire world

to conserve China's biodiversity. However, China's biodiversity is under severe threats because of its huge population and rapid and ongoing economic growth (Shen et al. 2012).

It used to be believed by China's leaders that nature should and could be conquered by humans. However, this belief started to change in 1972 when a China's delegation attended the First United Nations Conference on the Human Environment (Qu 2000). Since then, China changed its environmental policy from "conquering nature" to "sustainable development based on harmonious co-existence of human and nature" (Diamond 2005). In 1983, environmental protection became a basic national principle in China and a broad strategy to achieve sustainable development was laid in 1994 (Editorial Board Environmental Protection in China 2000). China has also made participations into international treaties such as the Convention on Biological Diversity and the UN Millennium Development Goal. China has passed more than 100 environmental policies, laws and regulations (Diamond 2005).

1.1.3.1 PAs in China

It is of profound challenges to manage PAs in developing countries due to their widespread poverty, rapidly increasing population, economic growth and political instability (Naughton-Treves et al. 2005). As one of the fast-growing developing countries, China started its establishment of PAs from the mid-1950s (Zhang et al. 2017).

China's PA area takes up 21.02% of its territory (15.61% for area terrestrial; 5.41% for area marine) by 2018 (Figure 1.3) (Protected Planet 2017b). Many researchers have paid their attentions to China's PAs. Xu et al. (2009) pointed out that because of China's environmental impacts on national and international rate and scale, the unique

characteristics of environmental values and policy should be understood.

Zhou et al. (2017) revealed coniferous forest area had an increase of 214.3 ha in Donghai National Nature Reserve indicating the positive effect of reforestation. China has made great progress in nature conservation by having a national biodiversity strategy and action plan developed and implemented (Xu et al. 2009). However, negative effects of China's PAs have been indicated as well. Negative impacts of the current management systems on certain pheasant species conservation have been revealed by Zhou et al. (2017). Based on the analysis and comparison of pre- and post-establishment of Wolong Giant Pandas Reserve, Liu (2009) concluded that high-quality habitat lost in a higher rate after the establishment; habitat fragmentation inside the reserve was also facing a worse situation than that outside.

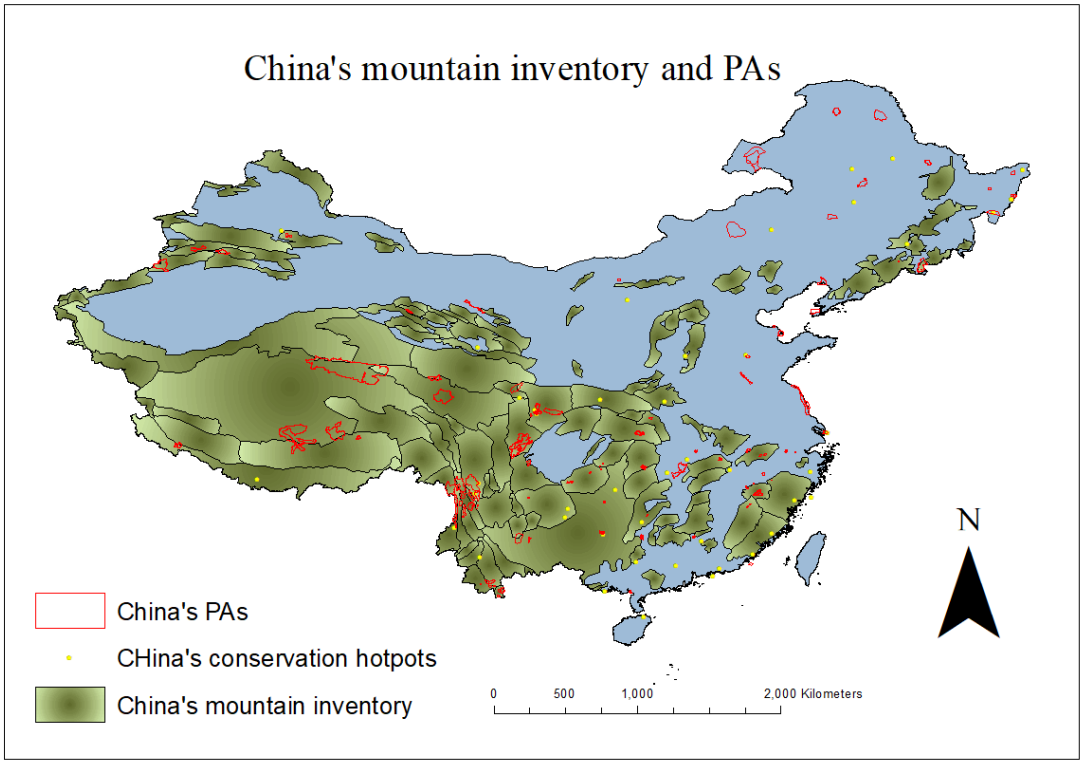

Figure 1.3. China's PAs distribution in 2019.

Besides National Reserves, China has other 10 types of PAs including Geoparks, Scenic Spots, Forest Parks, Wetland Parks, Aquatic Germplasm Resources Conservation Zones, Community-based Protected Areas, Special Marine Reserves, no-logging areas of Natural Forest Conservation Project (NFCP), no-grazing areas of the Return Grazing Lands to Grasslands Project, and National Park Pilots (NPPs) (Zhang et al. 2018), as shown in Figure 1.4. China has set up its national geoparks in several batches (8 batches till now with batch 8 currently under qualification evaluation) (Zhang et al. 2017). There are now 217 national geoparks, in which 37 are members of UNESCO Global Geopark Network (Appendix 3). Most China's geoparks were designated from the existing national parks or scenic areas; therefore, it is common to see a geopark with more than one title and under the management of many agencies (Table 1.4). Zhang et al. (2017) attempted to apply the IUCN's PAs management categories to China's according to Chinese government's management objectives (Table 1.5).

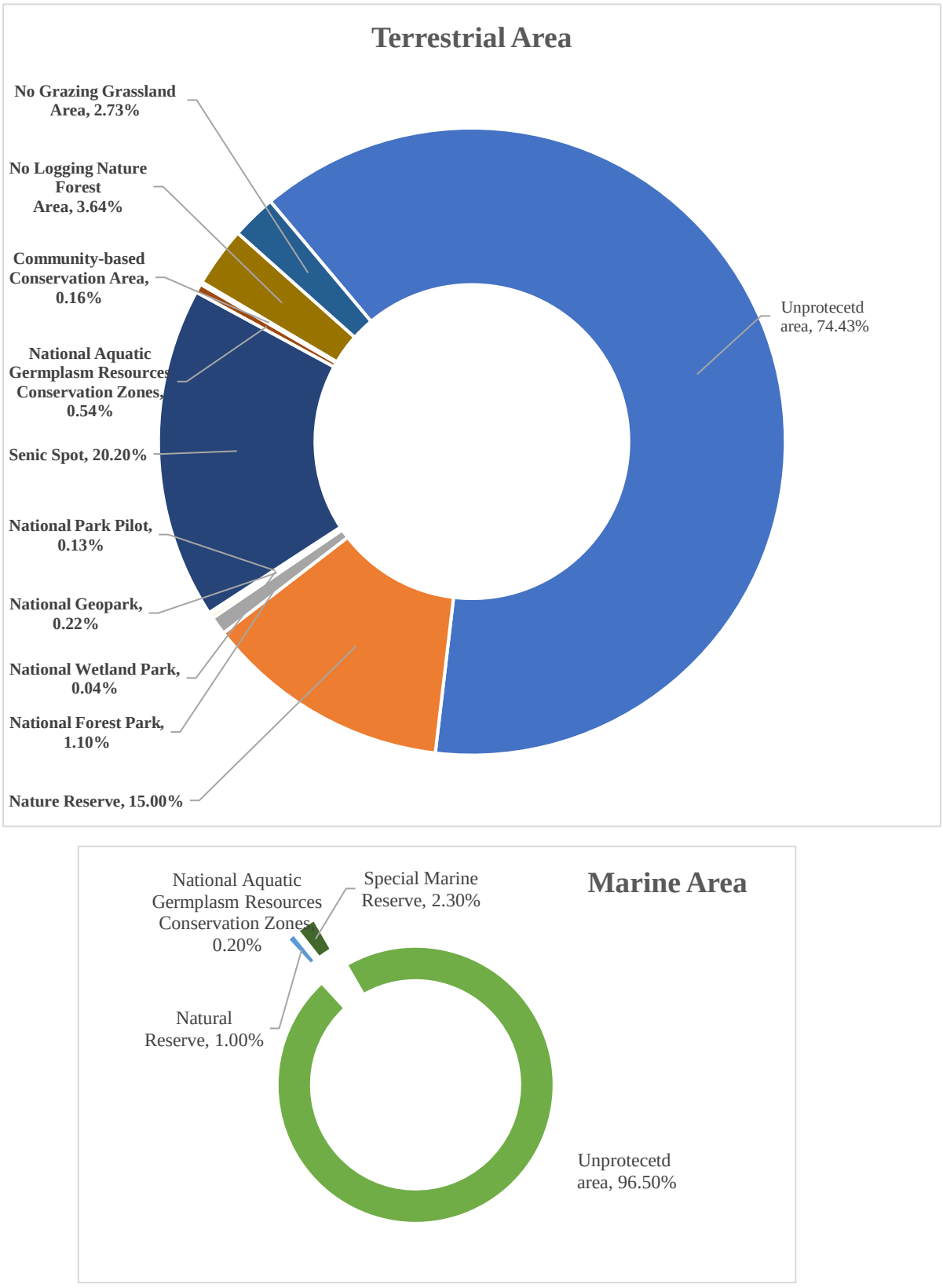

Figure 1.4. Proportion of different types of China's PAs (Source: summarized based on Zhang et al. (2017).

Table 1.4. Different designation superior administration departments of China

（Source：Summarized based on Ren et al. 2013）

National superior administrative department	Title designation	Initiation time	Number National
China National Tourism Administration	National 5A-rated tourist attractions	Rating system in 2002 5A rating system in 2007	259 as of 2018
Ministry of Housing and Urban-Rural Development of P.R. China	National Scenic Area	1982	244 as of 2018
	UNESCO World Heritage	1987	53 as of 2018
Ministry of Land and Resources of P. R. China	National Geopark	2000	217 as of 2018
	UNESCO National Geopark	2004	37 as of 2018

Table 1.5. Applying IUCN' PAs management category to China's PAs (Source: Summarized based on Zhang et al. 2017b)

Types of China's PAs	IUCN categories	Management Agencies*
Nature Reserve (the core zone and buffer zone)	Ia, Ib or III	SFA, MEP, SOA, MOHURD, MLR, MWR, MOA, CAS
Nature Reserve (the experimental zone)	V or VI	SFA, MEP, SOA, MOHURD, MLR, MWR, MOA, CAS
National Park Pilot	II	The Government of Yunnan Province
Scenic Spot	II, III, V	MOHURD
National Forest Park of China	V	SFA
National Wetland Park of China	II or V SFA	SFA
National Geopark of China	III	MLR
Special Marine Reserve	III, IV, V or VI	SOA
Community-based Conservation Area	IV	Coordinated by SFA
No-logging natural forest area	V	SFA
No-grazing grassland area	V	SFA
National Aquatic Germplasm Resource Conservation Zone	VI	MOA

* 1. CAS: Chinese Academy of Science; 2. MEP: The Ministry of Environmental Protection; 3. MLR: The Ministry of Land and Resources; 4. MOA: The Ministry of Agriculture; 5. MOHURD: The Ministry of Housing and Urban-Rural Development; 6. MWR: The Ministry of Water Resources; 7. SFA: The State Forestry Administration, and 8. SOA: The State Oceanic Administration.

1.2 Connectivity and protected area-people connectivity

In China, as many as 60 million people are living in or around PAs and they depend on the resources for their livelihoods (Zhou and Grumbine 2011). It is important to explore PAs-people connectivity in China. This part, the present research will examine various relationships among PA's stakeholders, including PAs-management agencies, PAs-state, PAs-local government, PAs-local residents and PAs-visitors. By doing so, a framework for the connectivity is organized (Figure 1.5). The term 'connectivity' is not new in scientific disciplines. For example, the term 'connectivity' has been used in ecology (e.g., Crooks and Sanjayan 2006; Hodgson et al. 2009), landscape research (Tischendorf and Fahrig 2000; Heller and Zavaleta 2009), hydrology (Amoros and Bornette 2002), sediment connectivity (Hooke 2003), climate change research (Hodgson et al. 2009), and geomorphology (Heckmann et al. 2015; Wohl et al. 2019). Furthermore, 'connectivity' is also well defined in the study of the governance for PAs (Lockwood 2010). In the foregoing literature review on PAs, it can be seen that much of the scholarship focuses on only one or several of the relationships. For example, Lockwood (2000) focused on the connectivity among governing bodies at different levels, but not among other stakeholders such as tourists and local residents. Therefore, research dealing with all these relationships within one study is important.

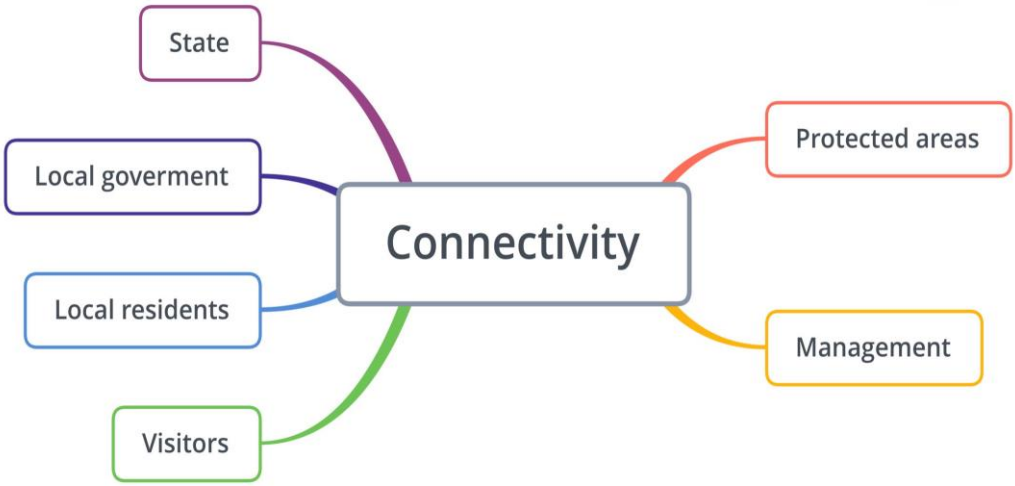

Figure 1.5. Connectivity framework in the present study.

1.2.1 China's PAs and profit generation

Usually, the state, an agent of capital, provides PAs to non-local agencies. These agencies can obtain profits from the commodification of parks (Dressler and Büscher 2008). However, this is a different story when it comes to China where nature tourism is dominated by state-owned firms. Zinda (2017) employed three cases of PAs, namely, Zhangjiajie-Wulingyuan, Jiuzhaigou, and Pudacuo, to show that China is spearheading the accumulation by tourism profit based on nature and is using it for state projects.

China's local governments have turned its protected areas across the country into high-volume tourism attractions (Zinda 2017). Local governments use their powers to sell using rights of certain lands to developers in order to generate revenue (Ho and Lin 2003; Tao et al. 2010; Xu et al. 2009). However, they cannot put PAs in the market. Although the central government is the main force of establishing protected areas, local governments are in charge of management and conservation tasks. Local governments

are able to supervise tourism development, which means the revenue and growth aims can be fulfilled by supporting tourism in PAs. Further, local governments use these returns to conduct infrastructure constructions out of PAs, expand scenic areas and spots, and enlarge central towns (Zinda 2017).

Similar to elsewhere in the world, China has a complex relationship of PA-local residents. Some already marginalized local residents are excluded from PAs by imposing restrictions and displacement policies (Yeh 2009; Liu et al.2013). However, local residents in some China's PAs have been included in the management and benefit sharing (Herrold-Menzies 2006; Weckerle et al. 2010).

1.3 Research objectives

According to the previous introduction, there are no studies presenting a whole picture of QZUGG. Therefore, it is of great significance to first deliver a panoramic description, including:

(1) What are the advantages and disadvantages as a UNESCO Global Geopark?

(2) What problems are there in this area?

(3) Why do visitors come here?

(4) What are the characteristics of the visitors to this area?

Then, this study also fills a research gap in the study discipline as was stated earlier that to our knowledge no studies have been conducted on perception perspectives of local residents and visitors towards this geopark. No research existed on exploring and understanding the people-park connectivity. It is hoped that some questions be addressed:

(1) How do local residents view this geopark?

(2) In visitors' eyes, how satisfied they are with this geopark?

(3) Do professionals and experts hold the same idea with residents and visitors?

(4) How about point of views from management officials?

(5) Any differences could be detected among those different users?

(6) How is people-park connectivity going on here?

As a UNESCO Global Geopark containing some China's National Geoparks and National Forest Parks, it is assumed that there should not be large-scale deforestation. However, it should be noticed that there still could have been vegetation cover change due to the construction of the facilities such as visitor center and parking lots. Therefore, a Geographic Information System (GIS) approach is intended to be applied to the detection. This part investigates into:

(1) Vegetation change before and after the designation of the geopark;

(2) Any difference in change trend among different scenic areas; and,

(3) The reason why those changes happened.

This study aims at exploring the connectivity among different stakeholders of China's PAs, their perceptions towards PAs and the forest cover change.

1.4 Justification and significance of the present research

The foregoing sections discussed that empirical evidence has proved the sharp increase of the number and coverage area of PAs all over the world in recent several decades, which clearly demonstrated that the common sense of environmental protection has grown. However, various problems facing the PAs also aroused. Many people's participation into the recreational activities in PAs produce negative impacts on the environment. Therefore, people should pay more attentions to better understanding and management of PAs.

To understand the connotation and to thoroughly study the disciplines of PAs and

geopark system is of great significance. This is especially true in China, because China is such a vast country regraded as a “Mega-biodiversity” territory, which means China bares huge impacts on both national and international rate and scale. After the change of China’s environmental policy from nature conquering to pursuing a sustainable development in order to achieve the harmonious co-existence with nature, many PAs have been established. It has been pointed out that many negative effects are facing China’s PAs. By this time, China has launched its new National Park development plan. This plan gives 2% of China’s national territory to the protection of rare species. Thus, it is high time for us to better understand China’s past experiences on PAs to provide some valuable insights to future planning and development. It is very important to consider the need of local communities, because some PAs are already home to them. Therefore, the relationship between local people, PAs and management officials is significant.

China established its first National Forest Park, Zhangjiajie National Forest Park; since then, the number of China’s various National Parks have increased rapidly (Wang et al. 2012). Liu (2007) has pointed out there had been two main drivers in China’s National Parks’ development. The first driver was economic development which has made many people have more vacation time and grow interest in outdoor recreational activities; the other was the introduction of the five-day workweek in 1995 and three “Golden Week” holidays from 1999-2007, which led to the substantial increase of the need for outdoor recreation and vacation venues.

Various problems emerged despite the National Parks’ intention to enhance ecological sustainability and raise people’s living standards. Many researchers pointed out problems. For examples, soil erosion and vegetation trampling (Buckley et al. 2017; Godde et al. 1999; Li et al. 2005; Pettigrew et al. 2012; Zhong et al. 2015). Like stated

above, many China's National Parks have been criticized for focusing on social and economic benefits (Wang et al. 2012). Li (2004) categorized China's National Parks as "self-founding organizations" because they have to support themselves by generating revenue, and furthermore, they have to make contribution to local economic development. Until now, there are 140 Geoparks on Global Geopark Network name list, of which, 37 (26%) is in China. "China is a pioneer and it is the driving force of the world Geoparks movement" announced the UNESCO Secretariat in 2012 (Fukami 2013).

Qinling Zhongnanshan UNSECO Global Geopark is one of the outstanding geoparks on the GGN list. It is highly necessary to investigate the relationship between local residents and geopark as is stated above that a positive residents-park relationship can enhance the management and conservation. However, to our knowledge, no previous research has touched this topic. Therefore, this study contributes to the understanding of the relationship situation in the study site. Moreover, not much research has been done to detect visitors' perception and opinions. It is also crucial to consider visors' ideas when making decisions on management and development on geoparks. Hence, the present study also provides referential and theoretical basis for the future construction and management of geoparks.

Chapter 2 Study area and methodology

Preliminary field survey had been conducted before the design and arrangement of this research. The first survey was done from October 30th to November 2nd in 2016, which was during off season of the study site. October 1st to 7th is China's National Day holiday, plus usual weekends and favorable temperature, which makes October's peak time for tourism activities (Sun and Li 2007). Therefore, it was assumed observation should be easier and more correct that after the peak time. Besides, the after-peak time situation and management efficacy could be seen. Those were the reasons why this period was chosen. Visitations have been paid to Cuihuashan National Geopark, Taiping and Zhuque National Forest Parks mainly to observe the general condition of the study site; for example, infrastructure construction including access convenience, hiking trails and other architectures. The author met a management official with whom an interview was conducted, which greatly helped with the research design.

Second field trip consisted of several times of visitations from May 2nd to June 11th in 2017 to different scenic spots of Qinling Zhongnanshan UNESCO Global Geopark (QZUGG). During this period, GPS data of most hiking trails were obtained by a handy GPS device (Ice 610, Beijing Ice Technology Company LLC) with an accuracy of 2.5 m. GPS data are to be used when conducting image analysis as ground truth points. In total, 2140 photographs have been taken to serve as a record of observed problems and references and as reminders and references for a final writing period.

2.1 Study areas

QZUGG is located in Xi'an, one of the cradles of Chinese civilization and a humanity birthplace (The Xi'an Organizing Committee for the 15th ICOMOS General Assembly,

2005**)**, Shaanxi Province, China. Xi'an is regarded as one of the "four ancient capitals" of the world. Xi'an has its significance nationally as well as internationally as is described by UNESO:

An ancient imperial capital and eastern departure point of the Silk Road, Xi'an (formerly Chang'an) has long been an important crossroads for people from throughout China, Central Asia, and the Middle East, and thus a hub of diverse ethnic identities and religious beliefs. The central location of Xi'an in what is now the Shaanxi Province, near the confluence of the Wei and Feng Rivers, helps explain why the area was the site of several important imperial capitals for almost a millennium of Chinese history. The first unified Chinese empire, the Qin Dynasty (221-206 BC), had its capital just north of the current city, where the impressive tomb complex of the Qin emperors was discovered, famously containing more than 8000 terracotta statues spread over some 56 square kilometers.

In recent several decades, Xi'an has seen an increase in both population, GDP, and tourist arrivals. From the 1990s, Xi'an never stopped its efforts to increase the number of residents leading to a sharp increase. Tourist arrivals kept increasing especially when some important events happened. For example, Beijing Olympics in 2008, Xi'an EXPO and Sild Road Tour campaign really did boost the arrivals number, although there have been some unfavorable situations, namely, SARS in 2003 and Wenchuan Earthquake in 2008 (Figure 2.1). However, those did not affect Xi'an's tourism industry to a serious extent.

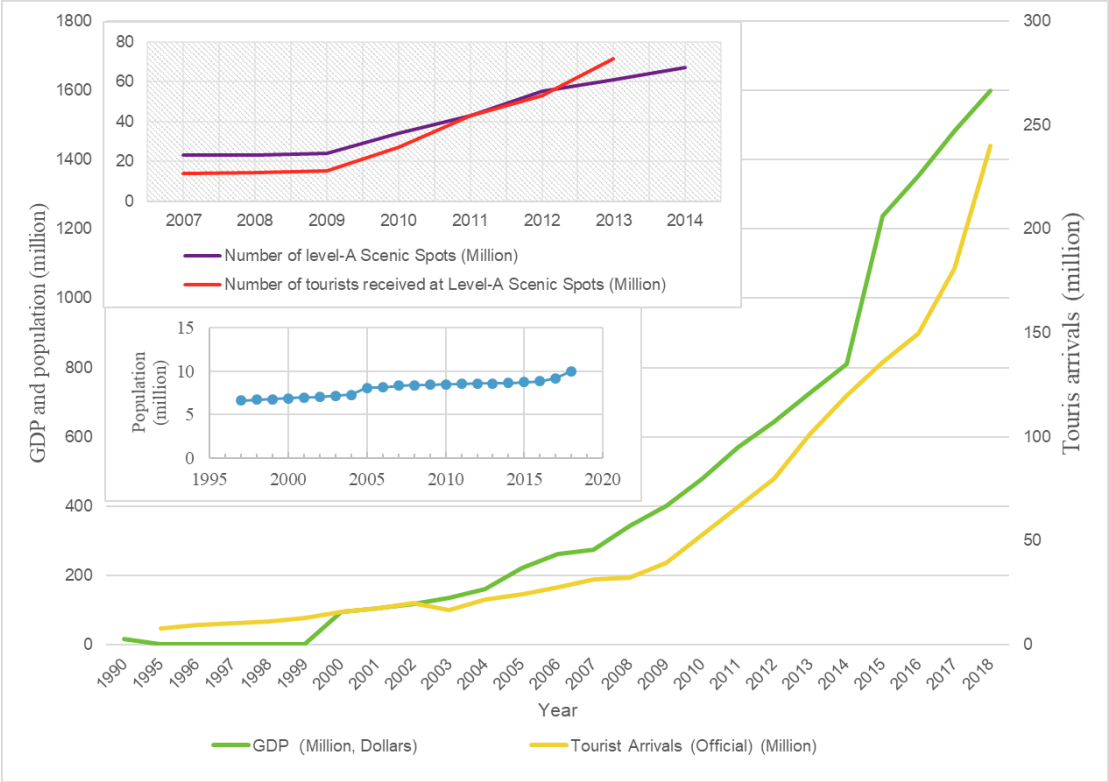

Figure 2.1 The trends of Xi'an's population, tourist arrivals to Xi'an, tourist arrivals to Level-A rated scenic spots, number of Level-A rated scenic spots and GDP; Level-A Scenic Spots is a rating system in China determining the attraction (Source: Shaanxi Statistical Bureau).

2.1.1 General picture of the Qinling Mountains

The Qinling Mountains is a biodiversity hotspot in China, which is internationally treasured (Zhang et al. 2017). It provides a natural and physical geographical boundary for China's north and south parts, and occupies the transitional region between subtropical zone and the warm-temperate zone of central China (Zhao et al. 2014a). It is also a significant watershed divide for China's Huanghe River and Yangtze River systems (Huang et al. 2012). The Qinling Mountains also hold outstanding geological features and is regarded as a refuge for many species on this planet (Shen et al. 2012). However, Zeng et al. (2011) indicated that rapid economic development and population

growth have brought major threat to the plants and animals in this region. The Qinling Mountains' elevation ranges from 61 to 3772 m (Figures 2.2 and 2.3).

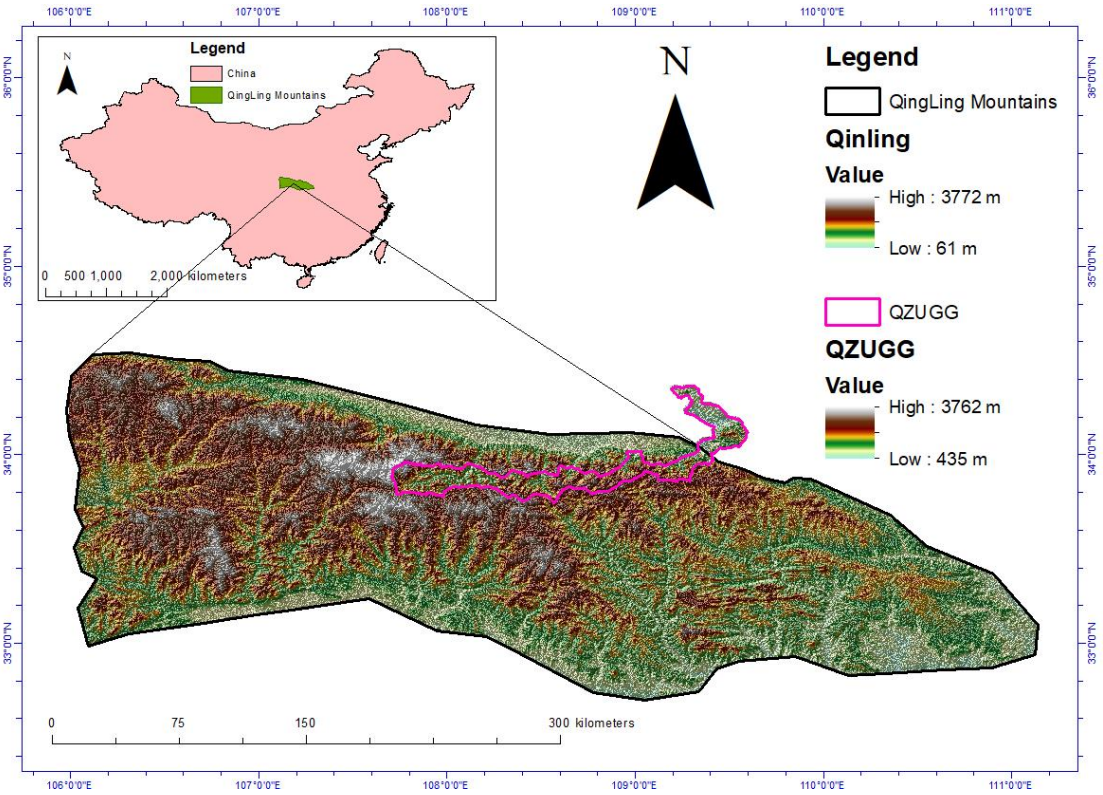

Figure 2.2 The location of Qinling Zhongnanshan UNESCO Global Geopark and their elevation range (m)

Figure 2.3a. Scenic spots of the QZUGG, the Zhuque scenic spot.

Figure 2.4b. Scenic spots of the QZUGG, the Zhuque scenic spot.

Figure 2.5c. Scenic spots of the QZUGG, the Taiping scenic spot.

Figure 2.6d. Scenic spots of the QZUGG, the Taiping scenic spot.

Figure 2.7e. Scenic spots of the QZUGG, the Nanwutai scenic spot.

Figure 2.8f. Scenic spots of the QZUGG, the Nanwutai scenic spot.

Figure 2.9g. Scenic spots of the QZUGG, the Wangshunshan scenic spot.

Figure 2.10h. Scenic spots of the QZUGG, the Wangshunshan scenic spot.

Figure 2.11i. Scenic spots of the QZUGG, the Cuihuashan scenic spot.

Figure 2.12j. Scenic spots of the QZUGG, the Cuihuashan scenic spot.

Figure 2.13k. Scenic spots of the QZUGG, the Lishan scenic spot.

2.1.2 Qinling Zhongnanshan UNESCO Global Geopark

Qinling Zhongnanshan UNESCO Global Geopark was firstly designated a member of the Global Geopark Network (GGN) in 2009, and further named Qinling Zhongnanshan UNESCO Global Geopark after the validation. Qinling Zhongnanshan UNESCO Global Geopark is composed of 8 different National Parks (Table 2.1).

Table 2.1 Eight scenic areas (National Parks) of Qinling Zhongnanshan UNESCO Global Geopark

Scenic spots	Elevation (m)	Area (km^2)	Construction Time	Distance to Xi'an (km)	Forest coverage (%)	Entrance fee (USD)	Cable-car round-way (USD)	Tour vehicle fee round-way (USD)
Heihe	995	447.78	1997	138	94	8.34	N/A	N/A
Taiping	3000	122.13	1997	48	98	9.92	12.05	4.54
Zhuque	3015	48.08	1992	63	96	7.69	12.05	4.54
Cuihuashan	638	99.81	2001	38	96	10.66	N/A	4.54
Nanwutai	1688	26.57	1993	35	97	7.69	N/A	4.54
Wangshunshan	1217	210.62	1991	80	96	0	12.05	3.06
Lantian	768	56.65	1979	72	N/A	0	N/A	N/A
Li Shan	1302	63.23	1987	48	82	22.89	9.18	4.54

Located in the south of Xi'an, QZUGG which is usually regarded as "Chinese Central National Park" (Qinling Zhongnanshan UNESCO Global Geopark 2012) covers an area of 1074.85 km^2 (Figure 2.2). It is the nearest one to a metropolis among all the world's geoparks, only 25 km away from Xi'an city (Yang et al. 2018). The eight scenic spots are located from west to east of the geopark ranging from 435-3740 m in elevation, in which each set of the following spots is adjacent with each another: Taiping and Zhuque, Cuihuashan and Nanwutai, and Wangshunshan and Lantian, leaving Heihe and Lishan standing alone (Figures 2.4 and 2.5).

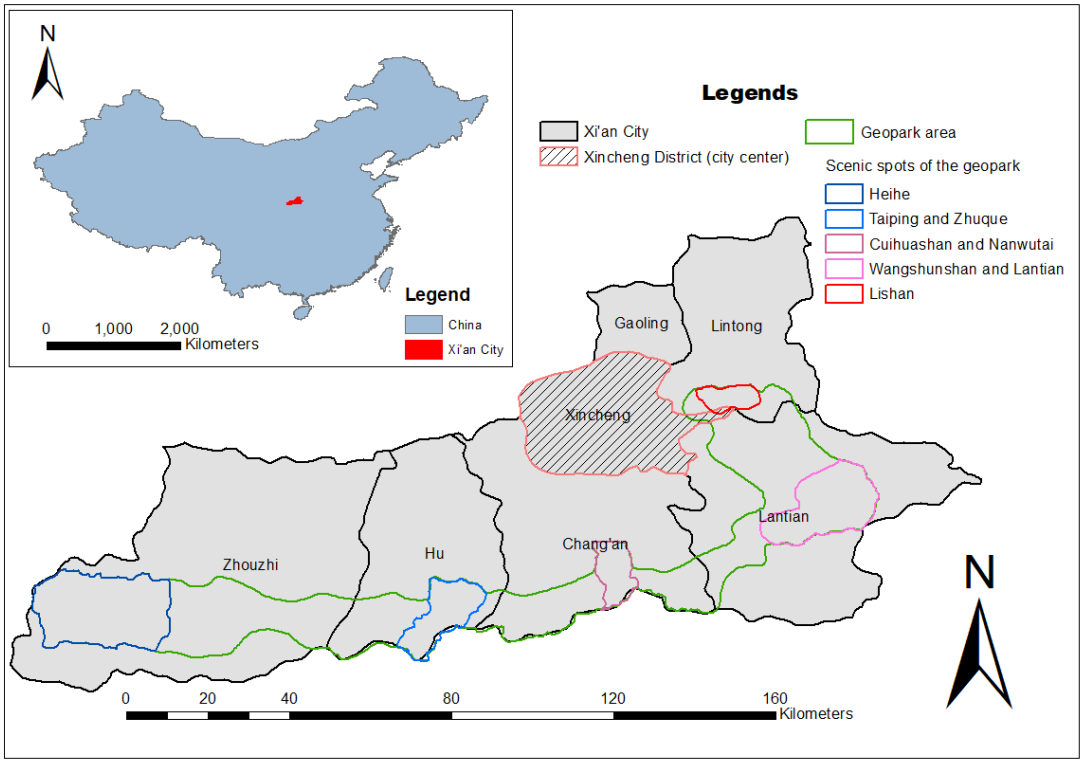

Figure 2.14. The location of Qinling Zhongnanshan UNESCO Global Geopark.

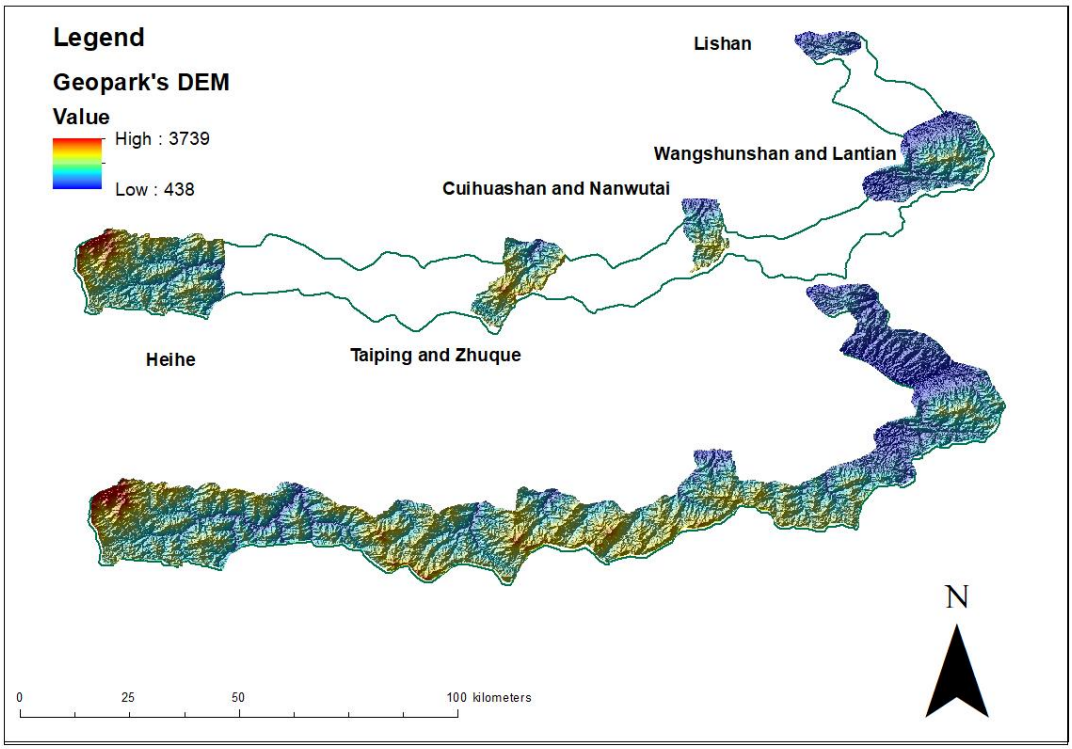

Figure 2.15. Elevation range of Qinling Zhongnanshan UNESCO Global Geopark and its scenic spots.

2.2 Data collection for questionnaire survey

Questionnaire survey was adopted to collect users' information data. In the present study, "users" takes a generalized definition as it includes both local residents and on-site visitors.

2.2.1 Questionnaire design

Two versions of structured questionnaires were developed carefully with expert and peer reviews, one of which is used for visitors, and another one for local residents. The different aspect of these two versions lies in the first part (general information). Questions related to livelihood and income issues were included in the version for local residents. The second part of the questionnaire contains the same questions in both two versions.

There are 26 and 30 items contained in these two versions for visitors and local residents, respectively. The questionnaire is divided into two parts in both versions. The first part of visitor version collects mainly respondents' demographic information by providing 14 questions with one or more than one choice. For users' satisfaction part, a five-point Likert scale structure was used from 1 = very dissatisfied to 5 = very satisfied. For their opinion and perception part, there were four or five different descriptions raging from low to high.

2.2.2 Reliability and validity test

Reliability and validity were tested before the finalization of the questionnaires. Reliability represents to what degree results are consistent over time while validity determines if the research really can measure what it was meant to measure (Bashir et

al. 2008).

Cronbach's alpha coefficient is the most commonly used indicator of reliability, ranging from 0-1, with higher reliability being represented by higher score. It is recommended that a questionnaire reliable enough should be of a point of higher that 0.7. The questionnaire of the present study scored a point of 0.926. Validity is usually done by KMO and Bartlett's test with similar standard as Cronbach's alpha coefficient. This questionnaire got a point of 0.728.

2.2.3 Conducting methods

Questionnaire survey was conducted with local residents using a face-to-face fashion, which can ensure a 100% collection rate. Only one representative was selected to be interviewed from each single household in order to avoid getting too much information from one family. After a thorough explanation of the purpose of the present study, questions were read one by one to respondents and answers were recorded faithfully.
As for the number of individual households, a carpet-method was used because the number of the local people who were allowed to live within the park or do a business within or near the parks was so limited. Finally, this study collected 164 questionnaires from 4 spots (Table 2.2).

For visitor part, holidays and weekends were chosen as this study needed a large number and different types of respondents. This study also used face-to-face way to read each question and record their answers. In total, 640 answers were collected (Table 2.3).

Table 2.2 Details of questionnaire survey conducting with local residents

	Conducting spots	Conducting date	Collection number	Collection rate (%)
Local residents	Cuihuashan	29th May 2017	43	100
	Taiping	28th May 2017	38	100
	Zhuque	17th June 2017	41	100
	Wangshunshan	11th June 2017	42	100
Total			164	

Table 2.3. Details of questionnaire survey conducting with visitors

	Conducting spots	Conducting date	Collection number	Collection rate (%)
Visitors	Cuihuashan	29th May 2017	185	100
	Taiping	28th May 2017	177	100
	Zhuque	17th June 2017	170	100
	Wangshunshan	11th June 2017	108	100
Total			640	

Online survey was mainly done with the students from the universities and colleges which were located in the areas adjacent to Qinling Zhongnanshan UNESCO Global Geopark; another targeted group was citizens of Xi'an city who had visited the study site. This study used a professional online survey service provider website, Wenjuanxing (https://www.wjx.cn/). Questionnaires were uploaded to this website and a link was produced for respondents to finish and submit all answers. This study set the submitting condition as "You have to finish all questions before you can successfully submit them" to avoid invalid questionnaires. When this section finished, a set of reports and datasets were downloaded from the website to be converted into required data type (sav file) for next-step analysis. This part was conducted from 5th June to 10th July 2017 and 349 questionnaires were collected totally (Table 2.4).

Table 2.4. Details of questionnaire survey conducting with students and citizens online

	Conducting spots	Conducting date	Collection number	Collection rate (%)
Citizens	Online	7th June-8th July 2017	213	100
Students	Online	6th-28th June 2017	136	100
Total			349	

Datasets of questionnaire survey were firstly checked manually to ensure their completeness and validity. All data were organized by using Excel of Microsoft Office 365 Professional version. In order to conduct further data analysis, all datasets were arranged into several groups according to specific purposes, i.e., the group of visitors, the group of local residents, the group of students and the group of citizens. By doing this, various descriptive analysis processes were conducted; for statistical differences analysis, this study further grouped local residents and management, outsiders and management, respectively, in order to conduct one sample T-test. In the following step, those data sets' groups were faithfully input IBM SPSS 24 for Windows. Before doing detailed analyses, all data were converted into required data type (sav file).

2.3 Data collection for interview with management officials

With the same procedure used in the questionnaire survey, a semi-conducted survey was developed for management officials, in which 33 questions were included. Several aspects were examined, including management's opinion and perception towards the study site. A face-to-face in-depth interview method was employed with four management officials from the management agency and a female experienced hiker. Everything was recorded with a voice recorder and a notebook. It took 9-43 minutes each and 164 minutes in total. They were also invited to do the visitor version questionnaire to serve as a test standard. (Table 2.5)

Table 2.5. Details of questionnaire survey conducting with 4 management officials and one experienced hiker

	Number of interviewees	Conducting date	Time duration (Minutes)
Cuihuashan management	1	25th June 2017	35
Taiping management	1	17th June 2017	43
Zhuque management	1	17th June 2017	35
Wangshunshan management	1	11th June 2017	23
Experienced hiker	1	18th May 2017	9
Total	5		145

2.4 The elimination of sampling bias

Li (2018) discussed the Calendar Effect on visitors in the Cuihuashan scenic spot, one of the scenic spots in which this study was conducted, indicating that 72.2% of her respondents showed the willingness to visit on weekends and National Holidays. The present study conducted all questionnaire surveys on weekends and the Dragon Boat Festival (one of China's National Holidays), which was corresponding to Li's study. Besides, this compared its respondents' demographical characteristics with Li's and concluded that no abnormality was found (Table 2.6). Besides, it has been pointed out that the best periods for tourism in Qinling area is from May to October, and about the tourist index was 40% (Sun and Ma 2007). It was recently reported by the official website of the Geopark that during a national holiday (3 days) in May this year the Geopark received 250,000 people. All these above showed that the respondents' samples were not biased.

Table 2.6. A comparison of demographic information of samples with Li's study

Demography	Li' study %	This study %
Age (14-40 years old)	70.2	74.8
Occupation		
Students and teacher	40.5	36.7
Business staff	25.7	25.0
servant	2.2	3.6
peasants	6.0	5.2
Education level		
University level	53.0	50.6
High school	20.6	26.3
Residency		
From Xi'an and within province	92.7	83.0

2.5 Data collection for vegetated area and non-vegetated area change detection

Land use and land cover change analysis is very important when it is assumed at various spatial-temporal scales (Lambin 1997). On a given specific environment, it can be used to reflect dimension of human activities (López et al. 2001). However, in the present study, our interest was forest cover change detection. This was because in PAs, large area of deforestation for other type of use is rare.

2.5.1 Satellite remote sensing

Three cloud-free satellite images downloaded from Landsat 5 and 8 via United States Geological Survey (USGS) server were adopted to conduct land cover maps (Table 2.7). Based on the quality, availability and even time intervals, these images were chosen to be downloaded and analyzed (Table 2.7).

Table 2.7. Details of the images used in the present study

Year	Date	Source	Resolution
2003	14th June	Landsat-5	30 m
2009	30th June	Landsat-5	30 m
2016	17th June	Landsat-8	30 m

2.5.2 Vegetation change detection

Maximum Likelihood Classification (Supervised Classification) was employed to do forest cover change detection. Then, forest-cover maps were analyzed to conduct forest cover changer from 2003 to 2016.

2.5.3 Check procedure and accuracy

When conducting visual presentation classification of forest and non-forest areas, this study referred to randomly chosen GPS data as ground truth control points (100 in number). This study also used Google Earth, site photographs and Global PALSAR-2/PALSAR/JERS-1 Mosaic and Forest/Non-Forest map as references. This study achieved an overall accuracy of 0.90 both in 2003 and 2006, 0.95 in 2016.

Chapter 3 Perceptions of the QZUGG's management officials and forest cover change

In this chapter, the results of interviews with four management officials' officials from four scenic spots and forest cover change detection are to be presented. This study conducted interview in a face-to-face fashion and recorded the whole process. In order to carry out our statistical comparison later with other respondents, this study also invited management officials to take part into our questionnaire survey.

3.1 The management officials' attitudes

3.1.1 The management officials' attitudes towards entrance fee, parking fee, resource abundance and resource appreciation

This study firstly conducted the interview about these four basic aspects to get a general understanding of how management officials perceive the geopark, which could serve as a foundation for the further analysis. The interview started with these four general aspects, i.e., entrance fee, parking fee, resource abundance and resource appreciation. In Chapters 4 and 5, this study asked the other respondents the same questions, and in Chapter 6, the comparison between management officials and other users was conducted.

On the whole, four management officials showed their satisfaction towards the entrance fee (Table 3.1). The Cuihuashan official showed less satisfactory attitude than the other three ones. According to what he said during the interview, he thought the entrance fee should be more expensive, because in his mind, the Cuihuashan has a long history and

outstanding tourism resources. Parking fee produced exactly the same results among all four scenic spots (Table 3.1). However, it should be pointed out that the parking fee of the Wangshunshan spot is almost free (Table 2.1).

Table 3.1. Managements' attitude towards entrance fee and parking fee

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Entrance fee				
Satisfied	●			
Very satisfied		●	●	●
Parking fee				
Satisfied	●			
Very satisfied		●	●	●

The officials of the Cuihuashan, the Taiping and the Zhuque scenic spots were very satisfied with the geopark's scenic resource abundance whereas the Wangshunshan official showed a satisfied attitude. The Cuihuashan and the Zhuque officials were very satisfied with the resource appreciation, which was higher than that of the Taiping and the Wangshunshan officials (Table 3.2).

Table 3.2. Managements' attitude towards resource abundance and resource appreciation

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Resource abundance				
Satisfied				●
Very satisfied	●	●	●	
Resource appreciation				
Satisfied		●		●
Very satisfied	●		●	

Overall, all management officials showed positive attitudes towards these four general aspects of the geopark.

3.1.2 The management officials' attitudes towards the existing facilities, information providing services, nature protection and educational service

3.1.2.1 The management officials' attitudes towards the well-paved hiking trails, trails planning and the quantity of artificial constructions

In this study, a well-paved hiking trail is defined as a trail which has been paved with cement, precast concrete and processed stones (Figure 3.1). When asked about their opinions on if well-paved hiking trails can increase or decrease one's joy of ascending mountains, only the Cuihuashan's official reported 'increase' and the other three 'decrease' (Table 3.3).

The Zhuque official thought the hiking trails were very reasonably planned, which was higher than the other three ones (reasonably planned). Their ideas on the quantity of artificial constructions within the geopark differed. The Cuihuashan and the Taiping officials did not think there are many of constructions. However, the official from the Zhuque area thought that they have a large quantity and the Wangshunshan thought there are many in their scenic area (Table 3.3).

Figure 3.1. A typical well-paved hiking trail in the Cuihuashan scenic spot (source: author).

Table 3.3. Management officials' attitudes towards the existing facilities

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Your opinion on trekking trails construction				
Well-paved trails increasing certain joy of ascending a mountain	●			
Well-paved trails increasing great joy of ascending a mountain				
Well-paved trails decreasing certain joy of ascending a mountain		●	●	●
Well-paved trails decreasing great joy of ascending a mountain				
Your opinion on trekking trails planning				
Very reasonable planning			●	
Reasonable planning	●	●		●
Poor planning				
Unreasonable planning				
Very unreasonable planning				
Your opinion on the quantity of artificial constructions				
Very few	●	●		
Few				
Reasonable				●
Many				
Very many			●	

3.1.2.2 The management officials' attitudes towards information service, nature protection and educational service

All of four officials thought the geoparks guide maps can provide certain information (Table 3.4). The similar idea was found about trails informative boards (Figure 3.2). They all agreed that visitors can get certain information from those boards while hiking.

Figure 3.2. A trail informative board along the sides of trails (source: author)

Table 3.4 Management officials' attitudes towards the information services

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Your opinion on guide map				
Providing abundant information				
Providing certain information	●	●	●	●
Providing no valid information				
Providing no tour-map at all				
Your opinion on trekking routes informative sideboard				
Abundant information and clear indication				
Certain information	●	●	●	●
Insufficient information				
Almost zero information and reference				
A failure of design, following it making one disorientated				

The Cuihuashan and the Taiping officials believed that they provide visitors with abundant geo-educational information and service while the other two places thought that they provide certain information (Table 3.5). The official of the Wangshunshan scenic spot hold the idea that the geopark can greatly protect the nature. However, the other three ones said the nature is protected only to a certain degree (Table 3.5).

Table 3.5. Management officials' attitudes towards educational services and nature protection

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Your opinion on educational service				
Providing abundant educational information	●	●		
Providing certain educational information			●	●
Providing very little educational information				
Providing zero educational information				
Your opinion on protecting the nature				
Protecting the nature to a great degree				●
Protecting the nature to a certain degree	●	●	●	
Destroying the nature to a certain degree				
Destroying the nature to a great degree				

3.1.3 The management officials' idea about the problems facing the geopark

The official of the Cuihuashan scenic area said that the service quality and underdevelopment are the problems facing the geopark. Further, as the general manager of this scenic spot, he said that more parking space and a larger visitor center were needed because the number of visitors increases very rapidly (Table 3.6). The Taiping official also mentioned the problem of underdevelopment, and the need of better transportation (Table 3.6). The Zhuque official reported that the largest four problems in the geopark were facilities, service quality, poor infrastructures and overbuilding. The Wangshunshan official also thought that facilities, underdevelopment and poor infrastructure were the problems facing the geopark (Table 3.6).

Table 3.6. The management officials' ideas about the problems facing the geopark

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Transportation		●		
Education activity				
Facilities			●	●
Entrance fee				
Service quality	●		●	
Under development	●	●		●
Over development				
Poor infrastructure			●	●
Overbuilding			●	
Others	More parking lots and large visitor center should be constructed			

3.1.4 The management officials' idea about the overall impression

The Wangshunshan official showed a neutral attitude towards the overall satisfaction

(Table 3.7). The Cuihuashan and Zhuque official officials were satisfied whereas the Taiping was very satisfied (Table 3.7). As for the attraction of the geopark, the Taiping and Zhuque officials showed a satisfied attitude and the other two ones were very satisfied (Table 3.7). They all reported the very high willingness of recommending this geopark to the others except for the Wangshunshan official, who showed only high probability (Table 3.7).

Table 3.7. The management officials' idea about the overall impression

Characteristics	Cuihuashan	Taiping	Zhuque	Wangshunshan
N=	1	1	1	1
Overall satisfaction				
Very dissatisfied				
Dissatisfied				
Neutral				●
Satisfied	●		●	
Very satisfied		●		
Attraction				
Very dissatisfied				
Dissatisfied				
Neutral				
Satisfied	●			●
Very satisfied		●	●	
Willingness of recommending this place to others				
Very low willingness				
Low willingness				
Neutral				
High willingness				●
Very high willingness	●	●	●	

3.1.5 The overall satisfaction and perception

To summarize the foregoing results, it is not difficult to see their satisfaction towards

this geopark, including their management, development, maintenance and the fulfillment of the geopark's mission. Also, they seemed to be quite confident about the geopark as was seen that mostly they showed either satisfied or very satisfied attitudes or perceptions about the natural and scenic resources in the geopark. Hence, it can be said that they gave credit for their efforts and work performance in the geopark.

3.2 Forest cover change

3.2.1 Forest and non-forest area change

In order to investigate forest change within the QZUGG before and after its designation as a UNESCO global geopark, this study classified the land-cover into two types: forest and non-forest covers. The QZUGG was designated as a UNESCO global geopark in 2009, based on which, this study selected 2003 (6 years earlier) and 2016 (7 years after) suitable images were not available for 2015 as shown in Table 2.7.

Intentionally, this study chose all images of the acquisition months in June in order to achieve good consistency and accuracy. Besides, June corresponds to season of leaf-on canopy condition. The image classifications would largely produce a more conservative estimate of forest loss (Liu et al. 2001). The final results of forest and non-forest areas are shown in Figure 3.3, in which three maps are included, namely, the years of 2003, 2009 and 2016, respectively. It is clear that this geopark has experienced some forest coverage fluctuation. Especially in the east end of the geopark, the change seems to have been dramatic.

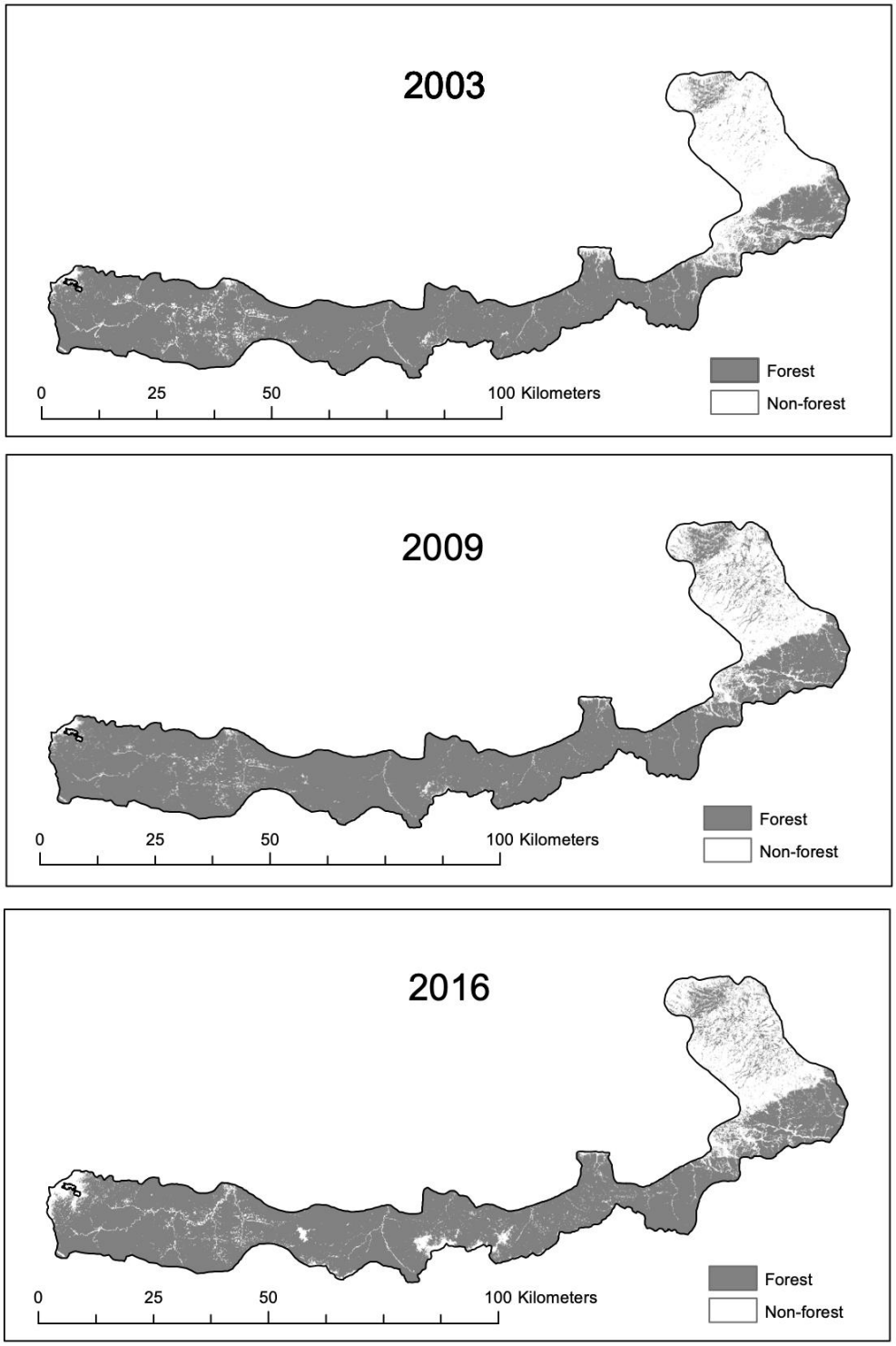

Figure 3.3. Forest and non-forest area maps in 2003, 2009 and 2016.

The results of the forest and non-forest area in the QZUGG in 2003, 2009 and 2016

(Figure 3.4) were summarized. From 2003 (6 years before its designation), to 2009 (the year of its designation), the geopark has experienced an increase in the forest area from 2024 km^2 to 2189 km^2. However, by 2016, a decrease to 2096 km^2 happened (Figure 3.5).

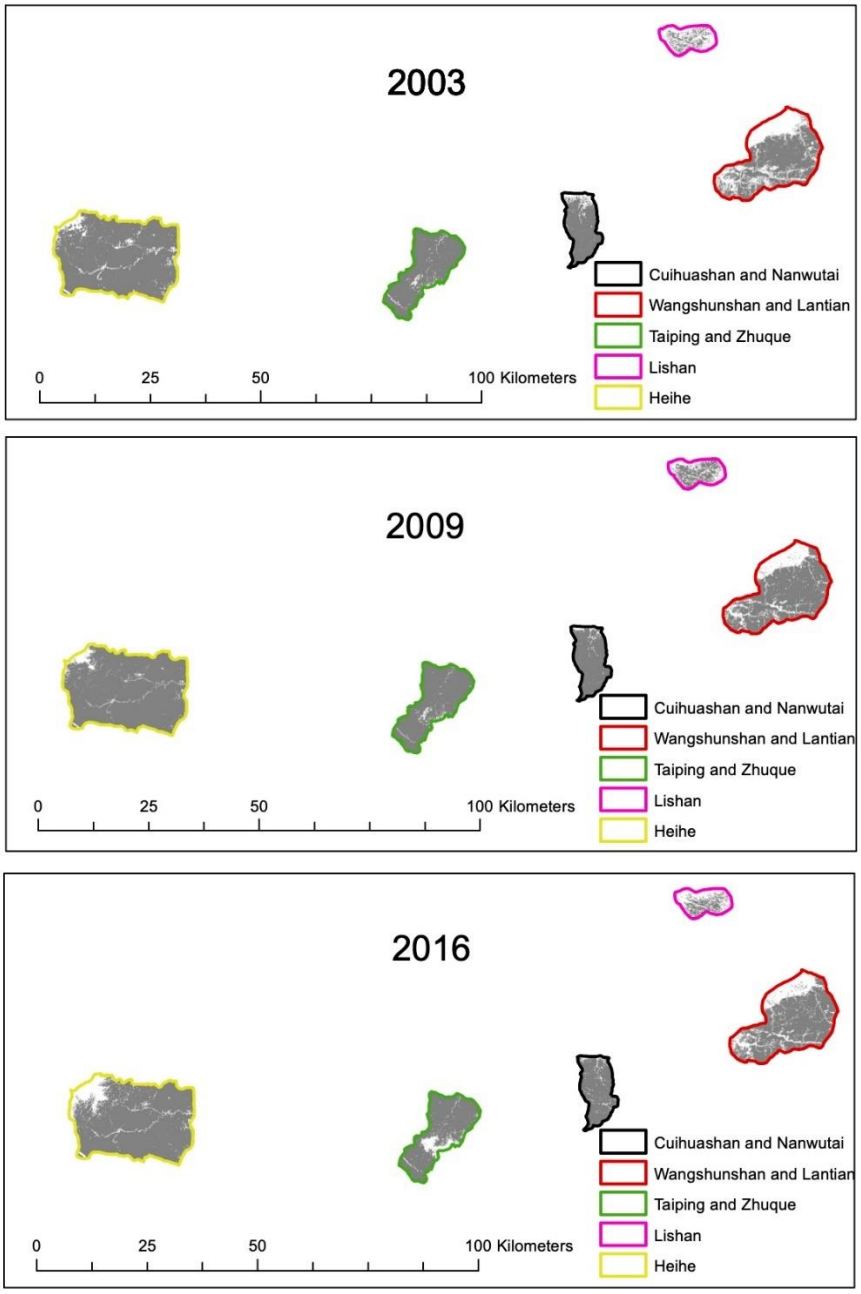

Figure 3.4. Forest and non-forest maps of each scenic spot in 2003, 2009 and 2016.

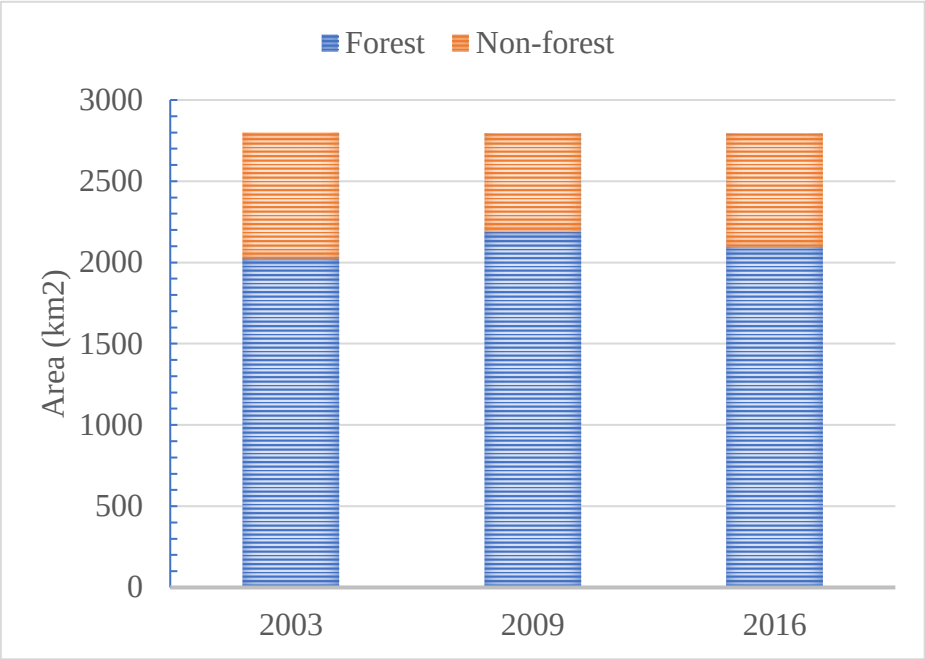

Figure 3.5. The summary of QZUGG's forest and non-forest area change in 2003, 2009 and 2016.

This study also checked each of the four spots' forest and non-forest change over the same periods (Figures 3.4-3.9). Figure 3.5 shows that Lishan scenic spot experienced a decrease of more than 30 percent of non-forest area until 2009. However, the non-forest area increased again after 2009. The Lishan scenic spot is the only one whose forest area was smaller than non-forest area in 2003 and 2016, respectively. In the Wangshunshan (Figure 3.7) and Lantian (Figure 3.6) scenic spots, similar changing trend was observed as from 2003 to 2009 non-forest area decreased about 30 percent, which was much higher than that of the Lishan scenic area. However, the non-forest area increased around 7 percent after the designation year, namely, 2009 (Figures 3.5-3.9).

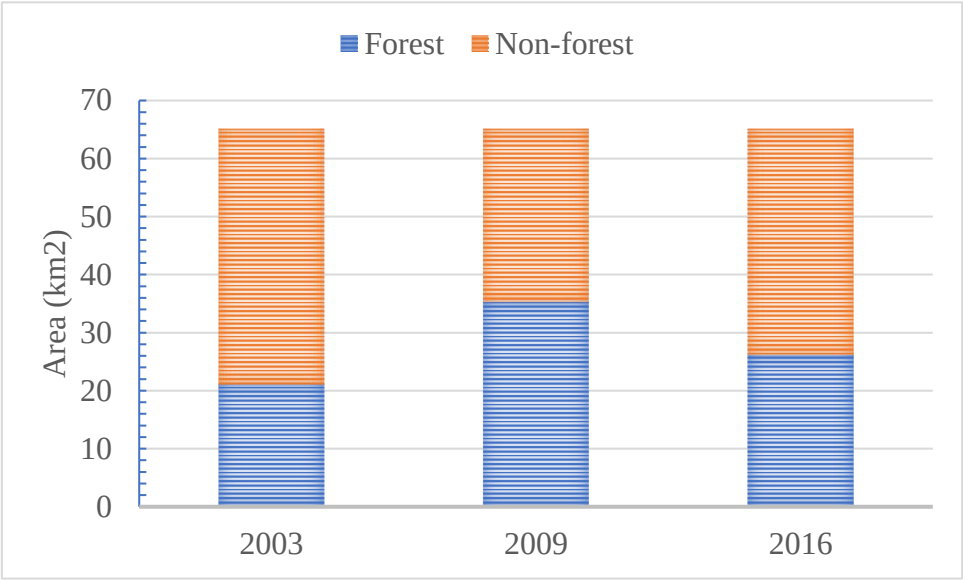

Figure 3.6. Lishan forest and non-forest area change from 2003 to 2016.

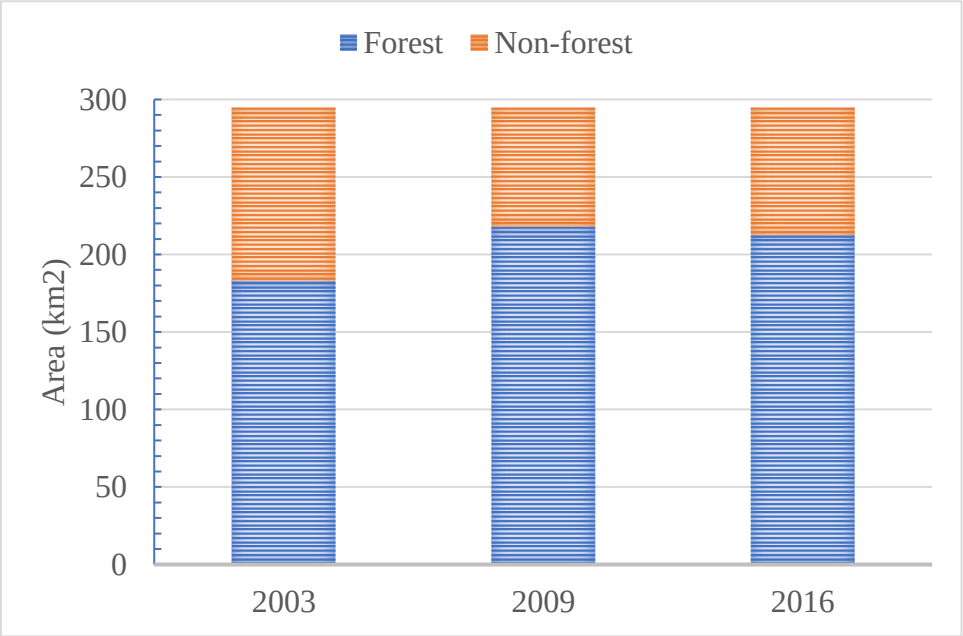

Figure 3.7. Wangshunshan and Lantian forest and non-forest area change from 2003 to 2016

Figure 3.8 shows the changing trend of non-forest and forest area in the Cuihuashan and Nanwutai scenic spots. From 2003 to 2009, the non-forest area largely decreased. Surprisingly, after 2009, the increase of the non-forest area happened slightly. Taiping

and Zhuque scenic spots also experienced the same changing trend as from 2003 to 2009 forest cover increased. However, decrease happened after 2009 to a degree that is three times larger than that of 2003 (Figures 3.8 and 3.9).

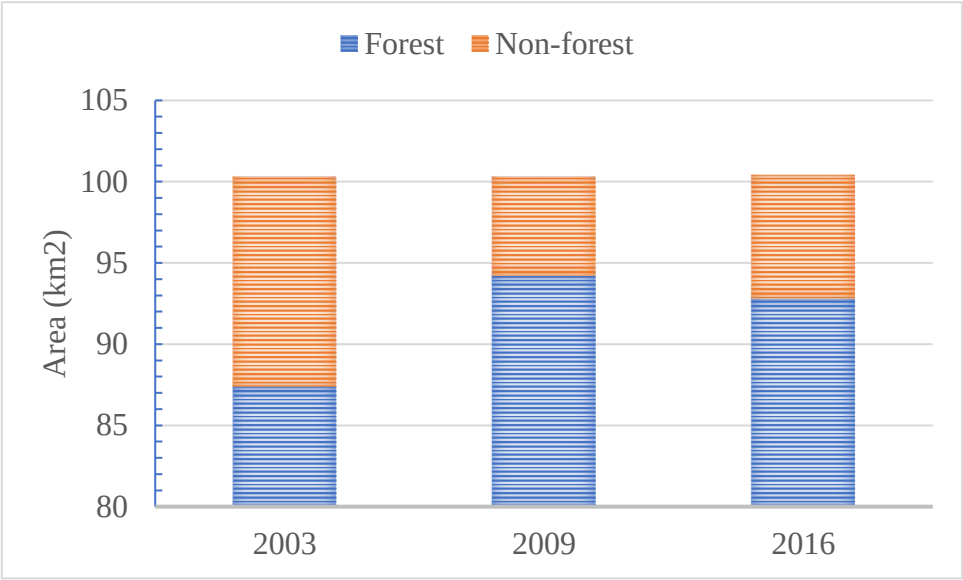

Figure 3.8. Cuihuashan and Nanwutai forest and non-forest area change from 2003 to 2016.

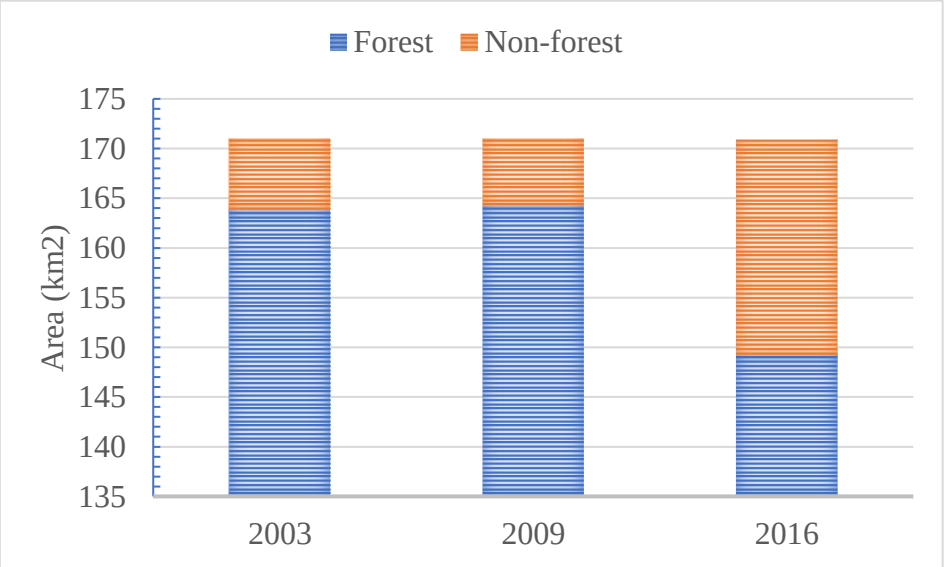

Figure 3.9. Taiping and Zhuque forest and non-forest area change from 2003 to 2016.

3.3 Discussion

The whole geopark area and all scenic spot showed the same trend of forest cover change, which was in accordance with a previous study in the same area. Tao (2017) observed the same trend on forest cover change, i.e., the area has experienced increase from 2000-2004 and from 2007-2013, decrease from 2013-2015 with the main decrease happening in high altitude area and valleys. To be specific, before the establishment in 2009, forest cover increased to different degrees, which could be explained by China's Natural Forest Conservation Program (NFNP) and the Green to Green Program (GTGP) (Figure 3.10). Also, this study showed that with the range of 2-10 km from Xi'an's neighboring cities the change rate NDVI was negative showing deterioration caused by human activities (construction land).

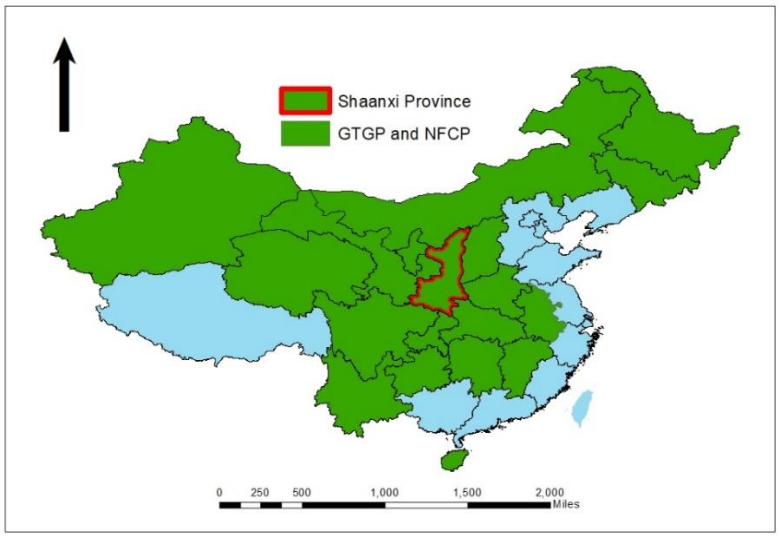

Figure 3.10. The distribution of China's NFCP and GTGP. Source: prepared based on Liu et al. (2008)

Table 3.5 showed the comparison result between visitors and each of the management officials from four scenic areas. It can be found that with a mean of 2.050, visitors hold a slight negative perception, i.e. this geopark is destroying the nature to a certain degree.

The management official from the Wangshunshan thought this geopark is protecting the nature to a great degree, which was significantly different from all others (including visitors). The Wangshunshan is the only one which is under management of government agency. Its management officials are all from certain governmental departments, which can probably explain why this official had such a high remark. However, the classification of forest and non-forest areas indicated a decrease of forested areas. This is quite strange because according to Deng et al. (2003), visitors are very sensitive to trees' damage. During several times of field work, this study did not find any signs of tree damage let alone deforestation. This proves that around visitors' touring areas and along the hiking trails the maintenance of forest is properly managed. It is very important for managers because usually visitors are attracted to parks out of pursuit of appearance of authenticity, being not altered, not polluted or over commodified. Operators try their best to maintain what was favored by visitors (Butt 2012; West et al. 2004; Zinda 2017).

Table 3.5. Comparison between visitors and management officials about QZUGG's nature protection

Characteristics		Management Test value							
Managing Site	All visitors Mean	Cuihuashan		Taiping		Zhuque		Wangshunshan	
N=		1	P	1	p	1	p	1	p
Your opinion on protecting the nature	2.050	2.000	0.009	2.000	0.009	2.000	0.009	1.000	0.000
Protecting the nature to a great degree									
Protecting the nature to a certain degree									
Destroying the nature to a certain degree									
Destroying the nature to a great degree									

However, in order to embrace the increasing trend of China's domestic visitors (Chio

2014), the geopark has seen many artificial constructions within it. For example, parking lots, shopping places and restaurants, and even some other entertainment facilities (Figure 3.11).

Figure 3.11. A slide in the Cuihuashan scenic area (source: author).

There was more evidence to support the results of forest cover change, for example, compared to 2009, there were much more roads in 2019 in the Lishan scenic spot (Figure 3.12) and in the Cuihuashan scenic spot, a skiing resort was found in 2016, which did not exist in 2009 (Figure 3.13).

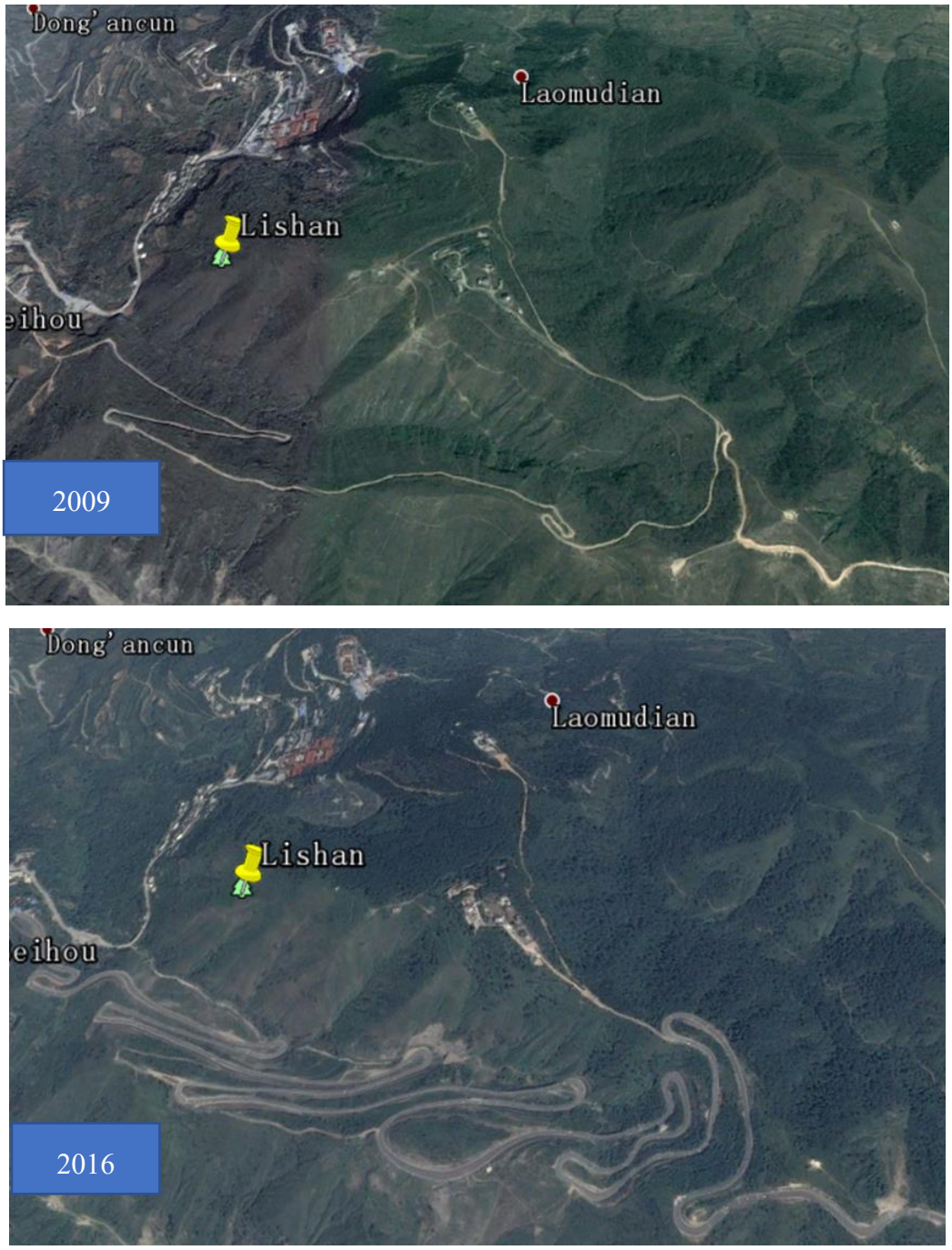

Figure 3.12. Roads in the Lishan scenic spot in 2009 and 2016 (Source: Google Earth).

Figure 3.13. A skiing resort in the Cuihuashan scenic spot in 2016 (Source: Google Earth).

According to the management official, they were tearing down this place and trying to recover it to its natural landscape. The management explained this is because this skiing resort had been classified as “an illegal building”. This is not uncommon in China. New hotels and commercial retail outlets were built in the Wulingyuan area (a World Heritage Site) in Zhangjiajie National Forest Park, which caused a warning from the IUCN in 1998; three cable cars built through Mt. Tai an UNESCO World Cultural and

Natural Heritage Site) has permanently altered the landscape; and Zhangjiajie National Forest Park constructed a 325-m Sky Elevator on the side of a rock tower allowing access to a previously secluded area (Wang et al. 2012).

3.4 summarization

To summarize the results presented above, it can be seen that management officials are generally satisfied with the Geopark, including entrance fee and parking fee. This is not strange to see because those fees are directly related to their levels of rating, i.e., higher level always brings high price. Those scenic spots are National level parks and belong to a UNESCO Global Geopark, which entitles them to high charges. At the same time, the officials showed their confidence towards tourism resources. As for the infrastructures, information and educational services, they also expressed satisfied or very satisfied perceptions. Therefore, it is concluded that the connectivity between the Geopark and management officials is strong. Officials all had the idea that this Geopark is protecting the nature to a certain or high or great degree. However, the vegetations cover change showed an opposite trend before and after the establishment of the QZUGG.

Chapter 4 Local residents' attitudes and perceptions

It is important to explore the attitudes and perceptions of the local residents as from a certain sense, they belong to a group of special users despite living or doing business within or around the geopark. Moreover, there is increasing awareness regarding local residents as an important part of conservation activities.

4.1 Entrance and parking fee, resource abundance and appreciation

This section was operationalized using four general items related to perceptions and satisfactions and formatted with a five-point Likert scale method. For each item, responses range in an order of 'very dissatisfied', 'dissatisfied', 'neutral', 'satisfied' and 'very satisfied' corresponding to point 1-5, respectively. Being recorded in such a way, higher score always represented higher degree of satisfaction. Frequency analysis and mean were conducted initially followed by compared means t-tests. In this study, higher means always represent more satisfied attitude. Significance was measured at the 0.05 level, two-tail significance, i.e. if t-value is less than 0.05, a significant difference is thereby indicated. Compared means is usually employed when doing a comparative test among more than two groups which is also indicated at 0.05 level.

4.1.1 Entrance fee and parking fee

All respondents living in the Wangshunshan scenic spot (n=42) reported that they were very satisfied with the entrance fee (Figure 4.1a). However, in the other three scenic spots, responses to those two items varied. In the Cuihuashan scenic spot, nearly half of the respondents were very dissatisfied or dissatisfied with the entrance fee. Interestingly, the Taiping and Zhuque scenic spots share some similarities. The neutral view holders towards the entrance fee accounted for around 40%. This study did not see many very satisfied respondents in the Zhuque, Taiping and Cuihuashan, around

10% of each (Figure 4.1a).

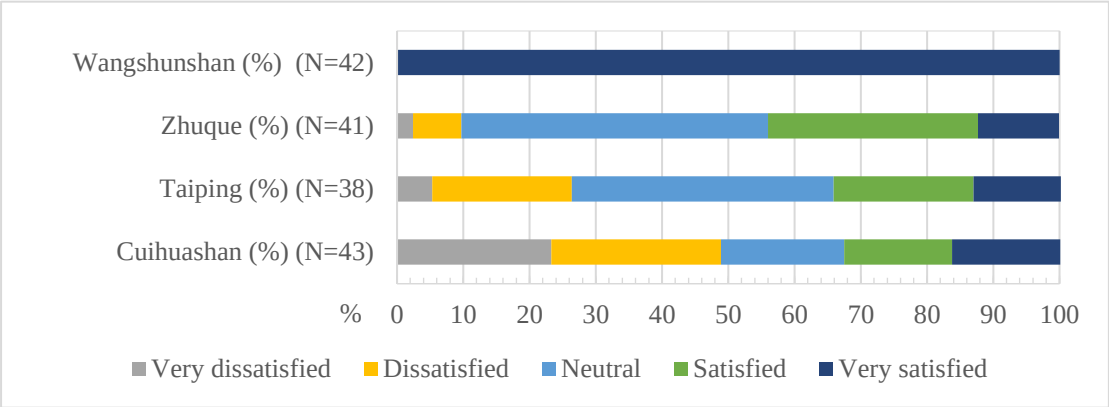

Figure 4.1a. Local residents' satisfaction towards entrance fee.

A hundred percent of the Wangshunshan residents were very satisfied with the parking fee, but more than half of the respondents was very dissatisfied or dissatisfied with the parking fee in the Cuihuashan (Figure 4.1b). Around one-fourth of the respondents hold a neutral point of view. In the Zhuque and Taiping, mostly, respondents hold a neutral attitude towards the parking fee (Figure 4.1b).

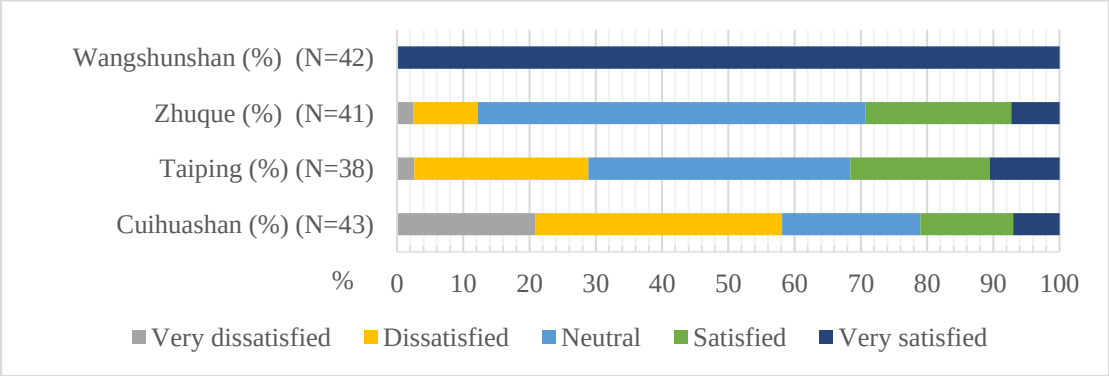

Figure 4.1b. Local residents' satisfaction, b: towards parking fee.

The compared means between those four scenic spots showed a significant difference in both items, i.e. the entrance fee and the parking fee with a P-value less than 0.05 (0.000 for both).

4.1.2 Resource abundance and resource appreciation

Overall, most respondents of all the four scenic spots hold a neutral or satisfied attitude towards the resource abundance. In the Cuihuashan scenic spot, 9.3% the local residents showed a very dissatisfied attitude toward the resource abundance and. The percentage for neutral and satisfied was the same, 34.9%. The response for very satisfied was 18.6%. In the Taiping scenic spot, as high as 42.1% of the respondents showed a neural attitude. Satisfied and very satisfied responses were 36.8% and 15.8%, respectively. In the Zhuque scenic spot, no one reported very dissatisfied opinion towards the resource abundance. Neutral opinions took up 36.6% and this was 41.5% for the response of satisfied, 19.5% for very satisfied. No one reported response of very dissatisfied in the Wangshunshan scenic spot toward the resource abundance. However, large percentage of the respondents showed a neutral attitude (57.1%). Satisfied and very satisfied was 28.6% and 11.9%, respectively (Table 4.1c).

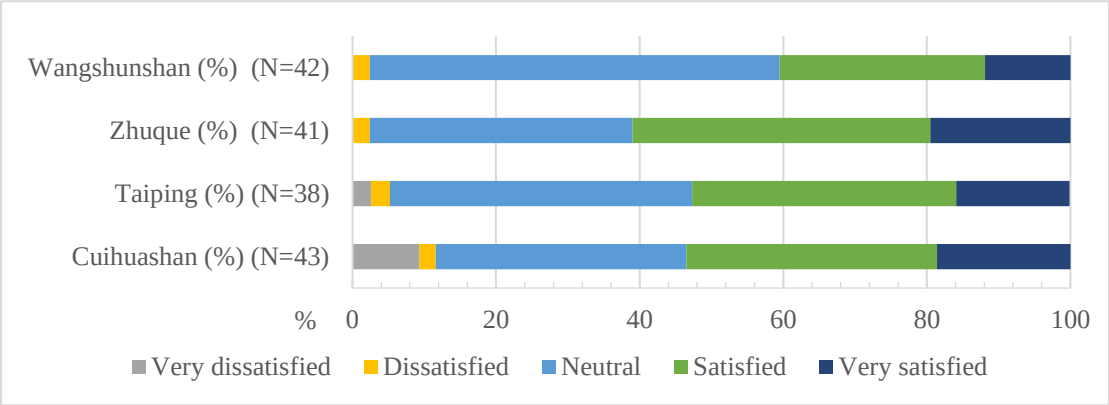

Figure 4.1c. Local residents' satisfaction, c: resource abundance.

The responses of the resource appreciation were similar with the part of resource abundance (Figure 4.1d). In the Cuihuashan, neutral took up 34.9% and 39.5% for satisfied. Small percent of respondents showed dissatisfied or even very dissatisfied perception. In the Taiping, the trend was very similar to that of the Cuihuashan. In the

Zhuque, there were 39% of the response of neutral. Satisfied and very satisfied responses accounted for 43.9% and 17.1, respectively. More than half (52.4%) of the respondents from the Wangshunshan scenic spots were neutral response holders. Satisfied and very satisfied responses were 28.6% and 16.7%, respectively (Figure 4.1d). T-test showed no significant difference among the respondents of the four scenic spots about these two aspects, i.e. resource abundance (T=0.462) and resource appreciation (0.265).

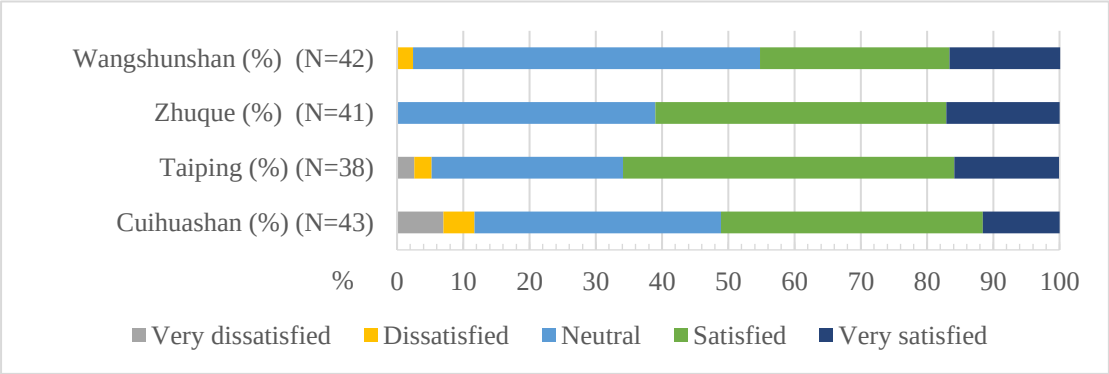

Figure 4.1d. Local residents' satisfaction, d: resource appreciation.

4.2 Local residents' opinions on the existing facilities, information providing services, nature protection and educational service

In this section, this study examined respondents' opinions on some geopark-related perspectives, i.e. hiking trail's design and construction and, guide map, informative sideboard, educational service, protection of the nature and the quality of artificial constructions. Compared means was also conducted to detect if significant differences exist among those four scenic spots.

4.2.1 Local residents' opinion on the existing facilities

Almost half of the respondents (48.8%) of the Cuihuashan scenic spot thought that well

paved trails can increase joy of ascending mountains to a certain degree and 20.9% believed that this can increase joy to a great degree (Figure 4.2). Approximately 30% of the respondents hold the opposite ideas. The situation for the Taiping scenic spot is similar to that of the Cuihuashan scenic spot. In the Zhuque scenic spot, the story is somehow different. The highest percentage is great joy (53.7%) followed by 39.0% for certain joy of ascending mountains. In the Wangshunshan scenic spot, around half of the respondents (45.2%) thought well paved hiking trails can bring great joy followed by 33.3% for decreasing certain joy of climbing. There were 19% of the respondents holding the idea of increasing certain joy. However, T-value was 0.076, indicating no significant difference was found (Figure 4.2).

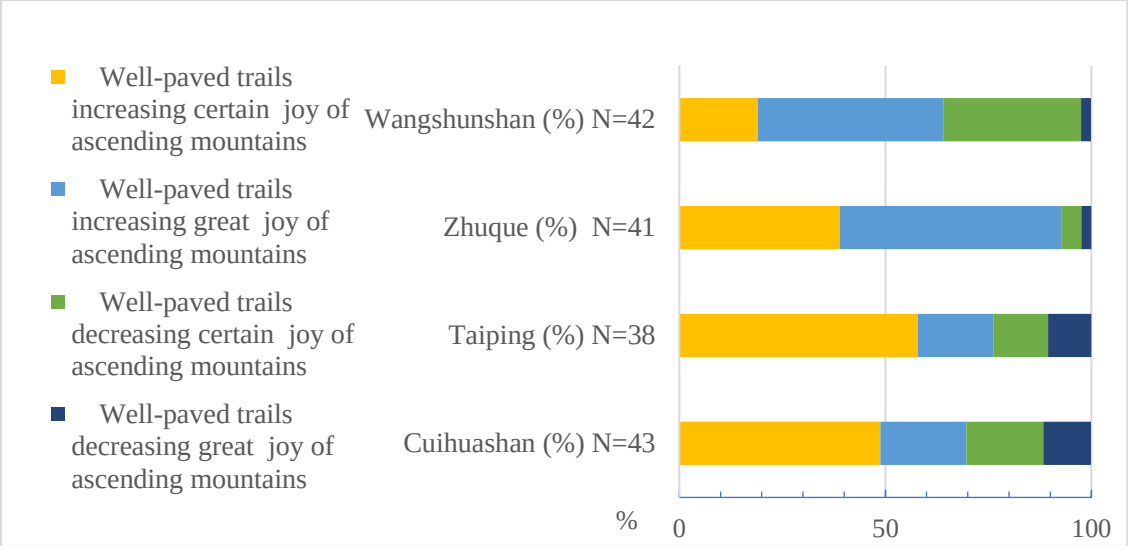

Figure 4.2. Local residents' opinion on well-paved hiking trails.

The respondents from the Cuihuashan scenic spot accounted for the highest percentage of very reasonable planning followed by the Zhuque (24.4%), the Taiping (21.1%) and the lowest was the Wangshunshan scenic spot (4.8%) (Figure 4.3). In all scenic spots, this study has found very high percentage response of reasonable planning, in which the highest one was 70.7% in the Zhuque. A few respondents chose poor planning in the Cuihuashan (7%), the Taiping (7.9%), the Zhuque (2.4%), whereas one-third of

respondents chose poor planning in the Wangshunshan scenic spot (Figure 4.3).

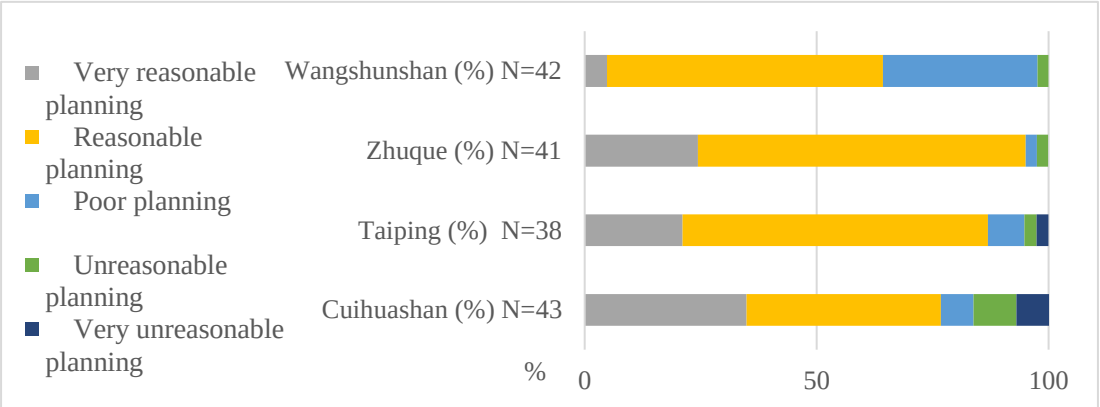

Figure 4.3. Local residents' opinion on planning of hiking trails.

In the Cuihuashan scenic spot, 39.5% of the respondents hold the view that the quantity of the artificial constructions was reasonable. (Figure 4.4). In the Taiping scenic spot, the highest percentage was many (39.5%) followed by reasonable (36.8%). In the Zhuque scenic spot, 46.3% chose many followed by 43.9% of reasonable. In the Wangshunshan, the highest percentage was many (47.6%) followed by reasonable (35.7%) and very many (16.7%). The T-value was 0.049, indicating that there exists significant difference among four scenic spots (Figure 4.4).

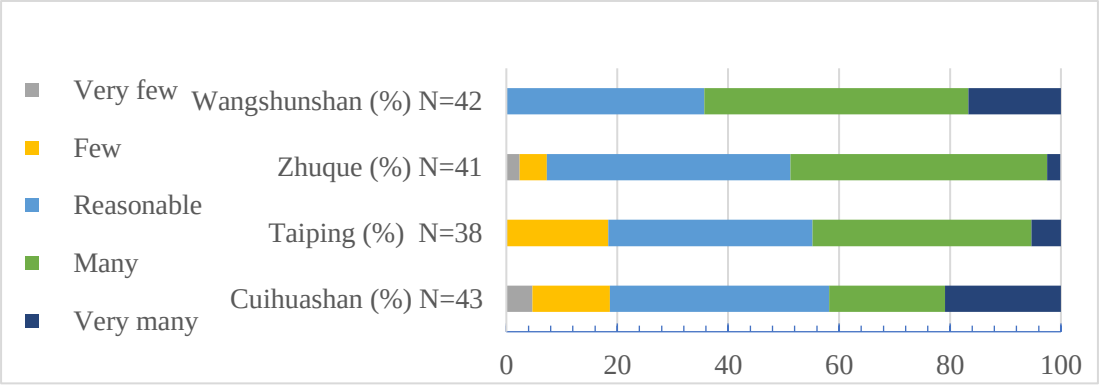

Figure 4.4. Local residents' opinion on quantity of artificial constructions.

4.2.2 Local residents' opinion on the information providing services

In the Cuihuashan spot, approximately 60% of the respondents hold the idea that the

scenic spot's guide maps can provide information to an abundant degree (23.3%) and certain (37.2%) degree. However, as many as 30.2% thought no valid information can be provided. In the Taiping scenic spot, the percentage of providing certain information accounted for 63.2%. In the Zhuque scenic spot, the highest percentage was the same as that of the Taiping. In the Wangshunshan scenic spot, mostly, respondents went for certain degree. The T-value was 0.000, indicating that there exists significant difference among four scenic spots (Figure 4.5).

Figure 4.5 is an official overall map of the QZUGG. Figures 4.7-4.10 are the sample of these four scenic spots' guide maps. Usually, they are available at the visitor centers. However, on some occasions, they are out of storage.

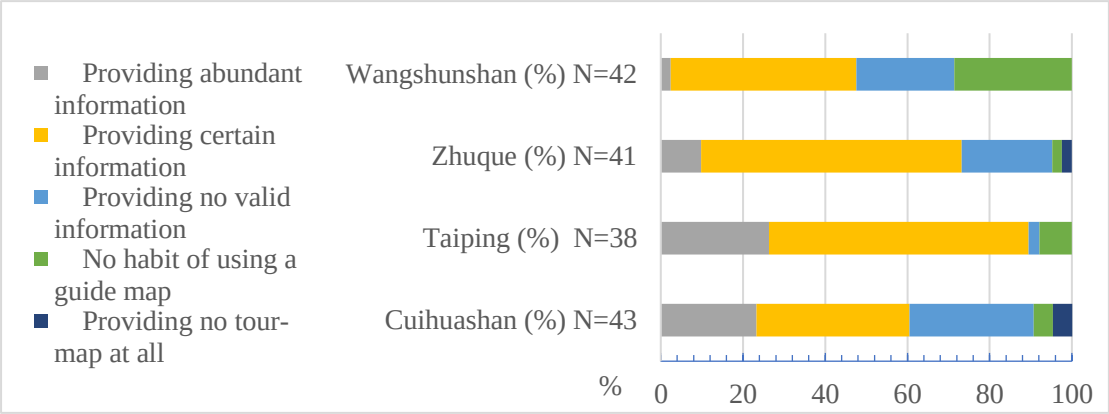

Figure 4.5. Local residents' opinion on guide maps.

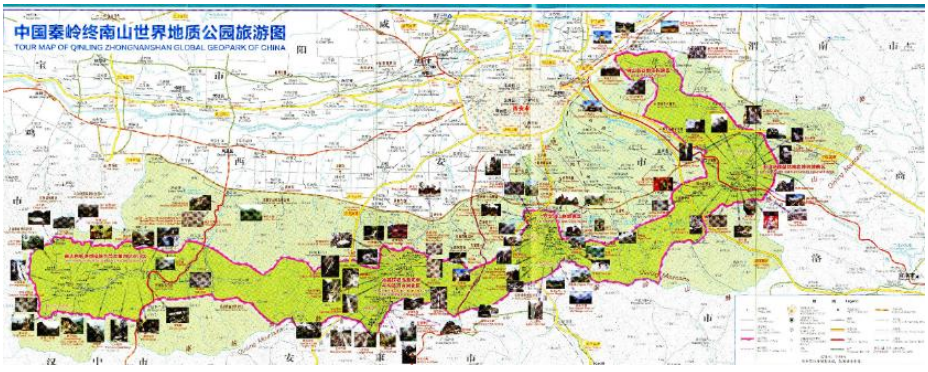

Figure 4.6 Official guide map of QZUGG (reduced in size).

Figure 4.7 Official guide map of the Cuihuashan scenic spot (reduced in size).

Figure 4.8 Official guide map of the Taiping scenic spot (reduced in size).

Figure 4.9 Official guide map of the Wangshunshan scenic spot (reduced in size).

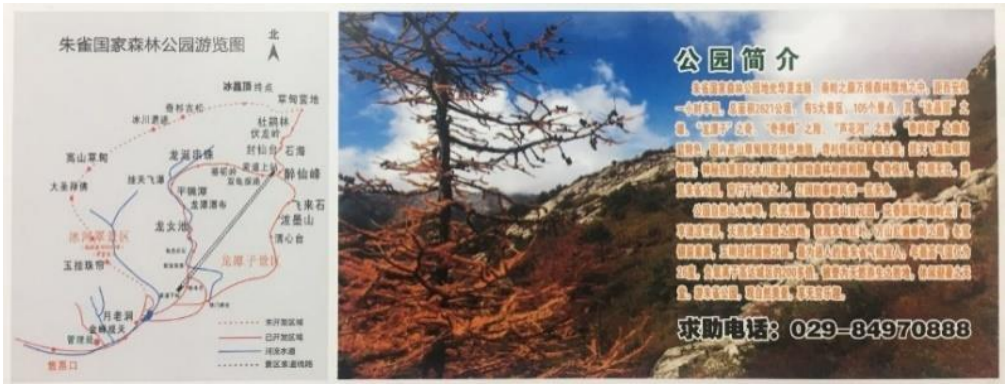

Figure 4.10 Official guide map of the Zhuque spot (reduced in size).

In the Cuihuashan, Taiping and Zhuque scenic spots many respondents hold the idea that the informative sideboards installed along hiking trails can provide abundant information (Figure 4.11). However, this percentage was only 2.4% in the Wangshunshan scenic spot. Conversely, the Wangshunshan scenic spot showed the highest percentage (about half) of providing certain information. The Wangshunshan had the highest percentage of providing insufficient information (23.8%) and the highest percentage of providing almost zero information and reference was still found

in the Wangshunshan scenic spot, which was 14.3%. Among all four scenic spots, only 7% of the respondents from the Cuihuashan thought the informative sideboards was a failure of design and following them could make one disoriented (Figure 4.11). The T-value was 0.000 indicating that there exists significant difference among four scenic spots. Figure 4.12 is a typical informative sideboard. Usually they can be found along the trails. However, many of them are not showing the clear information.

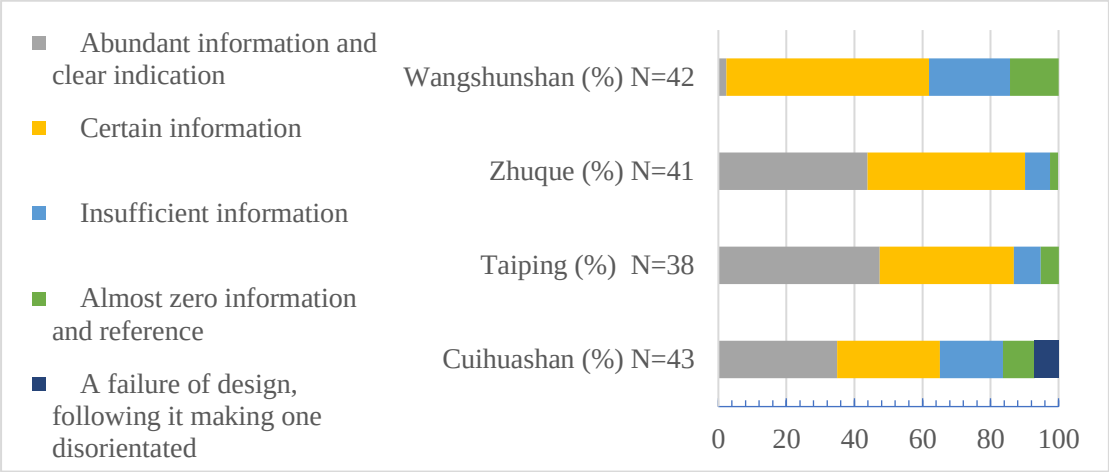

Figure 4.11. Local residents' opinion on informative sideboard.

Figure 4.12. An informative sideboard in the Cuihuashan scenic spot (source: author).

4.2.3 Local residents' opinions on educational service

The respondents from the Cuihuashan scenic spot showed the highest percentage (34.9%) providing abundant geological education (Figure 4.13). This was slightly higher than that from the Zhuque (31.7%) and much higher than that from the Taiping (7.9%) and the Wangshunshan (2.4%). Quite high percentage of providing certain geological education was found in Wangshunshan (66.7%) followed by the Zhuque (58.5%) and the Taiping (52.6%). The Cuihuashan accounted for 30.2% of this response.

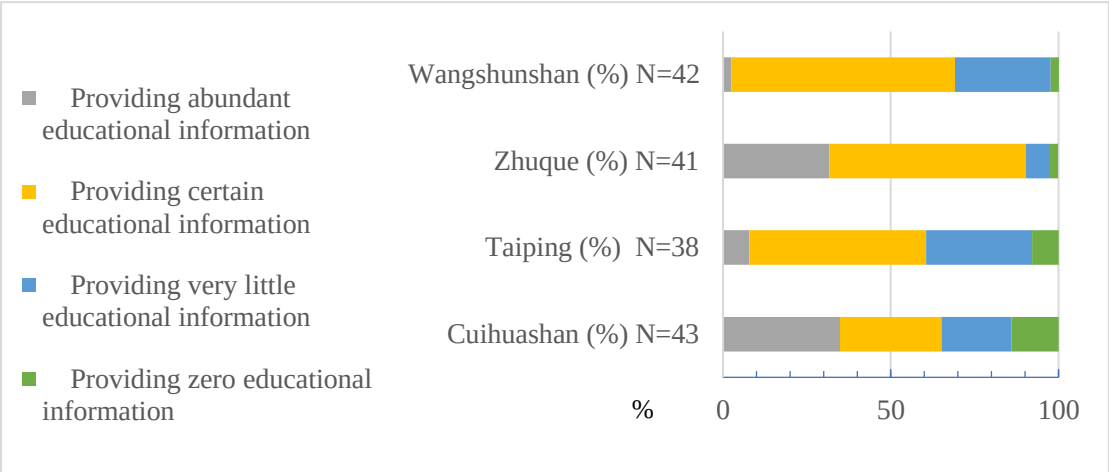

Figure 4.13. Local residents' opinion on educational service.

There were some respondents holding the idea that the geopark provides very little geological education. This was 31.6% in the Taiping followed by the Wangshunshan (28.6%), the Cuihuashan (20.9%) and the Zhuque (7.3%). In the Cuihuashan scenic spot, the percentage of providing zero geological education was 14% and this was 7.9% in the Taiping, and 2.4% in both the Zhuque and Wangshunshan scenic spots. The T-value was 0.005 indicating that there exists significant difference among four scenic spots (Figure 4.13).

4.2.4 Local residents' opinions on the function of protecting nature

In all scenic spots, respondents thought that the geopark protects the nature to some degree (Figure 4.14). The highest percentage of protecting the nature to a great degree was observed in the Cuihuashan (27.9%). On the opposite, there were 27.9% of the respondents of the Cuihuashan who thought that the geopark is destroying the nature to a certain degree. Around 10 % and 8% respondents in the Cuihuashan and Taiping scenic spots thought that the geopark is destroying the nature to a great degree (Figure 4.14). The T-value was 0.042 indicating that there exists significant difference among four scenic spots (Figure 4.14).

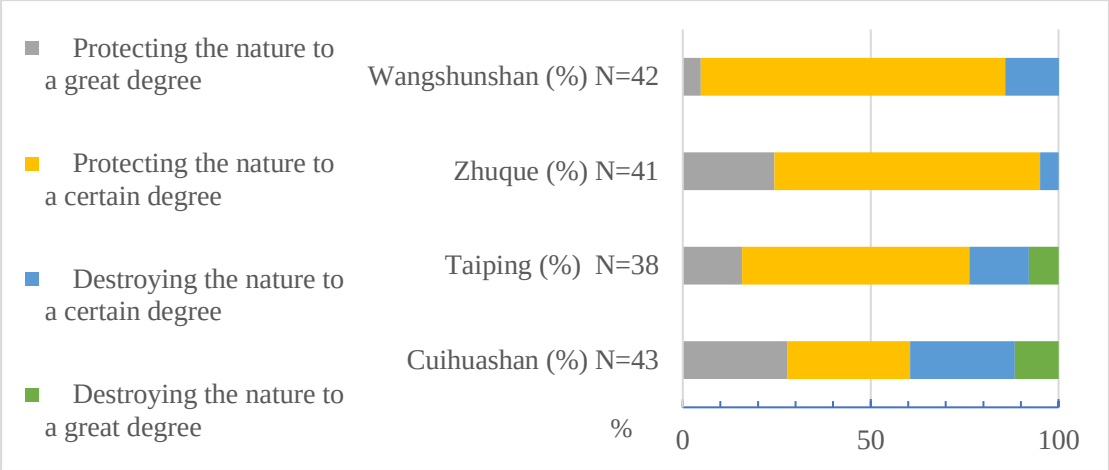

Figure 4.14. Local residents' opinion on nature protection.

4.2.5 Local residents' opinions on the quantity of artificial constructions

4.3 Problems facing this geopark

This study also has inspected local residents' ideas on some possible problems facing this geopark. (Table 4.1).

Table 4.1. local residents' ideas of the problems facing this geopark

Characteristics	Cuihuashan (%)	Mean	Taiping (%)	Mean	Zhuque (%)	Mean	Wangshunshan (%)	Mean	P
N	43		38		41		42		
Transportation	62.8	0.63	81.6	0.82	63.4	0.63	42.9	0.43	0.005
Education activity	25.6	0.26	2.6	0.03	12.2	0.12	11.9	0.12	0.023
Facilities	44.2	0.44	18.4	0.18	31.7	0.32	61.9	0.62	0.000
Entrance fee	65.1	0.65	23.7	0.24	2.4	0.02	0.0	0.00	0.000
Service quality	34.9	0.35	21.1	0.21	7.3	0.07	11.9	0.12	0.006
Under-development	53.5	0.53	7.9	0.08	31.7	0.51	42.9	0.43	0.000
Over-development	25.6	0.26	5.3	0.05	7.3	0.07	9.5	0.10	0.017
Poor infrastructure	41.9	0.42	31.6	0.32	51.2	0.51	31.0	0.31	0.194
Over-building	23.3	0.23	7.9	0.08	9.8	0.1	11.9	0.12	0.164

4.3.1 Transportation

Table 4.1 clearly shows that all these four scenic spots faces a problem in transportation. The Taiping scenic spot showed the highest percentage (81.6%), followed by the Zhuque (63.4%), the Cuihuashan (62.8%) and the Wangshunshan (42.9%). T-value was 0.005 indicating that there exists significant difference among four scenic spots (Table 4.1).

4.3.2 Education activity

As for the education activity, the lowest percentage was found in the Taiping scenic spot (2.6%) while the highest one in the Cuihuashan (25.6%). The Zhuque and the Wangshunshan had similar percentage, i.e.,12.2% and 11.9%, respectively. T-value was 0.023 indicating that there exists significant difference among four scenic spots (Table 4.1).

4.3.3 Facilities

The highest percentage was seen in the Wangshunshan scenic spot (61.9%). In the Cuihuashan scenic area, 44.2% of the respondents thought facility was the problem facing the geopark followed by the Zhuque and the Taiping, 31.7% and 18.4%, respectively. T-value was 0.000 indicating that there exists significant difference among four scenic spots (Table 4.1).

4.3.4 Entrance fee

In the Wangshunshan scenic spot, no respondents thought that the entrance fee was a problem whereas 65.1% of the Cuihuashan's respondents see it a problem facing the geopark. This was 23.7% in the Taiping and 2.4% in the Zhuque. T-value was 0.000 indicating that there exists significant difference among four scenic spots (Table 4.1).

4.3.5 Service quality

In the Cuihuashan scenic spot, 34.9% of the respondents regarded service quality as a problem facing the geopark, which was the highest percentage. This was 21.1% in the Taiping, 11.9% in the Wangshunshan and 2.6% in the Taiping. T-value was 0.006 indicating that there exists significant difference among four scenic spots (Table 4.1).

4.3.6 Under-development and over-development

There were 53.5% of the residents in the Cuihuashan scenic spot who showed under-development as a problem followed by the Wangshunshan (42.9%), the Zhuque (31.7%) and the Taiping (7.9%). T-value was 0.000 indicating that there exists significant difference among four scenic spots (Table 4.1). The highest percentage of overdevelopment was also found in the Cuihuashan scenic spot, 25.6% followed by 9.50% in the Wangshunshan, 7.3% in the Zhuque and 5.3% in the Taiping scenic spot. T-value was 0.017 indicating that there exists significant difference among four scenic spots (Table 4.1).

4.3.7 Poor infrastructure and Overbuilding

In the Zhuque scenic spot, as high as 51.2% of the respondents thought of poor infrastructure as a problem that the geopark was faced with. This was 41.9% in the Cuihuashan, 31.6% in the Taiping and 31% in the Wangshunshan scenic spot. T-value was 0.194 indicating that there does not exist significant difference among four scenic spots (Table 4.1). The highest percentage of overbuilding was also found in the Cuihuashan scenic spot (23.3%), followed by the Wangshunshan (11.9%), the Zhuque (9.85%) and the Taiping (7.9%).

T-value was 0.164 indicating that there does not exist significant difference among four scenic spots (Table 4.1).

4.4 Overall impression by the local residents

In this section, this study examined the local residents' overall impression on the geopark including their overall satisfaction, the difference between the expectation and reality, and the probability of recommending this geopark. In order to find out if there is a significant difference among four scenic spots, a compared means method was employed.

4.4.1 Overall satisfaction

It is obvious that most respondents from all those four scenic spots hold a neutral overall satisfaction (Figure 4.15). The highest percentage of satisfied respondents was 39% in the Zhuque scenic spot followed by the Wangshunshan (38.1%). In the Taiping scenic spot, the percentage of very satisfied was the highest (23.7%) followed by the Cuihuashan (18.6%). Dissatisfied and very dissatisfied took rather small part. T-value was 0.57 indicating that there does not exist significant difference among four scenic spots (Table 4.1).

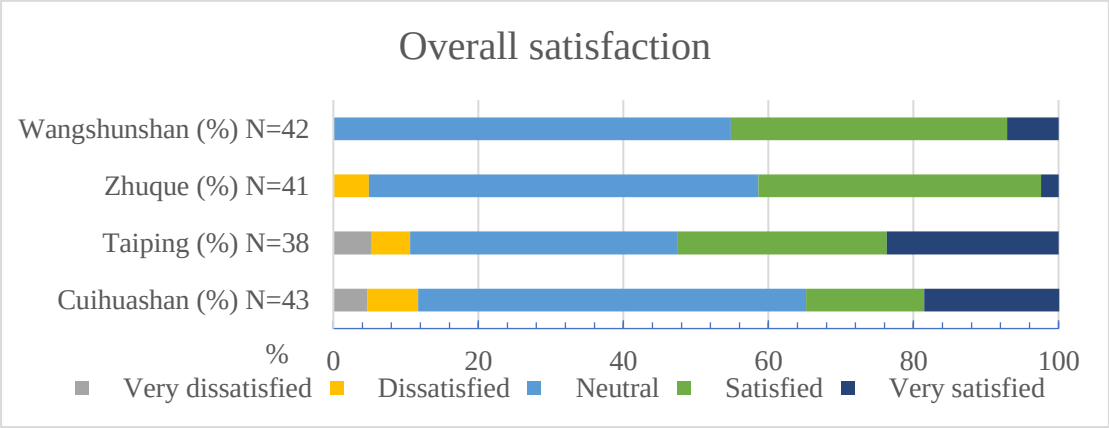

Figure 4.15. Overall satisfaction by the local residents.

4.4.2 Attraction

In all four scenic spots, most respondents hold a neutral attitude towards the attraction

of the geopark (Figure 4.16). The highest percentage was found in the Zhuque scenic (56.1%), followed by the Cuihuashan (51.20%). Only 4.7% in the Cuihuashan chose the response of very dissatisfied. This was 0.0% in the other three scenic spots. The highest percentage of the dissatisfied was in the Cuihuashan (14%) followed by the Zhuque (9.8%). T-value was 0.23 indicating that there does not exist a significant difference among four scenic spots (Figure 4.16).

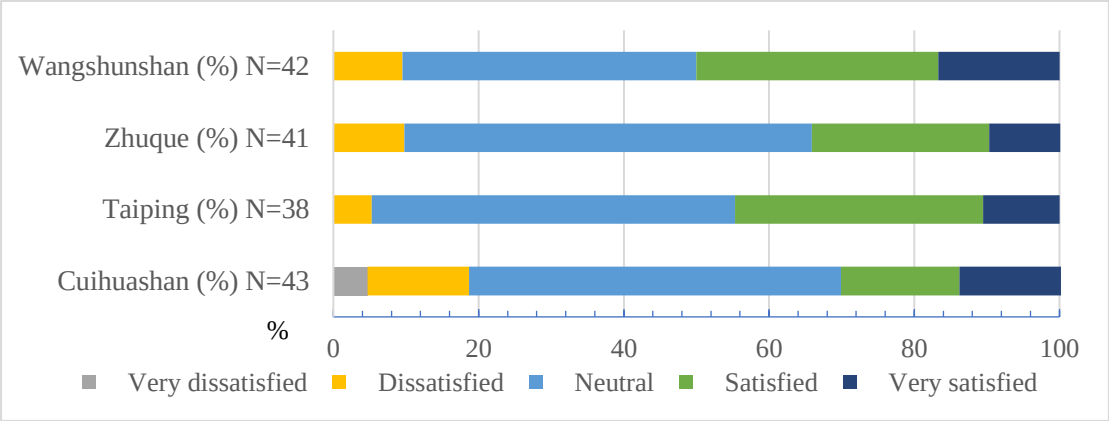

Figure 4.16. Local residents' ideas on geopark's attraction.

4.4.3 Difference of imagination and reality

No respondents from the Zhuque and Wangshunshan scenic spots chose very dissatisfied. In the Cuihuashan and the Taiping, this percentage was also very low, 7% and 2.6%, respectively (Figure 4.17). However, the percentage of dissatisfied in the Wangshunshan scenic spot was 26.2%, followed by the Cuihuashan (18.6). Most people had neutral attitude. The highest percentage of satisfied was in the Zhuque scenic spot (53.7%) followed by the Taiping (39.5%). The Wangshunshan scenic spot had the highest percentage of very satisfied (21.4%) followed by the Taiping (21.1%), the Cuihuashan (14%) and the Zhuque scenic spot (9.8%). T-value was 0.12 indicating that there does not exist a significant difference among four scenic spots (Figure 4.17).

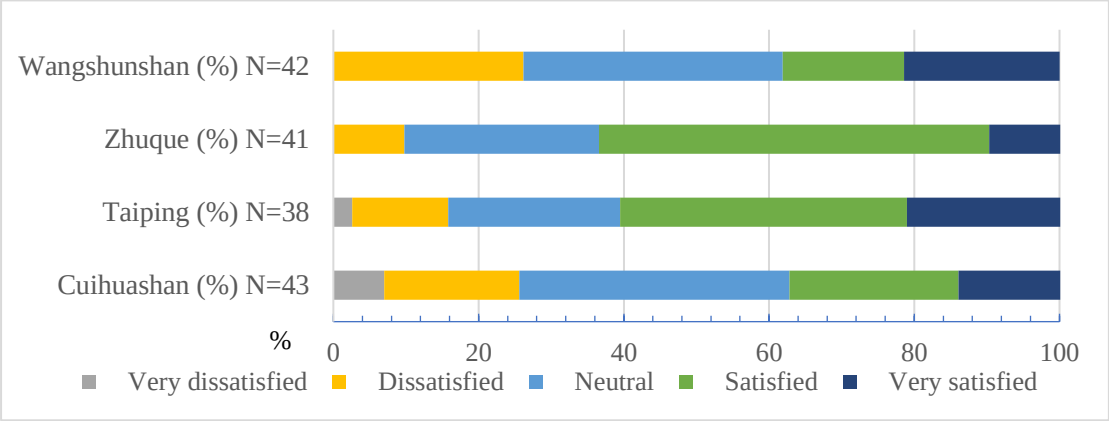

Figure 4.17. Local residents' ideas on difference of imagination and reality of the geopark.

4.4.4 Willingness of recommending the geopark to others

Basically, our respondents would like to recommend this geopark to other people (Figure 4.18). In the Taiping scenic spot, 26.3% of the respondents had very high willingness of recommendation. More than half of the respondents (53.7%) from the Zhuque scenic spot had high willingness of recommendation, followed by the Taiping (34.2%). Response of the neutral attitude was quite similar in all scenic spots, about 25%. The response of low probability happened in all spots with the highest percentage in the Wangshunshan (35.7%) followed by the Cuihuashan (23.3%). Respondents who chose the response of very low willingness were 11.6% in the Cuihuashan and 2.4% in the Zhuque. T-value was 0.08 indicating that there does not exist a significant difference among four scenic spots.

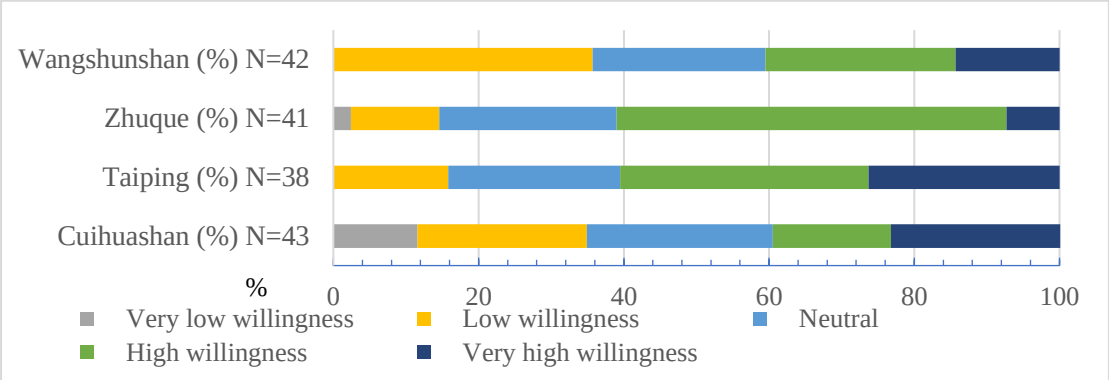

Figure 4.18. Willingness of recommending the geopark to others.

4.5 Discussion

Local residents basically showed higher than average satisfaction towards the aspects of entrance and parking fee of the geopark except for the Cuihuashan scenic area's local residents. This is possibly because the entrance fee of the Cuihuashan is the most expensive, about 100 USD. During the interview, they did show their concern about the potential negative effects that overpriced entrance fee and parking fee would discourage visitors' intention to pay a visit. However, the manager of the Cuihuashan told us that he was not very satisfied with the present price for entrance and parking because he is very confident about the aesthetic and sight-seeing value of the geopark. Besides, to develop more infrastructure and facilities, as he mentioned he wants to build larger parking lots and visitor centers, more profit is thus needed. The Wangshunshan gave the highest score because it is the only one which is directly run by the local government. In order to attract more visitors to generate avenue, this area is free to enter and park. Although the local residents from all of four scenic areas seemed quite satisfied with the park's resource abundance and appreciation, the management officials still need to value and respect people's perception and attitude. The previous study done by Costanza and Folke (1997) indicated that people's perception can influence the management of recreational ecosystem services. Therefore, it is no doubt necessary to take people's perception and attitude into consideration when making managerial decisions (Daily 2000).

The management officials told us that they also keep doing interview with visitors. According to their results, more than 90 percent of visitors showed very satisfied attitude and perception. This was totally different from what was presented in present study: for example, the resource quality, facility and information materials (Table 4.2). This is possibly because when facing management officials' faces, visitors would not be willing to expose their one hundred percent real thoughts. Hence, questionnaire

survey with visitors or local residents should be done by the third party.

Table 4.2. Questionnaire survey done by the Taiping-Zhuque scenic area

Items	Very satisfied	Satisfied	Neutral	Dissatisfied	Very satisfied
Resource quality	945	25	30	0	0
Facility	926	41	30	3	0
Sideboard	863	106	25	6	0
Maps	831	99	66	4	0
Overall satisfaction	950	25	25	0	0

4.6 Summarization

It is very interesting to notice that all residents from the Wangshunshan scenic spot were very satisfied with fees. According to their explanation, this was because the entrance fee is free and parking fee was very cheap, 0.77 USD ($), almost nothing. All of them think this is helpful to attract visitors. This is a very unique feature. According to their official, the Wangshunshan scenic spot is the only one that is under management of governmental agency among all scenic spots of QZUGG. This spot is far from city area; therefore, the local government tries to attract visitors by free entrance fee and cheap parking fee, with which the Wangshunshan scenic spot-visitor connectivity is maintained. However, those local people in the Cuihuashan thought that overpriced entrance fee and parking fee could discourage visitors, and lead to a decrease of their income, weakening the Cuihuashan scenic spot-visitor connectivity.

Basically, local residents hold neutral to satisfied attitude towards the aspects described above. However, the Cuihuashan showed relatively lower satisfaction towards several

perspectives, such as trail planning, artificial quantity, information service, educational service and nature protection. The Cuihuashan scenic spot is the only one where there live local residents within the Geopark. This close relationship may be the reason that they have deeper and better observation about the Geopark.

Chapter 5 Outside attitudes and perceptions

5.1 Demography of visitors

This chapter examined respondents' demography, characteristics and perception of the QZUGG. Hereby, this study classified the respondents into three groups, i.e. visitors on sites, citizens of the Xi'an city and the students from nearby universities and colleges. For visitors on site, this study conducted questionnaires in the geopark using a face-to-face method. Citizens and students finished questionnaires online. Totally, this study had 640 responses from visitors in the Cuihuashan, the Taiping, the Zhuque and the Wangshunshan scenic spots. Citizens contributed 213 and students 136 responses. Data were input and analyzed with SPSS 24 for Windows. To detect the existence of significant differences among three groups, the method of compared means was employed at a significant level of 0.05. For the group of students, this study only considered their gender distribution because normally their age and education level are of similar characteristics.

In all three groups, more female took participation in the questionnaire surveys: 66.2% for the group of students, followed by the group of visitors (57.8%) and the group of citizens (53.1%) (Table 5.1).

Most visitors were between 20-40 years old: 20-30 took up 33.1% and 30-40 25.0%. The respondents younger than 20 years old accounted for 16.7%. The percentage of 40-50 years old was 12.5%, which was slightly lower than that of elder than 50 years old (12.7%). The group of the citizens shared the similarity with visitors. Most respondents belonged to 20-30 years old (40.8%) followed by 30-40 years old (36.6%). Only 5.6% of them were younger than 20 years old. Respondents of 40-50 years old were more than the ones of elder than 50 years old, the former 12.2% and the latter 4.7% (Table

5.1).

Large percentage of the visitors were from Xi'an city (64.7%) while 18.3% of them were from somewhere in Shaanxi Province (Xi'an is the capital city of Shaanxi Province). There were only 9.7% of the respondents who were from out of Shaanxi Province. In the group of visitors, 7.3% of the respondents were not willing to expose their origin. Many of the citizens (68.1%) were originally from Xi'an city whereas some of them were immigrants from other parts of Shaanxi Province (12.2%) and out of Shaanxi Province (19.7%) (Table 5.1).

Table 5.1. Demography of respondents

Characteristics	General visitors (%)	Citizens (%)	Nearby university and college students (%)
N=	640	213	136
Gender			
Male (%)	42.2	46.9	33.8
Female (%)	57.8	53.1	66.2
Age			
< 20	16.7	5.6	
20-30	33.1	40.8	
30-40	25.0	36.6	
40-50	12.5	12.2	
>50	12.7	4.7	
Where are you from			
Xi'an	64.7	68.1	
Shaanxi Province	18.3	12.2	
Out of Shaanxi Province	9.7	19.7	
Unwilling to tell	7.3		
Education			
Middle school or under	15.2	1.9	
High school	26.3	10.3	
College or university	50.6	67.6	
Master of above	7.5	20.2	
Unwilling to tell	0.5		
Occupation			
Servant	3.6	4.2	
Business staff	25.0	11.7	
Self-employed	16.4	21.1	
Teacher	6.4	11.7	
Student	28.0	4.7	
Researcher	2.3	0.9	
Retiree	5.2	2.3	
Peasant	5.2	0.5	
Other	7.7	11.7	
Unwilling to tell	0.3		

In the groups of both visitors and citizens, more than half of the respondents had an education level of college and university (visitors, 50.6%; citizens, 67.6%). In the group of visitors, 15.2% had a level of education of middle school or under, which was higher

than that of the group of citizens (1.9%). Percentage of 26.3% of visitors had high school education and this was 10.3% for the group of citizens. Citizens had higher percentage of master's or above education level which was higher than that of the group of visitors (7.5%).

Occupation had various results (Table 5.1). For the group of visitors, students had the highest percentage (28%) followed by business staff (25%) and self-employed (16.4%). The other kinds of occupations accounted for 7.7% followed by teachers (6.4%). The retiree and peasant had the same percentage (5.2%), followed by servants (3.6%) and researchers (2.3%). The group of citizens appeared slightly different. The highest percentage was self-employed (21.1%), followed by business staff, teachers and the other kinds (all was 11.7%). Students accounted for 4.7% followed by servants (4.2%), followed by retirees (2.3%). Researchers and peasants only took up very small part, 0.9% and 0.5%, respectively (Table 5.1).

5.1.1 Other characteristics of respondents

Both in the groups of visitors and citizens there had high percentage of going to scenic spots by diving cars: visitors, 63.1% and citizens, 58.2%. In the group of students, it was 33.8%. Most students chose public transportation (41.2%), followed by the group of visitors (19.8%) and citizens (16%). Citizens had a percentage of 22.1% to use tour bus and this was 11.6% for visitors followed by the group of students (8.8%). There were few respondents from the group of visitors and citizens choosing bicycles to go to a scenic spot while students had 12.5%. Some students prefer to use motorcycles; however, this was zero for both visitors and citizens. Some respondents went to the scenic spot on foot, visitors (3.9%), followed by students (2.2%) and citizens (1.4%). In the group of visitors, some respondents (0.5%) used other means of transportations to scenic spots (Table 5.2).

Table 5.2. Some other characteristics of respondents

Characteristics	General visitors	Citizens	Nearby university and college students	p-value
N=	640	213	136	
Your general means of transportation to scenic spots?				
Driving	63.1	58.2	33.8	
Public transport	19.8	16.0	41.2	
Tour bus	11.6	22.1	8.8	
Bicycles	1.1	2.3	12.5	
Motorcycles	0.0	0.0	1.5	
On foot	3.9	1.4	2.2	
Other	0.5	0.0	0.0	
Considering factors when deciding a destination to visit				
Features	79.4	85.9	90.4	0.003
Transportation	31.6	47.9	48.5	0.000
Safety	29.5	38.5	50.7	0.000
Price	18.9	32.9	47.8	0.000
Service	9.4	33.3	47.8	0.000
No better choice	4.2	3.3	34.6	0.049
Do you know this geopark?				
Yes, I do.	62.0	45.5	43.4	0.000
Via what you know this is a Geopark				
Official website of this park	5.8	5.6	8.1	0.087
GGN website	4.4	1.4	7.4	0.005
Other cyber resources	25.0	23.0	19.1	0.184
Friends and fellow students	23.0	20.7	27.2	0.001
Lectures of University	0.0	0.5	5.9	0.000
Travel agencies	3.0	8.0	8.8	0.000
Others	6.6	0.9	0.7	0.004
Did you learn the knowledge of geopark at schools?				
Yes, I did.	24.8	24.9	27.2	0.668
How many times you came here?				
1	71.7			
2	19.2			
3	4.7			
>3	20.0			
I cannot remember	2.3			

When making their decisions of which destination to go for visitation, three groups

showed different concerning factors. In general, features of a scenic spot were the most considered for all groups (Table 5.2). The group of students accounted for the highest percentage of taking transportation as a considering factor (48.5%). For the factor of safety, the highest percentage was still in the students' group which was 50.7%. The group of visitors considered the factor of price the least (18.9%) whereas the highest was form the group of students (47.8%).

Surprisingly, the lowest percentage of if the respondents knew it was a Global Geopark was seen in the group of students, which was 43.4%, less than half. The highest was the visitors' group, but still less than two-thirds (62.0%). The difference among three groups was significant indicated by a T-value of 0.000. Mostly, respondents obtained their information via cyber resources (visitors, 25% followed by citizens, 23.0% and students, 19.1%) or their friends and fellow students (students, 27.2% followed by visitor, 23.0% and citizens, 20.7%). The official website of the geopark only contributed 8.1% to the group of students, 5.8% to visitors and 5.6% to citizens. (Table 5.2).

In all groups, only approximately one-quarter of the respondents learnt the knowledge of the geopark at their schools. The highest was students' group (27.2%), followed by citizens (24.9%) and the group of visitors (24.8%). This study did not have significant difference among three groups, T-value being 0.668 (Table 5.2). As high as 71.1% of the visitors came to the geopark for the first time. The second-high percentage was the visitors who had visited here more than three times followed by the visitors of two times.

5.2 Popularity of the eight scenic spots among groups of visitors, citizens and students

This section examined the popularity of eight scenic spots among different groups, i.e. the group of visitors, the group of citizens of the Xi'an City and the group of the students

of the nearby universities and colleges. It was conducted by two parts. The first part examined which of these eight scenic spots the respondents knew, and the second part examined which of them they had been to. The results of this section are to be described according to the groups by ranking of eight scenic spots.

5.2.1 The ranking for the response of "which of those eight scenic spots of the QZUGG do you know"

It is very clear that among all three groups, the Cuihuashan was the most famous one. The other scenic spots also were well known. (Figure 5.1). However, the Wangshunshan and the Heihe spots did not enjoy too much fame (Figure 5.1).

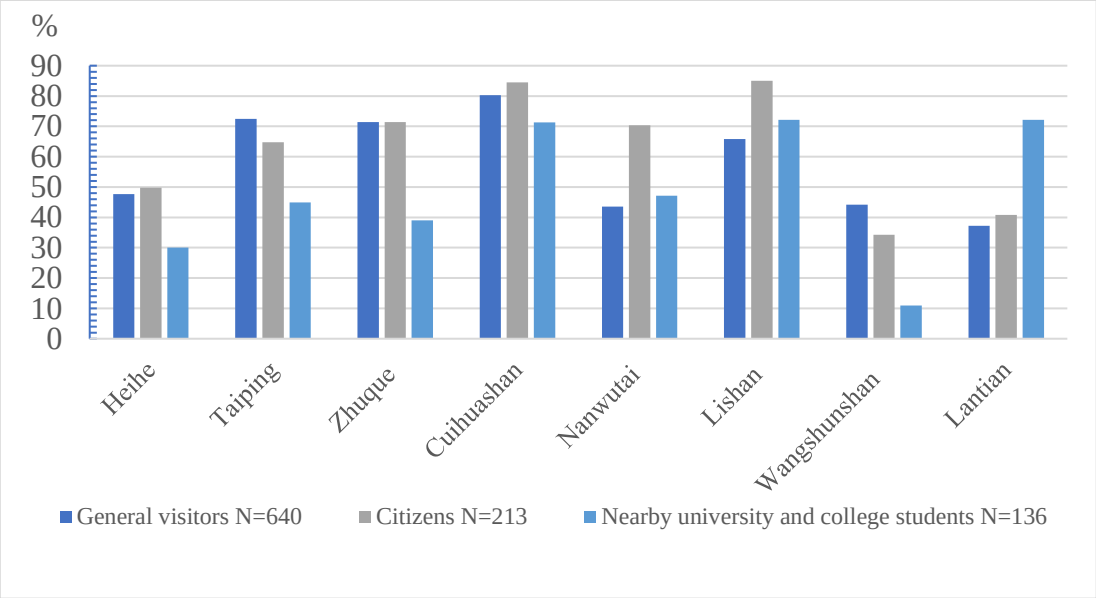

Figure 5.1. Which of those eight scenic spots of the QZUGG do you know?

5.2.2 The ranking for the response of "which of those eight scenic spots of the QZUGG you have been to"

For the actual visitation, it is somehow different situation. It seemed that visitors group preferred the Taiping, the Zhuque and the Nanwutai spots (Figure 5.2). Students liked to go to the Cuihuashan and the Lishan spots. The group of citizens showed the same

trend with students' group (Figure 5.2).

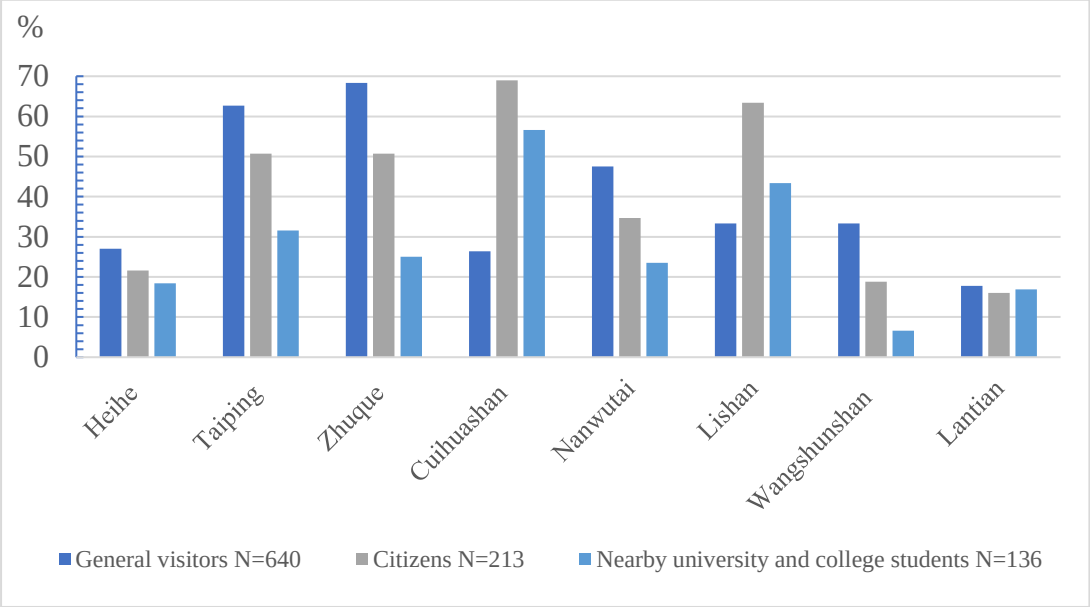

Figure 5.2. Which of those eight scenic spots of the QZUGG you have been to?

5.3 Some information in detail about the study site

This study further examined the satisfaction and perceptions of three groups, i.e. the group of visitors, the group of citizens and the group of nearby university and college's students. This part was conducted with two steps. Firstly, this study investigated respondents' ideas on some general items, i.e. their satisfactions towards the entrance fee, parking fee, resource abundance and resource appreciation. Further, some more detailed questions about several aspects related to the geopark were asked.

5.3.1 Respondents' satisfaction towards entrance fee, parking fee, resource abundance and appreciation

It is interesting to notice that in all four asked items, the outsiders showed neutral to satisfied attitude towards the entrance fee (Figure 5.3). More than 30% of the visitor group was very satisfied with the entrance fee. There were only small percentages of

respondents expressed their dissatisfaction.

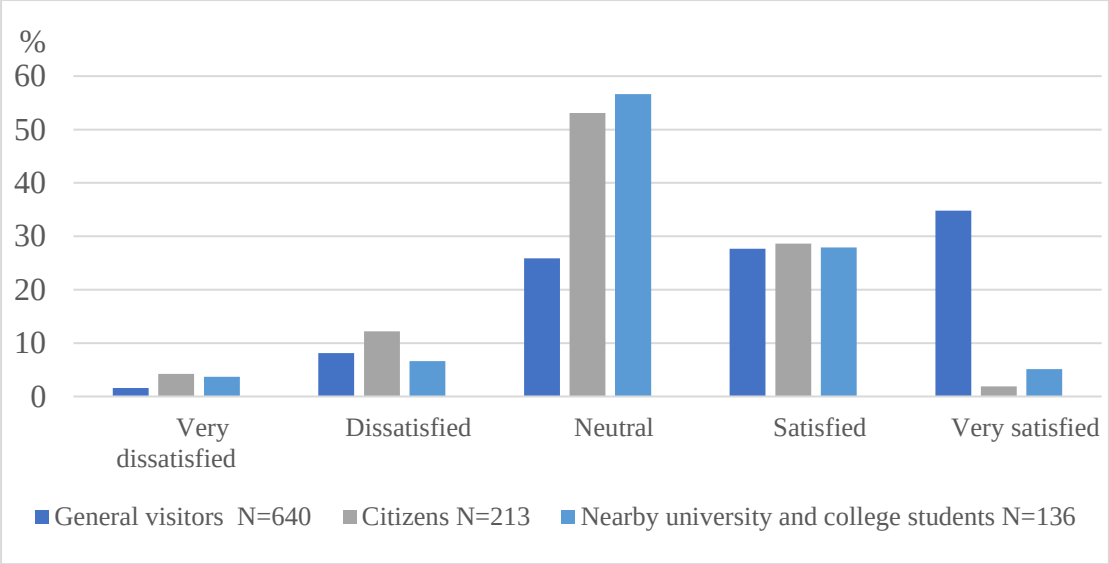

Figure 5.3. Outside opinions on the entrance fee of the QZUGG.

However, when it comes to the parking fee, less respondents were satisfied. On the opposite, more dissatisfied voices were made (Figure 5.4).

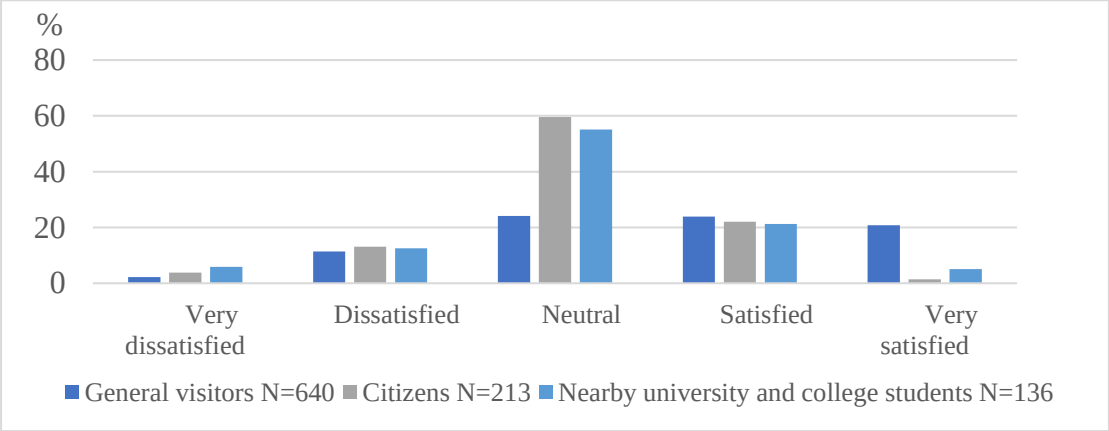

Figure 5.4. Outside opinions on parking fee of the QZUGG.

About the resource abundance and appreciation, around 40% of all three groups of outsiders showed neutral to satisfied attitude. Very small percentage of very dissatisfied attitudes was observed (Figures 5.5 and 5.6).

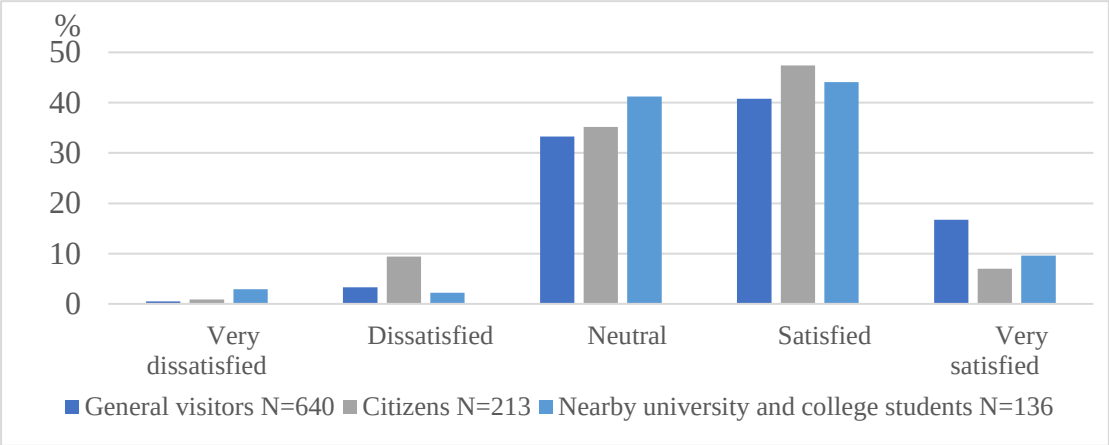

Figure 5.5. Outside opinions on resource abundance of the QZUGG.

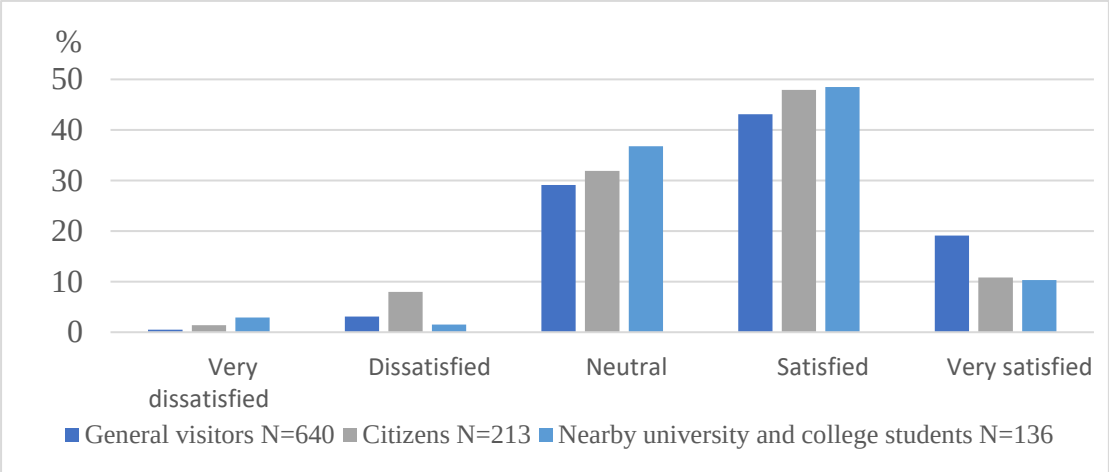

Figure 5.6. Outside opinions on resource appreciation of the QZUGG.

5.3.2 Respondents' satisfaction towards some detailed aspects

5.3.2.1 The opinions on the existing facilities

In the group of general visitors, more than half of respondents (54.1%) thought that well paved hiking trails reduce the joy of climbing a mountain to a certain degree and 14.2% of respondents hold the idea that the joy of ascending a mountain can be reduced to a great degree (Figure 5.7). On the contrary, there was 28.1% of our respondents thought that well paved hiking trails can increase the joy of mountain hiking to a great degree and only 1.7% of them thought this to be a certain degree.

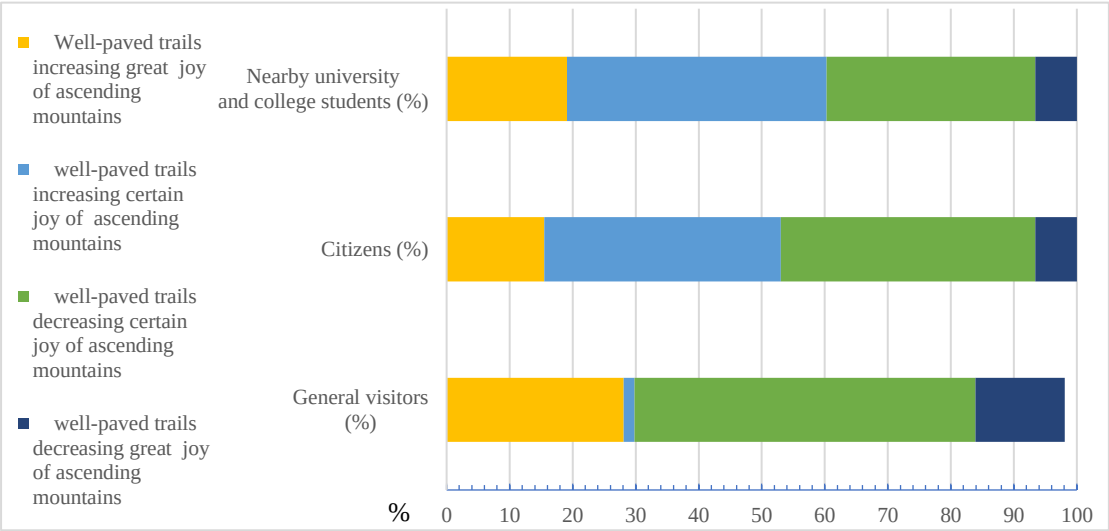

Figure 5.7. Respondents' opinion on well-paved trails.

This study found that similar to the group of general visitors, the group of citizens also had quite a high percentage of respondents (40.4%) holding the idea that the joy of ascending a mountain can be reduced by well-paved hiking trails to a certain degree (Figure 5.7). However, this study also found out that 37.6% of this group's respondents hold the opposite point of view that well paved hiking trails can bring them certain joy of climbing a mountain (Figure 5.7).

A similar trend was observed within the group of nearby university and college students. Nearly half (41.2%) of them reported that well-paved hiking trails can bring joy of ascending a mountain to a certain degree whereas 33.1% of them thought that those well-paved hiking trails can reduce hiking joy to a certain degree. (Figure 5.7).

In all three groups, more than 60% of respondents hold the idea that the hiking trails were reasonably planned. Similarly, around 10% respondents in all groups thought that hiking trails planning were very reasonable. In the group of general visitors, 23.9% chose poor planning, followed by 16.91 for students. The highest one was from the citizens' group, 27.23% (Figure 5.8).

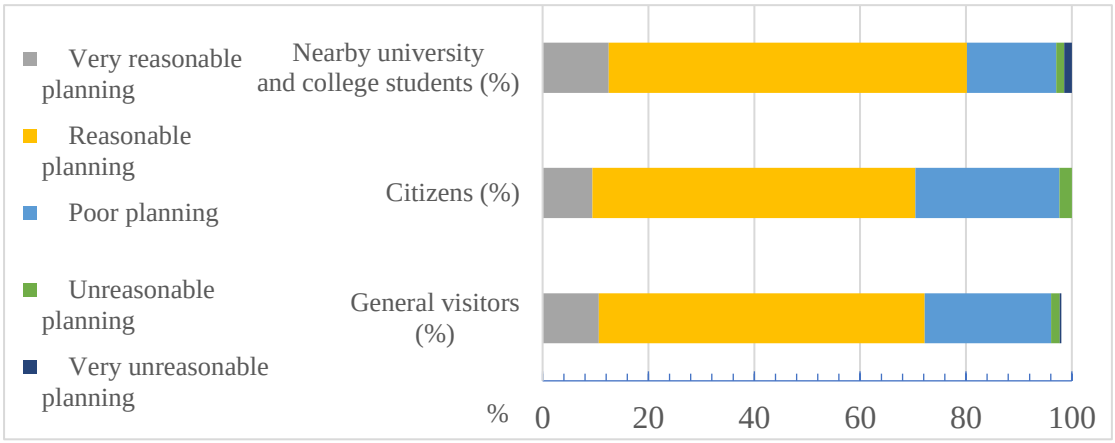

Figure 5.8. Respondents' opinion on trails planning

The group of students had the highest percentage that very few artificial constructions can be found here in the geopark 16.2% (Figure 5.9). A little more than 40% respondents thought there were few constructions and around 30% of them went for reasonable quantity. This study had small number of thinking many and even smaller number of very many (Figure 5.9).

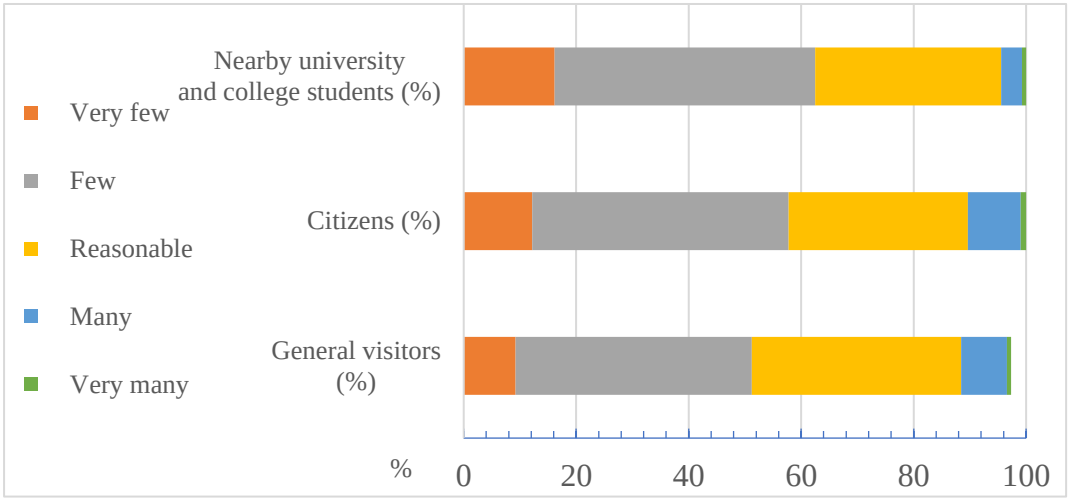

Figure 5.9. Respondents' opinion on the artificial construction quantity.

5.3.2.2 The opinion on guide maps

Around half respondents in all groups thought that the geopark guide maps can provide

certain information (Figure 5.10). More than 30% students thought they can get abundant information from the provided maps, which was followed by 22.3% general visitors and 15.5% of citizens. Some respondents hold the idea that those maps can provide no valid information (Figure 5.10).

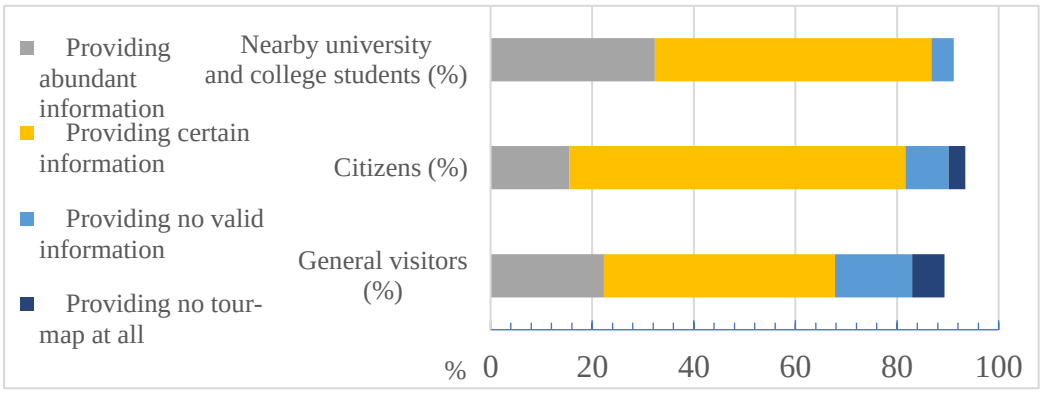

Figure 5.10. Respondents' opinion on maps.

The students' group had quite high percentage of respondents (36%) who thought that information sideboards provide abundant information and clear. Mostly, respondents hold the idea that they can get certain information. This study also had some respondents who thought they can get insufficient information. Small percentage reported that they can get zero information, furthermore, some said worse (Figure 5.11).

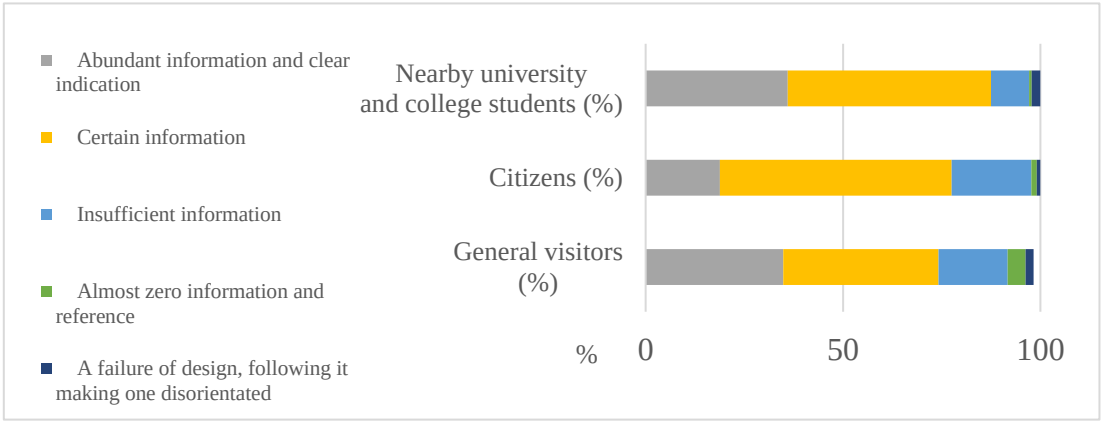

Figure 5.11. Respondents' opinion on the sideboards.

5.3.2.3 The opinion on educational service

More than 70% of all respondents hold the idea the geopark provides abundant or certain geo-educational information (Table 5.12). On the opposite, 25.4% thought the educational information provided is little, and even zero (Figure 5.12).

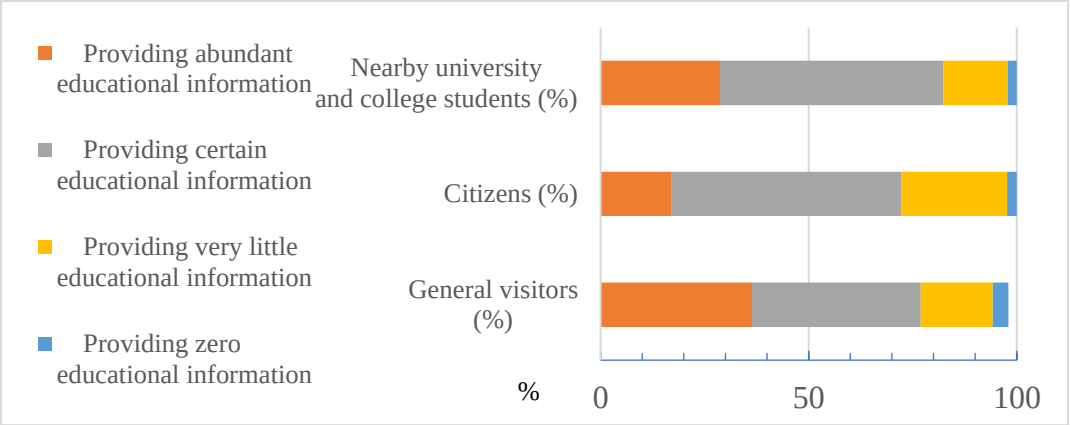

Figure 5.12. Respondents' opinion on the educational service.

5.3.2.4 The opinion on protecting nature

More than 70% of all respondents hold the point of view that this geopark is protecting our nature to a certain or great degree (Figure 5.13). However, around one-fourth thought the other way, reporting this geopark is actually destroying the nature to a certain degree. This study had small number of respondents who thought the nature was destroyed to a great degree (Figure 5.13).

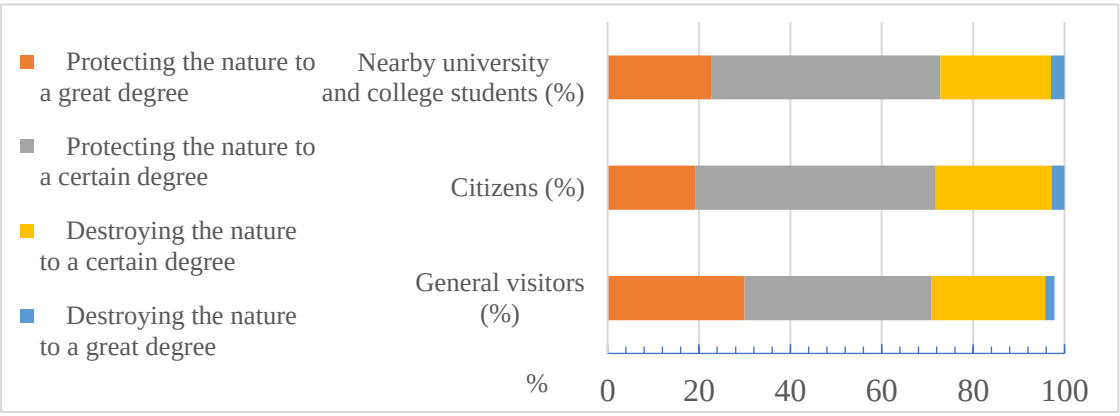

Figure 5.13. Respondents' opinion on the nature protection.

5.4 Problems facing the study site

In the group of visitors on site, about half respondents thought that poor facilities would be a problem facing the geopark and around 40% mentioned poor infrastructure and transportation (Table 5.3). In the group of citizens, similarly to visitors' group, the mostly mentioned was poor facilities (63.4%), followed by entrance fee (43.7%), service quality and transportation. Poor facilities were also regarded as a problem by the group of students the most (55.9%), which was followed by transportation (45.6%), entrance fee (44.9%).

Table 5.3. Problems facing the study site

Characteristics	General visitors (%)	Mean	Citizens (%)	Mean	Nearby university and college students (%)	Mean	P
N=	640		213		136		
Transportation	35.2	0.35	40.8	0.41	45.6	0.46	0.044
Education activity	23.3	0.23	26.8	0.27	26.5	0.26	0.500
Facilities	48.0	0.48	63.4	0.63	55.9	0.56	0.000
Entrance fee	24.7	0.25	43.7	0.44	44.9	0.45	0.000
Service quality	28.9	0.29	43.2	0.43	3.7	0.04	0.000
Under development	39.1		0.0		0.0		
Over development	15.2		0.0		0.0		
Poor infrastructure	38.6		0.0		0.0		
Overbuilding	16.9		0.0		0.0		

5.5 An overall impression

For overall impression, it can be seen that the group of general visitors seems to be the most satisfied. This group had the most very satisfied responses (Figure 5.14). The other groups are almost the same, about 80% of the respondents were neutral or satisfied.

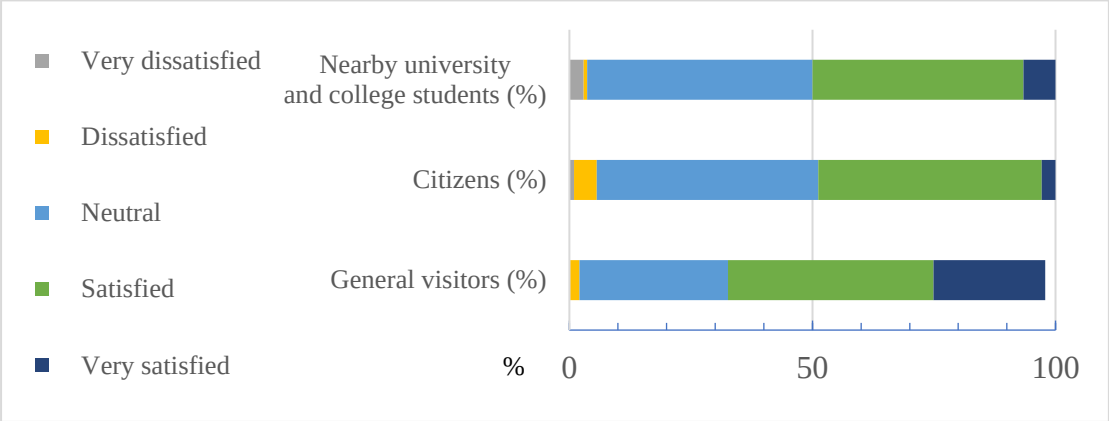

Figure 5.14. An overall satisfaction.

The same trend was found about the Geoparks' attraction. The group of visitors showed the highest percentage of very satisfied. Citizens seemed to have more neutral attitude towards this aspect (Figure 5.15).

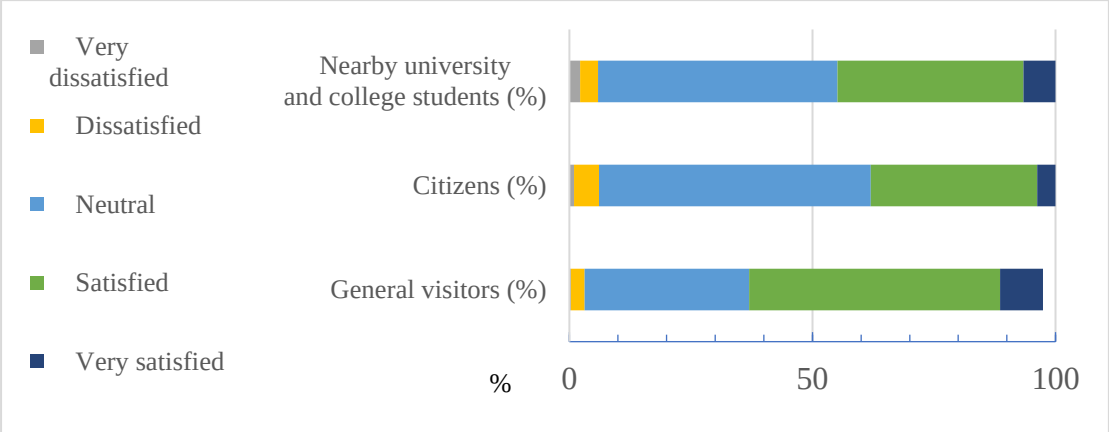

Figure 5.15. Satisfaction towards the attraction of the Geopark.

Citizens and students had about 55% of neutral attitude towards the future revisits. (Figure 5.16). About 10% of the respondents from these two groups showed a high probability. In the group of general visitors, 42% of the respondents showed high probability and 17% very high probability (Figure 5.16).

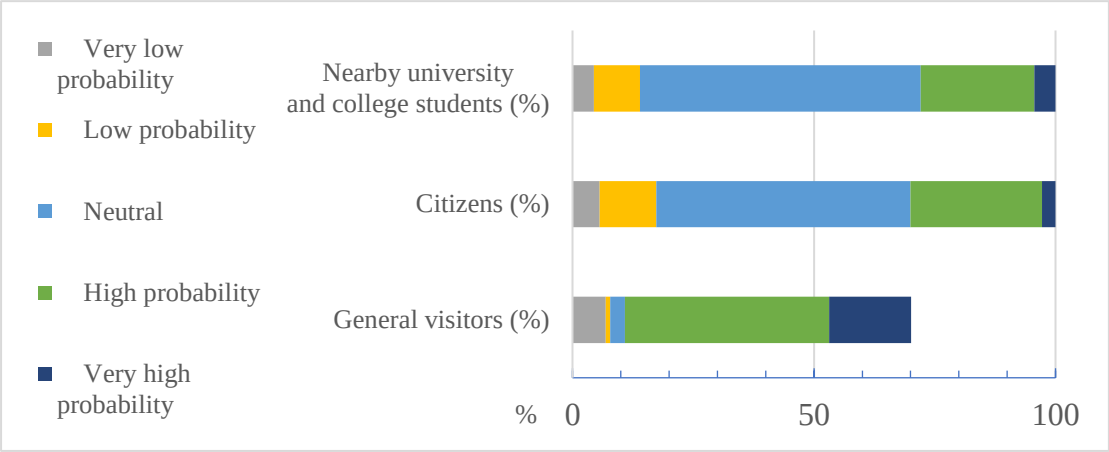

Figure 5.16. Possibility of revisit in the future.

Students showed the highest percentage of neutral attitudes towards willingness of recommendation this Geopark to others. All three groups had almost same respondents who were willing to recommend this Geopark (Figure 5.17).

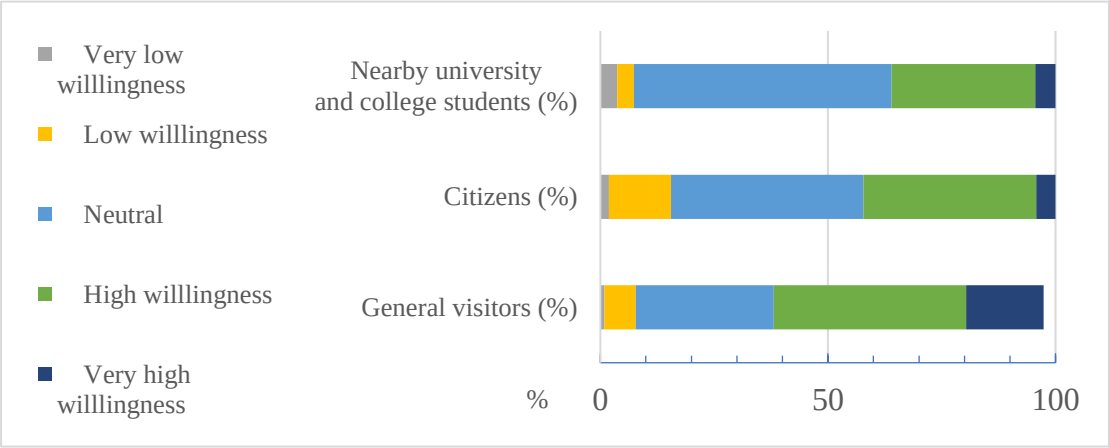

Figure 5.17. Willingness of recommendation.

5.6 Discussion

Table 5.4 clearly showed the means of local residents as well as the results of one-sample t-test. In all four tested items, the management officials had higher means. P-values are 0.000 which indicates there exist significant differences. Visitors' means of their satisfaction towards fees were higher than neutral, showing their awareness of the ecological value and willingness to pay, which was also indicated by Petrosillo et al.

(2007). However, as was indicated by Onwujekwe (2005), management officials should not totally trust in this because the actual willingness to pay could be different. Furthermore, management should always keep understanding visitors' perception and attitude to achieve long-term attraction. The significant difference between visitors and management officials well demonstrates that visitors are expecting more than present status (Table 5.4).

Table 5.4 .Comparison between visitors and management about fee and resource quality

Characteristics		Management official Test value							
Managing State	All visitors_ Mean	Cuihuashan		Taiping		Zhuque		Wangshunshan	
N=		1		1		1		1	
Your satisfaction towards the following items			P		P		P		P
Entrance fee	3.65	4.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00
Very dissatisfied									
Dissatisfied									
Neutral									
Satisfied									
Very satisfied									
Parking fee	3.68	4.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00
Very dissatisfied									
Dissatisfied									
Neutral									
Satisfied									
Very satisfied									
Resource abundance	3.74	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00
Very dissatisfied									
Dissatisfied									
Neutral									
Satisfied									
Very satisfied									
Resource appreciation	3.81	5.00	0.00	3.74	0.00	5.00	0.00	4.00	0.00
Very dissatisfied									
Dissatisfied									
Neutral									
Satisfied									
Very satisfied									

5.7 Summarization

It can be found out that most visitors to this Geopark are people of 20-40 years old, who have a university education level. Very high percentage of them was from local or somewhere within the province, indicating this Global Geopark is actually not that global. This could be due to bad advertisement. Further, many respondents did not know this is a Geopark even when they were standing in there. Even for the group of students, many of them had no idea about this Global Geopark. Some of them said they never had any courses related to geopark at school.

Large percentage of respondents drove their own cars to the Geopark. This might be the reason both management officials and outsiders thought there need better roads and lager parking lots. This also reflects a less ideal public transport to the QZUGG.

Mostly, the respondents were holding a neutral to satisfied attitudes towards all aspects, indicating that despite the shortcomings of this Geopark outsiders like to visit there. Most people said the resource there is very good, which is a good signal for a better future development. However, if compared with the management officials, the groups of the outsiders were not that satisfied, indicating weak connectivity of the Geopark with the outside.

Chapter 6 Local residents' livelihood, income and land issues

As an intractable problem facing conservation, conflicts are increasing both in frequency and intensity (Young et al. 2010). These conflicts can have negative impacts upon many aspects including biodiversity, livelihoods and human well-being, and therefore this topic receive considerable efforts (Redpath et al. 2015). Many conservation conflicts may be explained by poverty and inequality, imbalances of power, and inappropriate process of governance and other societal issues (Czech 2008; Gore et al. 2016; Raik et al. 2008; Vedeld et al. 2012).

In total, 164 questionnaires were collected, in which, 42 from Wangshunshan National Forest Park, 38 from Taiping National Forest Park, 41 from Zhuque National Forest Park and 43 from Cuihuashan National Geopark, respectively.

6.1 Demographic information of the responded local residents

Respondents to the household questionnaire survey were even in gender with 47.6% of male and 52.4% of female (Table 6.1). The respondents were mainly in their thirties to seventies (the eldest respondent is 70 years old); respondents of 20-30 years old only took up 25% (Table 6.1). Most of the respondents (89.0%) received an education of middle school or under (Table 6.1). Large percentage of the respondents were originally local (90.9%).

Table 6.1. Characteristics of the respondents

		Number of cases	Percent
Gender	Male	78	47.6
	Female	86	52.4
	Total	164	100.0
Age	Under 20 years	12	7.3
	20-30 years	29	17.7
	31-40 years	42	25.6
	41-50 years	44	26.8
	Over 50 years	37	22.6
	Total	164	100.0
Education level	Middle school and less	114	69.5
	High school	32	19.5
	College or university	17	10.4
	Master or more	1	0.6
	Total	164	100.0
Where are you from?	Local*	149	90.9
	Non-local	15	9.1
	Total	164	100.0

* Hereby, “Local” means the respondents who were born there.

6.2 Situation of local residents’ employment and occupation

In all those four scenic areas, many of the respondents reported that their jobs there were full-time, in which Wangshunshan scenic area showed the highest one (95.2%) followed by Zhuque scenic area (73.2%), Taiping scenic area (68.4%) and Cuihuashan scenic area (62.8%) (Table 6.2). In the meanwhile, some respondents are having other jobs: 2.6% of Taiping and 2.4% of Zhuque scenic areas are civil servants; only 7% of respondents from Cuihuashan scenic area is working as business staff; and the highest percentage is self-employed type (Taiping, 15.8%; Zhuque 12.2%; Cuihuashan, 9.3%; Wangshunshan, 4.8%) (Table 6.2). Some respondents were teachers, students, peasants or others.

Table 6.2. Employment and occupation situation of the local residents living in study sites area

Statements	Scenic spots			
	Cuihuashan	Wangshunshan	Zhuque	Taiping
	N = 43	N = 42	N = 41	N = 38
	%	%	%	%
1. This is your full-time job.	62.8	95.2	73.2	68.4
2. If it is not your full-time job, what else do you do?				
2.1. Civil servants	0.0	0.0	2.4	2.6
2.2. Business staff	7.0	0.0	0.0	0.0
2.3. Self-employed	9.3	4.8	12.2	15.8
2.4. Teacher	2.3	0.0	2.4	2.6
2.5. Students	14.0	0.0	0.0	5.3
2.6. Peasants	2.3	0.0	7.3	5.3
2.7. Other	2.3	0.0	2.4	0.0
Total	**37.2**	**4.8**	**26.7**	**31.6**
3. All my family member do the job related to this scenic area.	34.9	28.6	43.9	36.8
4. Number of my family member doing the job related to this scenic area.				
4.1. one	11.6	38.1	26.8	31.6
4.2. two	25.6	26.2	22.0	10.5
4.3. three	18.6	4.8	2.4	13.2
4.4. four	2.3	0.0	2.4	2.6
4.5. five	0.0	0.0	2.4	2.6
4.6. six	0.0	2.4	0.0	0.0
4.7. nine	0.0	0.0	0.0	2.6
Total	**58.1**	**71.5**	**56.0**	**63.1**
5. Number of my family member.				
5.1. two	0.0	2.4	0.0	0.0
5.2. three	4.7	9.5	7.3	10.5
5.3. four	18.6	9.5	14.6	13.2
5.4. five	20.9	21.4	22.0	15.8
5.5. six	9.3	14.3	7.3	7.9
5.6. seven	2.3	7.1	2.4	7.9
5.7. eight	2.3	4.8	2.4	2.6
5.8. nine	0.0	0.0	0.0	2.6
5.9. ten	0.0	2.4	0.0	0.0
5.10. eleven	0.0	0.0	0.0	2.6
Total	**58.1**	**71.4**	**56.0**	**63.1**
6. The kinds of job my family member does.				
6.1. catering services	90.7	83.3	97.6	97.4

Table 6.2 (continued). Employment and occupation situation of the local residents living in study sites area

Statements	Scenic spots			
	Cuihuashan	Wangshunshan	Zhuque	Taiping
	N = 43	N = 42	N = 41	N = 38
6.2. accommodation service	32.6	11.9	63.4	42.1
6.3. raw materials service	2.3	0.0	0.0	0.0
6.4. tour guide service	0.0	0.0	0.0	0.0
6.5. scenic area employee	4.7	0.0	0.0	0.0
6.6. transport service	0.0	2.4	0.0	5.3
6.7. other	2.3	14.3	2.4	2.6
Total	**132.6**	**111.9**	**163.4**	**147.4**

On average, 36.05% of respondents' all family members are doing the job related to the scenic areas, in which catering services are the most common one (Cuihuashan, 90.7%; Taiping, 97.4%; Zhuque, 97.6%; Wangshunshan, 83.3%, respectively) (Table 6.2). The second common job they do is to provide accommodation services (Cuihuashan, 32.6%; Taiping, 42.1%; Zhuque, 63.4%; Wangshunshan, 11.9%, respectively). The average household size was 4 people out of whom 1.25 is doing the job related to this Geopark, about 1/3 of the family member.

6.3 Local residents' income issues and livelihood situation

In each of the study sites, some respondents reported that income from the job related to the scenic areas takes up more than 50% of their total income, 74.4% in Cuihuashan, 73.8% in Wangshunshan, 87.7% in Zhuque scenic area and 76.3% in Taiping, respectively (Table 6.3). A large number of the respondents reported that they have been always living in the scenic area, 79.1% in Cuihuashan, 73.7% in Taiping, 75.6% in Zhuque and 88.1% in Wangshunshan scenic area, respectively. Around half respondents have been living there in the study sites over 20 years, 51.1% in Cuihuashan, 47.4% in Taiping, 70.7% in Wangshunshan and 83.3% in Zhuque scenic areas, respectively.

In Cuihuashan scenic area, 65.1% respondents knew the area they were living in is a

Geopark, 71.1 %, 63.4% and 69% in Taiping, Zhuque and Wangshunshan, respectively. They have reported various different ways they got this information, however the least mentioned was GGN official website. Mostly, they knew this was a Geopark via their village committees and other government organizations, on average, 24.2% (Table 6.3).

Table 6.3. Income issues and livelihood situation of the local residents living in study sites

Statements	Scenic spots			
	Cuihuashan	Wangshunshan	Zhuque	Taiping
	n = 43	*n* = 42	*n* = 41	*n* = 38
1. The degree to which my income from this job account for my family's total income	%	%	%	%
1.1. one-fourth or less	14.0	14.3	4.9	18.4
1.2. one-third or less	11.6	11.9	7.3	5.3
1.3. half	11.6	38.1	26.8	34.2
1.4. three-fourth or more	20.9	19.0	14.6	13.2
1.5. all from it	41.9	16.7	46.3	28.9
Total	100.0	100.0	100.0	100.0
2. I have been always living here	79.1	88.1	75.6	73.7
2.1. 20 years and under	23.3	4.8	4.9	23.7
2.2. 20-40 years	20.9	64.3	26.8	23.7
2.3. 40 years and above	30.2	19.0	43.9	26.3
Total	74.4	88.1	75.6	73.7
3. I know this is a geopark (via)	65.1	69.0	63.4	71.1
3.1. QZUGG official website	11.6	0.0	7.3	7.9
3.2. GGN official website	0.0	0.0	0.0	5.3
3.3. Other cyber-resources	7.0	0.0	9.8	10.5
3.4. Friends and relatives	2.3	7.1	14.6	13.2
3.5. Travel agency	2.3	31.0	7.3	5.3
3.6. Village committees and other government organizations	27.9	33.3	12.2	23.7
3.7. Advertisement of the geopark	14.0	23.8	22.0	23.7
Total	65.1	95.2	73.2	89.6

6.4 Farmland taken by the construction of the QZUGG

In Cuihuashan, as many as 60.5% of respondents reported their lands had been taken

over for use of the Geopark, which is higher than in Taiping (39.5%) and Wangshunshan (16.7%). Respondents from Zhuque reported only 2% (Table 6.4).

All respondents from Wangshunshan scenic spot whose land was taken received financial compensation; however, this was zero in Zhuque scenic area. On the other hand, 26.3% and 4.7% of respondents from Taiping and Cuihuashan scenic areas have received financial compensation, respectively. It is quite different when it comes to their satisfaction towards the compensation in 4 study sites. All respondents from Cuihuashan reported they were satisfied, on the contrary, no one was in both Zhuque and Wangshunshan scenic spots. In Taiping and Wangshunshan scenic spots, more than half of the respondents said they were very dissatisfied (Taiping, 60.0%; Zhuque 57.1%) (Table 6.4). Twenty percent from Taiping and 42.9% from Wangshunshan scenic spots reported dissatisfaction.

There were only 10.5% of respondents of Taiping scenic area reported they got bonus from the Geopark and they were not satisfied with it (7.9% dissatisfied, 2.6% neutral). In the other 3 study sites, no one received bonus. Thirty point two percent of the respondents from Cuihuashan scenic spot got other forms of compensation, which is 100 kg wheat flour per head per year. Only one reported having been given three rooms. One respondent from Taiping scenic area reported that he receives around 3000 USD to 4500 USD every year; however, the one from Zhuque scenic spot was not willing to tell what he got.

Table 6.4. The situation for the local residents' farmland taken by the construction of QZUGG

Statements	Scenic spots			
	Cuihuashan *n* = 43	Wangshunshan *n* = 42	Zhuque *n* = 41	Taiping *n* = 38
	%	%	%	%
1. My land was taken over for use during the park construction.	60.5	16.7	2.0	39.5
2. I received financial compensation.	4.7	100.0	0.0	26.3
3. The degree to which the financial compensation satisfied me,				
3.1. very dissatisfied	0.0	57.1	0.0	60.0
3.2. dissatisfied	0.0	42.9	0.0	20.0
3.3. neutral	0.0	0.0	0.0	10.0
3.4. satisfied	100.0	0.0	0.0	10.0
3.5. very satisfied	0.0	0.0	0.0	0.0
4. This Geopark provides bonus.	0.0	0.0	0.0	10.5
5. The degree to which the bonus satisfied me,				
5.1. very dissatisfied	N/A	N/A	N/A	0.0
5.2. dissatisfied	N/A	N/A	N/A	7.9
5.3. neutral	N/A	N/A	N/A	2.6
5.4. satisfied	N/A	N/A	N/A	0.0
5.5. very satisfied	N/A	N/A	N/A	0.0
Total	N/A	N/A	N/A	10.5
6. This Geopark provides other forms of compensation.	30.2	0.0	2.4	2.6

6.5 Discussion

6.5.1 Local residents' characteristics

Demographic research results show that young residents (under thirties) account for relatively small part of the respondents. According to some of the respondents, young people have to earn more bread for the family by working as migrant workers. This agrees with the increasing trend of migrant workers in the Shaanxi Province indicated by the Chinese government (The State Council 2017). Those rural migrant workers are usually young and are working at home only during planting and harvest seasons (Wong et al. 2007).

Teye et al. (2002) indicated that local people with higher educational levels tend to have more positive attitudes towards tourism development. This is because it is assumed that the better educated are able to comprehend ecological and political issues (Dunlap et al. 2000) and that they are better informed (Ciocănea et al. 2016). However, there were not many residents with high levels of education in the study sites (Table 6.5). This could possibly lead to lower satisfaction and more negative attitudes because the understanding of the benefits and other positive aspects would be hindered by low levels of education. Also, inefficient understanding of the geopark can be true in the area. It is interesting that more than 90% of the respondents are originally born local (Table 6.5) and many of them have been living in the area for more than 20 years (Table 6.6).

Table 6.5. Local residents' demographic information

		Number of cases	Percent
Gender	male	78	47.6
	female	86	52.4
	Total	164	100.0
Age	under 20 years	12	7.3
	20-30 years	29	17.7
	31-40 years	42	25.6
	41-50 years	44	26.8
	over 50 years	37	22.6
	Total	164	100.0
Education level	middle school and less	114	69.5
	high school	32	19.5
	college or university	17	10.4
	master or more	1	0.6
	Total	164	100.0
Where are you from?	Local[a]	149	90.9
	non-local	15	9.1
	Total	164	100.0

However, there are still many who have no idea that they are actually living in a geopark area. This could be explained by their low educational levels or the failure of the dissemination of GNN. The ones who are aware of the fact that they reside in the geopark area mostly received their knowledge from the village committees and other governmental agencies. This delivers a sign that those governmental agencies play an important role in the process of development and conservation of the area (Edward et al. 2011). Therefore, it is suggested that education related to the spreading of information and knowledge within the local community should be strengthened to raise the collective awareness and understanding of this geopark.

Table 6.6. Local residents' years of residency and familiarity with the Geopark

Statements	Scenic spots			
	Cuihuashan	Wangshunshan	Zhuque	Taiping
	n = 43	*n* = 42	*n* = 41	*n* = 38
I have been always living here	79.1	88.1	75.6	73.7
20 years and under	23.3	4.8	4.9	23.7
20-40 years	20.9	64.3	26.8	23.7
40 years and above	30.2	19.0	43.9	26.3
Total	74.4	88.1	75.6	73.7
I know this is a geopark (via)	65.1	69.0	63.4	71.1
QZUGG official website	11.6	0.0	7.3	7.9
GGN official website	0.0	0.0	0.0	5.3
Other cyber-resources	7.0	0.0	9.8	10.5
Friends and relatives	2.3	7.1	14.6	13.2
Travel agency	2.3	31.0	7.3	5.3
Village committees and other government organizations	27.9	33.3	12.2	23.7
Advertisement of the geopark	14.0	23.8	22.0	23.7
Total	65.1	95.2	73.2	89.6

6.5.2 Local residents' occupations and livelihood status

It can be inferred that local residents are depend highly on the geopark. Large

percentage of the respondents takes the full-time job related to the geopark (Table 6.7), which means they do not do farming or any other types of occupation anymore. Furthermore, almost 40% of the respondents rely on the geopark for family's entire income (Table 6.7). Besides, nearly half of family members of each household on average possesses the job related to the geopark. This is positive because it is an obvious demonstration that the geopark practically provides job opportunities and welfare to the local residents. However, they are mostly involved in food catering and accommodation services in the geopark or around the entrance area. There are not many job posts for the local people. During the interviews, only two local people reported that they are hired by the geopark itself. It is clear that this geopark does not provide enough job opportunities for the local people, which could further lower their understanding and perception.

It is understandable that the management companies hire people from the talent pool with working experiences and higher education; however, they should consider hiring more people from the local area. This would help the management companies do their job better and easier, especially when dealing with some possible conflicts with the local people; for example, when more land is needed to expand the geopark, and when some new rules are implemented for the management needs. This is because of the high dependency of the local people's understanding and awareness on the degree of the geopark activities that they engage in (Azman et al. 2010). A profit-sharing or bonus scheme is necessary to secure local people's financial interests (Walpole and Goodwin 2001). This should help to raise their satisfaction towards the geopark, which is a crucial influencing factor of the success of the QZUGG. Furthermore, more job opportunities should be provided and given to the local residents, For example, which is also emphasized by some research (Gubbi et al. 2008; West et al. 2006b). This is a significant way to strengthen the good local people-geopark connectivity.

Table 6.7. Relationship between the types of job contract and their income ratio (%)

		My income accounting for my family's total income				
		1/4 or less	1/3	one-half	3/4 or above	all
		%	%	%	%	%
Full-time job or not	Yes	10.6	7.3	26.0	17.9	38.2
	no	19.5	14.6	31.7	14.6	19.5

6.5.3 Farmland issues and compensation schemes among the local residents

Benefits can be a key factor triggering a conflict between the local people and PAs because they can be substantial, e.g. tourism generated income (Sandbrook 2010). It is fundamental to understand local people's benefits in order to strike a balance between conservation goals and their needs (Bruyere et al. 2009; DeFries et al. 2010b). In the study sites, while 50 local people (nearly one-third of the respondents) have experienced the land requisition for the QZUGG (Table 6.6), only 19 of them received financial compensation, of whom more than half showed dissatisfaction. Besides the one-time monetary financial compensation, some people (four) receive wheat flour every year; one received rooms as extra compensation; another receives money every year from the geopark as stated earlier. This could be explained by an uneven, inappropriate compensation scheme or even inexistence of compensation scheme.

Another possibility could be the failure of carrying out of the compensation scheme due to the complex top-down management system. Negotiation and agreement on the compensation might have been made with certain residents. Otherwise, the compensated local residents should have been more than the number revealed by this study. Taking a close look at the income of those 50 people, almost half of them have to obtain all their income from the geopark (Table 6.8). They are in the business with

very strong seasonality, which means that they have to ensure their income within several months, in which most visitors come. All stated above is an explanation for the existence of the unhappy or even angry respondents when interviewed. Therefore, it is not difficult to understand their dissatisfaction towards the management officials.

To raise the satisfaction among the local residents, some suggestions are hereby proposed. Management is a fundamental issue (Saito and Ruhanen 2017). Those eight spots' joint effort to apply for the UNESCO Global Geopark has brought a contradiction. The integrality as a UNESCO Global Geopark requires unified utilization and conservation. On the other hand, eight spots conduct their tourism resource development and business activities, which is difficult to unify. This could possibly lead to some problems, for example, the unclear themes of each scenic spot due to the design and construction according to different standards, insufficient communication among those eight scenic spots. Those problems could reduce the number of visitors leading to a decrease of local residents' income. Furthermore, a complex up-down management system of multiple supervising agencies makes it inefficient for those scenic spots to implement new policies or carry out new management schemes. Therefore, there should be some reform efforts to make the existing system more effective and unified. It is essential for policy makers and managers to understand the situation for PAs (Brooks 2004; Kleiman et al. 2000). This is the base for any further activities. The central management office of the QZUGG should make a complete evaluation of these eight scenic spots in order to achieve a balanced tourism resource development. A communication platform should be set up for a better cooperation among the scenic spots.

Table 6.8. Income/household total income ratio of 50 respondents whose land was requisitioned for the geopark

Income ratio	Cuihuashan	Wangshunshan	Zhuque	Taiping	%	Total
1/4 or less	1	2	0	0	6.0	3
1/3	3	0	0	1	8.0	4
half	2	1	0	3	12.0	6
3/4 or more	9	1	1	3	28.0	14
all	11	3	1	8	46.0	23
Total	26	7	2	15	100.0	50

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6.6 Summarization

Many local residents are actually highly dependent on the geopark. Most of the local residents living in or around the QZUGG are engaged in their full-time jobs there and more than one-third of the respondents' all family member is involved in the jobs related to the geopark. It is a major source of their income. These jobs are mostly to provide food and accommodations to visitors. Only two respondents are currently being employed by the park management company itself. Fifty respondents reported that their land had been requisitioned during the preparation of the QZUGG. However, not all of them received compensation, and the compensation was unevenly conducted taking different forms. It was indicated that some of the local residents are unsatisfied or even furious people.

Chapter 7 Discussion

7.1 The connectivity between geopark and government

The eight scenic spots of the QZUGG belong to different governmental agencies, e.g. The Ministry of Forestry, Water Conservancy Bureau, Tourist Administration, and Bureau of Land Resources (Table 1.4). They are at the same time under the management of a central management office of the QZUGG located in Xi'an City. The QZUGG is an area with multiple conservative objectives, including forest and water resources, precious fauna and flora species as well as geological features (Wang et al. 2014; Yan et al. 2016; Zhao et al. 2014b). This easily leads to very complex management needs which often relate to more than one agency (Xu and Melick 2007). For example, the Zhuque scenic spot had been Huxian county's forestry farm, then in 1999 it was designated as a National Forest park. In 2009, the QZUGG was established and the Zhuque became one part of it. In 2015, it was further designated as a National 4-A tourist attraction (Zhuque 2016). All these designations made the Zhuque have more than one conservative objective and be under multiple supervisions.

It is very difficult to achieve an internal coordination. When different management agencies need to carry out their own policies, when various objectives are developed and carried out, conflicts are inevitable (Zhang et al. 2017a). This is not unusual across China. For instance, the famous Zhangjiajie UNESCO Global Geopark was designated as a National Forest Park as well as National Geopark. As this structural problem is impossible to be eliminated soon, some countermeasures should be taken. Here this study proposes among multiple objectives, the QZUGG should evaluate and determine the most distinctive and representative conservation objective. By doing so, the other objectives should come second to the main one, and, ideally provide certain support

and protection.

7.2 The connectivity between people and geopark

As indicated by Deng et al. (2003) and Leung and Marion (2000), factors such as forest cover decrease (an example of environmental degradation), tree damage and tree-root exposure can negatively influence visitors' experiences in the geoparks, and visitors would have less satisfied impression on the geoparks which have these problems. As a result, the number of visitors may decrease which is certainly the last thing that the management would like to see because tourism activities generate revenue both for government and the geoparks (Zinda 2017). This will inevitably lead to a disconnection between visitors and the geoparks. In this study, there was around half respondents of students and citizens who had a neutral attitude towards revisit in the future (Figure 5.17); and more than half of the students and about 40% of citizens hold a neutral attitude towards recommendation of the Geopark (Figure 5.17). Visitors certainly want to enjoy high quality tourism experience; however, they seem not very satisfied with the present situation of QZUGG. Therefore, for both sides' benefits to be fulfilled, management officials really should consider visitors' perception and attitudes to make a win-win situation by establishing a sound and good connectivity.

Visitors behave differently in different countries, cultures and situations (Weiler et al. 2017); therefore, management officials from all individual PAs indeed need to get a good understanding of the visitors. However, there are few parks management agencies that consider their visitors' driving factors and behavior (Buckley et al. 2017). As mentioned earlier, China is a vast country with large population, high biodiversity and heavily visited PAs. Therefore, it is of great significance for China to address questions related to people and PAs. Chinese visitors are often regarded as with less concern about the value of wilderness and greater willingness to accept large-scale infrastructure

within PAs than Western nations (Foggin 2014; Zhou 2004). This study also found the same results (Figure 5.9). Further, the most critical problem for conservation is that Chinese culture cares less for the threatened species (Buckley et al. 2017). However, it has been pointed out by Marion et al. (2016) that visitors' attitudes and practices towards wildlife in PAs can be partially changed by interpretation programs for visitation. This is a good piece of news for management officials, because they can try to make these visitors pioneers to change China's culture towards nature and PAs. However, because management officials are generally satisfied with the Geopark in spite of the fact that the forest cover had decreased after the opening of the Geopark (Chapter 3), it may be another key for success to change management officials' attitudes and notions towards the conservation and visitors.

Management officials also need to take care of the local residents' issues. Nepal (2002) indicated that the main source of local people and the areas' conflicts are the ignorance of local people's interests and absence from the protected areas' planning, management and decision making. Results chapters indicated that there existed gap among the geopark, local residents regarding some aspects, i.e. fees, transportation, resource abundance and appreciation (Table 5.4). Local people also had complaints towards management providing uneven compensation and limited job opportunities. Local residents need those natural resources and farming land to support their livings, which can lead to conflicts (Allendorf et al 2007; Nagendra et al. 2006). Therefore, the current connectivity observed in the Geopark seems not complete among the Geopark and its stakeholders (Figure7.1). It is obvious that if the geoparks want to achieve an effective management result, they should gain more support from the local residents and eliminate conflicts. The social wellbeing should be maintained and enhanced (McCleave et al. 2006). For example, more job opportunities (especially in management) should be offered to attract more young people, because these job posts

are actually a sign of collaboration and involvement which are very important for the success of the geoparks (Barkin and Pailles 2014; de Beer and Marais 2005; Mzrzano et al. 2012). Young people are very important for future work in conservations, but at present stage, there are not many of them doing jobs there in the Geopark (Table 6.2). Besides, a reasonable compensation scheme and a profit-sharing system may help to dress local residents need of living costs.

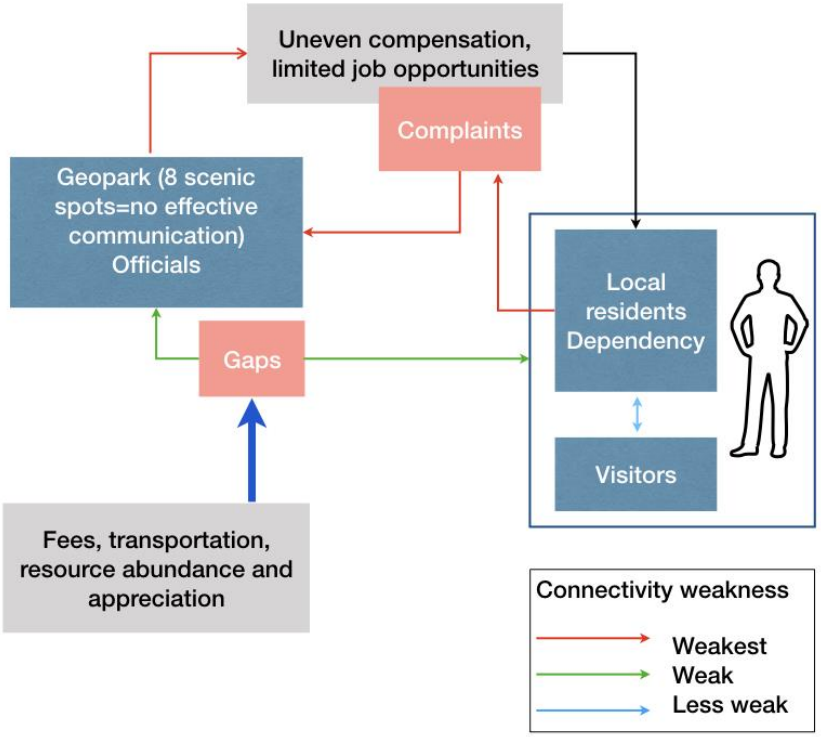

Figure 7.1. The current connectivity situation of QZUGG.

To summarize, it can be indicated that the current connectivity among stakeholders of the QZUGG shows weakness to different degree. Based on the results of gap analysis, the connectivity between the officials and local residents showed the highest degree of weakness (Tables 6.7-6.8), which is labeled with red lines in figure 7.1. People (local residents and visitors) and the QZUGG also showed a weak connectivity due to their different perceptions towards fees issues, transportation, resource abundance and

appreciation. However, this was not as drastic as local residents' livelihood and income issues, therefore, this connectivity is less weak, which is labeled with green lines (Figure 7.1). The least weak connectivity was identified between the local residents and visitors, which is labeled with blue lines. As shown in table 7.1, no significant differences were identified towards fees and resources issues between those two groups of stakeholders. However, it is still worth noticing that those dissatisfied local people are not expected to provide visitors with high quality services, which could further lead to dissatisfaction of visitors, hence a weak connectivity.

Table 7.1. Comparison between local residents and tourists towards fees and resources

Questions	All visitors_ Mean	Local residents_ Mean	P
N=	989	164	
Entrance fee	3.65	3.60	0.552
Very dissatisfied			
Dissatisfied			
Neutral			
Satisfied			
Very satisfied			
Parking fee	3.68	3.46	0.035
Very dissatisfied			
Dissatisfied			
Neutral			
Satisfied			
Very satisfied			
Resource abundance	3.74	3.60	0.057
Very dissatisfied			
Dissatisfied			
Neutral			
Satisfied			
Very satisfied			
Resource appreciation	3.81	3.63	0.020
Very dissatisfied			
Dissatisfied			
Neutral			
Satisfied			
Very satisfied			

It is very important to understand the points of view of different stakeholders in order to help decision makers and officials to achieve a consensus between people and conservation policies (Brescancin et al. 2018). For a scenario in the future to strengthen the current connectivity of QZUGG, stakeholders from every party should be involved in to the connection (Figure 7.2). Due to China's unique official management systems and notions, it seems very hard to start a change from the officials of every level. Maybe, it will produce a good result to enhance visitors and local residents' education in order to equip them with the proper way to perceive the nature and right notion to protect environment. When more people develop more scientific knowledge, there is a possibility that the officials would change their way to manage the geoparks and visitors. This will surely lead to a bright future in China's geoparks and nature conservations.

From the perspective of the eight scenic spots, it might be very difficult or even impossible to make a total reformation to the current management systems and methods, but they should firstly build up an effective connection to one another, which could benefit them all by sharing information, resources and customers. They can also jointly deal with local residents' issues, for instance, more job opportunities and posts information. The geopark should also try to provide more high-quality tourism resources and geo-educational service to visitors. Introducing new notions of nature conservation to both local residents and visitors also should be done by the management. Local residents would be able to generate more income if they can manage to provide visitors with better hotel and food experiences. With more visitors, more job opportunities will naturally be produced (Figure 7.2). It is possible for the officials to provide more job positions, because China's geoparks are developing very rapidly and creating many job opportunities. For example, until 2017, 20,500 Geopark managers and administrative staff were created and indirect positions created by associated activities and events of geopark and geotourism counted 2.6 million (Young, 2017).

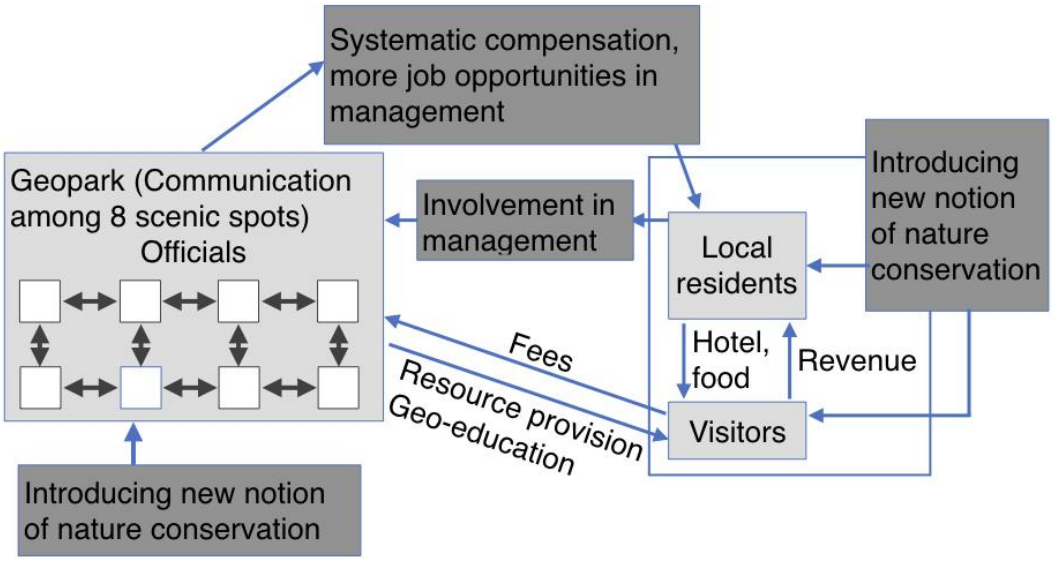

Figure 7.2. A scenario of complete connectivity of QZUGG in the future.

7.3 The application of this study

This study focused on a geopark as one of the PAs because China is a world's leading country of geoparks and because China's geoparks are internationally criticized. As discussed above, people of different background could be different in attitudes and behavior when they visit PAs. This means that that the approach of this study can be applicable to other PAs (geoparks) in China, and to those in some other developing countries with strong governmental control similar to China, but probably not to those in most developed countries. As described in Chapter 1.2, the term 'connectivity' is not new. There are studies on park-people connectivity, but most of them focus only on a part of the relationship: i.e., conflict between PAs and local residents (for example, De Porcq et al. 2018; West et al. 2006). Studies on the connectivity in PAs means that all stakeholders should be discussed together. Independent studies on parts of stakeholders would not be effective to solve or mitigate the issues especially in Chinese geoparks. In other words, it will be difficult to improve the current status in China's PAs if only government officers are concerned because they have less flexibility and less chance to

be changed as this study found.

Although there has been already a lot of relevant research around the world, especially western part, there is limited number of studies discussing the problems of PAs in China. By analyzing the differences existing, more about the connectivity of PAs and people could be well understood. When the entire connectivity among all stakeholders is discussed, it will be able to understand which parts can be improved or strengthened immediately, and which parts cannot. The approach by the connectivity study will find out the priority to be improved. For the future development and management of China's PAs, the concept of "Connectivity" has a potential to serve as a reference. At least, it can be a possibility for policy makers and management officials to consider the connectivity among different stakeholders related to PAs.

Chapter 8 Conclusions

This research has focused on the investigation into protected areas (PAs) and people connectivity in the Qinling Zhongnanshan UNESCO Global Geopark. This study introduced a new theory frame "connectivity" in the research discipline of PAs, (geopark as an example). By analyzing a combination of relationships between PAs and people (local residents and visitors), protected areas and state/ local government, this study provided the comparisons among different stakeholders.

Similar to elsewhere in China, the QZUGG is suffering from the complex managerial agencies. This makes the geopark find itself in a dilemma because of different conservation priorities determined by more than one agency. This structural problem cannot be solved soon enough. However, negotiation of deciding the priority can contribute to figuring out this issue. The management officials are self-confident about their work. However, the forest cover had decreased after the opening of the Geopark and people are less satisfied with the fees and tourism resource quality. The difference of visitors' perceptions about if the geopark is protecting the nature well with management officials was not significant. Because in the most visited areas and around hiking trails, forests are under proper maintenance. The management should take into consideration of visitors' perception and attitude when making decision or planning.

The analysis of local residents' livelihood, job condition and income issues in the QZUGG has provided a picture of the current status within the local communities. This study has found that many local residents are actually highly dependent on the geopark. Most of the local residents living in or around the QZUGG are engaged in their full-time jobs there and more than one-third of the respondents' all family member is

involved in the jobs related to the Geopark. It is a major source of their income. These jobs are mostly to provide food and accommodations to visitors. Only two respondents are currently being employed by the park management company itself. Fifty respondents reported that their land had been requisitioned during the preparation of the QZUGG. However, not all of them received compensation, and the compensation was unevenly conducted taking different forms. It was indicated that some of the local residents are unsatisfied or even furious people. This is because they have not agreed with the treatment that they received for the loss of their land, i.e. unfavorable compensation and few job opportunities. The complex management system is another factor which need to be properly scrutinized. All those could lead to a mixed success of the QZUGG.

At the present stage, there is a lack of effective communication and cooperation among eight scenic spots, which could probably lead to negative impacts on the geopark. Moreover, belonging to different management agencies inevitably lead to low efficiency and dilemma. It is suggested that profit-sharing scheme should be extended to more local people to make them percept positive aspects of the geopark, which is of great significance to the future development and success of the QZUGG. Also, a communication platform should be set up for those eight scenic spots. Further, a unified and more direct management system would be beneficial to not only the geopark itself but also the local residents. The geopark should take into consideration providing more job positions to the local people to raise their participation rate. This can help to do the management job more easily and improve satisfaction of the local residents. This study contributes to the analysis and understanding of PAs and people connectivity. Using this frame to investigate into the complex relationships between different stakeholders coexisting in a single geopark can be helpful for management even governance, which is of great significance to the efficacy and success of PAs.

References

Allendorf, TD, Smith, JLD, Anderson, DH (2007) Residents' perceptions of Royal Bardia National Park, Nepal. Landsc Urban Plan. 82(1-2):33-40. doi: 10.1016/j.landurbplan.2007.01.015

Amoros, C. and Bornette, G. (2002) Connectivity and biocomplexity in water bodies of riverine floodplains. Freshwater Biology. 47: 761–776.

Arnberger, A, Eder, R, Allex, B, Sterl, P, Burns, RC (2012) Relationships between national-park affinity and attitudes towards protected area management of visitors to the Gesaeuse National Park, Austria. For Policy Econ 19:48–55. doi: 10.1016/j.forpol.2011.06.013

Azman, N, Halim, SA, Liu, OP, Saidin, S, Komoo, I (2010) Public education in heritage conservation for geopark community. Procedia - Social and Behavioral Sciences. 7:504–511. doi: 10.1016/j.sbspro.2010.10.068

Balmford, A, Gaston, KJ, Blyth, S, James, A, Kapos, V (2003) Global variation in terrestrial conservation costs, conservation benefits, and unmet conservation needs. Proc Natl Acad Sci 100:1046–1050. doi: 10.1073/pnas.0236945100

Barkin, D and Paille, C (1999) NGO-community collaboration for ecotourism: A strategy for sustainable regional development. Tour Recreat Res. 24(2): 69–74. doi: 10.1080/02508281.1999.11014878

Barros, A, Gonnet, J, Pickering, C (2013) Impacts of informal trails on vegetation and soils in the highest protected area in the Southern Hemisphere. J Environ Manage 127:50–60. doi: 10.1016/j.jenvman.2013.04.030

Bashir, M, Afzal, MT, Azeem, M (2008) Reliability and Validity of Qualitative and Operational Research Paradigm. Pakistan J Stat Oper Res. 4:35. doi: 10.18187/pjsor.v4i1.59

Bennett, NJ, Dearden, P (2014) Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Mar Policy 44:107–116. doi: 10.1016/j.marpol.2013.08.017

Bernbaum, E (2006) Sacred Mountains: Themes and Teachings. Mt Res Dev. 26:304–309. doi: 10.1659/0276-4741(2006)26[304:SMTAT]2.0.CO;2

Blyth, S, Groombridge, B, Lysenko, I, Miles, L, Newton, A (2002) Mountain watch: Environmental change and sustainable developmental in mountains. UNEP/Earthprint, Cambridge

Bodoque, JM, Ballesteros-Cánovas, JA, Rubiales, JM, Perucha, MA, Nadal-Romero, E, Stoffel, M (2017) Quantifying Soil Erosion from Hiking Trail in a Protected Natural Area in the Spanish Pyrenees. L Degrad Dev. 28:2255–2267. doi: 10.1002/ldr.2755

Boys, B (2012) Sustainable Economic Development : Issue Framing and Opportunities for the Hondsrug Geopark. Ph.D thesis, University of Illinois Urbana Champaign, U.S.A.

Brooks, TM, Bakarr, MI, Boucher, T, Da Fonseca, GAB, Hilton-Taylor, C, Hoekstra, JM, Moritz, T, Olivieri, S, Parrish, J, Pressey, RL, Rodrigues, ASL, Sechrest, W, Stattersfield, A, Strahm, W, Stuart, SN (2004) Coverage Provided by the Global Protected-Area System: Is It Enough? Bioscience. 54(12):1081–1091. doi: 10.1641/0006-3568(2004)054[1081:CPBTGP]2.0.CO;2

Brescancin, F, Dobšinská, Z, De Meo, I, Šálka, J, Paletto, A (2018) Analysis of stakeholders' involvement in the implementation of the Natura 2000 network in Slovakia. Forest Policy and Economics. 89: 22–30.

Bruyere, BL, Beh, AW, Lelengula, G (2009) Differences in perceptions of communication, tourism benefits, and management issues in a protected area of rural Kenya. Environ Manage. 43:49–59. doi: 10.1007/s00267-008-9190-7

Buckley, R, Zhong, L, Ma, X (2017) Visitors to protected areas in China. Biol Conserv 209:83–88. doi: 10.1016/j.biocon.2017.01.024

Buta, N, Holland, SM, Kaplanidou, K (2014) Local communities and protected areas: The mediating role of place attachment for pro-environmental civic engagement. J Outdoor Recreat Tour. 5–6:1–10. doi: 10.1016/j.jort.2014.01.001

Cater, C (2015) Management perspectives of mountaineering tourism. In: Mountaineering tourism, First. Routledge, New York, pp 313–327

Chape, S, Harrison, J, Spalding, M, Lysenko, I (2005) Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets. 43(1):49–59. doi: 10.1098/rstb.2004.1592

Chavez, DJ (2000) Wilderness Visitors in the 21st Century - Diversity, Day Use, Perceptions and Preferences. Work Pap 6.

Chen, A (2013) Grand Tourism Earth Science Dictionary. Beijing Science Press, Beijing

Chen, JS (2015) Tourism stakeholders attitudes toward sustainable development: A case in the Arctic. J Retail Consum Serv. 22:225–230. doi: 10.1016/j.jretconser.2014.08.003

Chio, J (2014) A landscape of travel: The work of tourism in rural ethnic China. Anthropological Quarterly. 88(3) :835–839

Ciocănea, CM, Sorescu, C, Ianoş, IM, Bagrinovsch, IV (2016) Assessing Public Perception on Protected Areas in Iron Gates Natural Park. Procedia Environ Sci. 32:70–79. doi: 10.1016/j.proenv.2016.03.013

Cole DN (2004) Impacts of Hiking and Camping on Soils and Vegetation: A Review. Environ Impacts Ecotourism. 143:41–60. doi: 10.1017/CBO9781107415324.004

Company TZNFPM (2016) The Zhuque-taiping landscape quality assessment report

Crooks, KR and Sanjayan, M. (2006) Connectivity Conservation. Cambridge University Press, Cambridge.

Czech, B (2008) Prospects for reconciling the conflict between economic growth and biodiversity conservation with technological progress. Conserv Biol. 22:1389–1398. doi: 10.1111/j.1523-1739.2008.01089.x

Das, M, Chatterjee, B (2015) Ecotourism: A panacea or a predicament? Tour Manag Perspect. 14:3–16. doi: 10.1016/j.tmp.2015.01.002

de Beer, F, Marais, M (2005) Rural communities, the natural environment and development - Some challenges, some successes. Community Dev J. 40:50–61. doi: 10.1093/cdj/bsi006

DeFries, R, Karanth, KK, Pareeth, S (2010a) Interactions between protected areas and their surroundings in human-dominated tropical landscapes. Biol Conserv. doi: 10.1016/j.biocon.2010.02.010

DeFries, R, Karanth, KK, Pareeth, S (2010b) Interactions between protected areas and their surroundings in human-dominated tropical landscapes. Biol Conserv. 143:2870–2880. doi: 10.1016/j.biocon.2010.02.010

De Pourcq, K; Thomas, E; Elias, M; Van Damme, P (2018): Exploring park–people conflicts in Colombia through a social lens. Environmental Conservation. 8 p. Doi: https://doi.org/10.1017/S0376892918000413.

Deng, J, Qiang, S, Walker, GJ, Zhang, Y (2003) Assessment on and perception of visitors' environmental impacts of nature tourism: A case study of zhangjiajie national forest park, China. J Sustain Tour. 11:529–548. doi: 10.1080/09669580308667219

Diamond, JL (2005) China's environment in a globalizing world. Nature. 435:1179–1186

Dixon, G, Hawe, M, McPherson, G (2004) Monitoring and modelling walking track impacts in the Tasmanian Wilderness World Heritage Area, Australia. J Environ Manage. 71:305–320. doi: 10.1016/j.jenvman.2004.02.006

Drábková, A, Šišák, L (2013) Forest visitors' opinion of recreational facilities and trails

in forests in the Blaník Protected Landscape Area - A case study. J For Sci. 59:185–190

Dressler, W, Büscher, B (2008) Market triumphalism and the CBNRM “crises” at the South African section of the Great Limpopo Transfrontier Park. Geoforum. doi: 10.1016/j.geoforum.2007.09.005

Dudley, N (2008) Guidelines for Applying Protected Area Management Categories

Dunlap, RE, Van Liere, KD, Mertig, AG, Jones, RE (2000) New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. J Soc Issues. 56:425–442. doi: 10.1111/0022-4537.00176

Durrant, JO, Shumway, JM (2004) Attitudes Toward Wilderness Study Areas: A Survey of Six Southeastern Utah Counties. Environ. Manage. doi: 10.1007/s00267-003-3019-1

Faasen, H, Watts, S (2007) Local community reaction to the “no-take” policy on fishing in the Tsitsikamma National Park, South Africa. Ecol. Econ. doi: 10.1016/j.ecolecon.2007.06.026

Farrell, TA, Marion, JL (2001) Trail impacts and trail impact management related to visitation at torredse l paine national park, chile. Leis Loisir. 26:2–59. doi: 10.1080/14927713.2001.9649928

Farsani, NT, Coelho, C, Costa, C (2011) Geotourism and geoparks as novel strategies for socio-economic development in rural areas. Int J Tour Res. 13:68–81. doi: 10.1002/jtr.800

Farsani, NT, Coelho, COA, Costa, CMM (2014) Analysis of network activities in geoparks as geotourism destinations. Int J Tour Res. 16(1):1–10. doi: 10.1002/jtr.1879

Foggin, JM (2014) Managing Shared Natural Heritages: Towards More Participatory Models of Protected Area Management in Western China. J Int Wildl Law Policy.

17(3):130–151.doi: 10.1080/13880292.2014.953391

Fredman, P (2004) National Park Designation – Visitor Flows and Tourism Impact. Mmv. 2004(7):369–375

Fukami, S (2013) Perspective on geoparks and geotourism based on case studies of geoparks in Japan and China. Jpn J Hum Geogr, 65:58–70. doi: 10.4200/jjhg.65.5_434

Geneletti, D, Dawa, D (2009) Environmental impact assessment of mountain tourism in developing regions: A study in Ladakh, Indian Himalaya. Environ Impact Assess Rev. 29(4): 229–242. doi: 10.1016/j.eiar.2009.01.003

Geoparks UG (2015) UNESCO Global Geoparks Guidelines on the use of the UNESCO Global Geoparks linked logo Use of the UNESCO Global Geoparks Linked Logo

Gerhardinger, LC, Godoy, EAS, Jones, PJS (2009) Local ecological knowledge and the management of marine protected areas in Brazil. Ocean Coast Manag. 52(3-4): 154–165 doi: 10.1016/j.ocecoaman.2008.12.007

Gillingham, S, Lee, PC (1999) The impact of wildlife-related benefits on the conservation attitudes of local people around the Selous Game Reserve, Tanzania. Environ Conserv. 26(3):218–228 doi: 10.1017/S0376892999000302

Godde, PM, Price, MF, Zimmermann, FM (1999) Tourism and Development in Mountain Regions: moving forward into the new millennium. Mt Res Dev. 24(4): 491–492 doi: 10.1016/S0261-5177(02)00119-X

Gore, ML, Lute, ML, Ratsimbazafy, JH, Rajaonson, A (2016) Local Perspectives on Environmental Insecurity and Its Influence on Illegal Biodiversity Exploitation. PLoS One. 11(4) e0150337. doi: 10.1371/journal.pone.0150337

Gubbi, S, Linkie, M, Leader-Williams, N (2008) Evaluating the legacy of an integrated conservation and development project around a tiger reserve in India. Environ Conserv. 35:331–339. doi: 10.1017/S0376892908005225

Gustavo, SA, Jonathan, R (2012) Protected Areas and Local Communities: an Inevitable Partnership toward Successful Conservation Strategies? Ecol Soc. 17: doi: 10.5751/ES-05216-170414

Gynecol, S (2005) Forestry Strategy to the Year 2020. Vientiane Lao PDR. doi: 10.1007/s10397-005-0125-5

Hamilton, LS and McMillan, L (2004) Guidelines for Planning and Managing Mountain Protected Areas. Synthesised and edited by Hamilton, L. S. and McMillan, L., eds. IUCN World Commission on Protected Areas

Heckmann, T, Schwanghart, W, Phillips, JD (2015) Graph theory—Recent developments of its application in geomorphology. Geomorphology. 243: 130-146. https://doi.org/10.1016/j.geomorph.2014.12.024.

Heller, NE. and Zavaleta, ES. (2009) Biodiversity management in the face of climate change: a review of 22 years of recommendations. Biological Conservation. 142, 14.

Herren, RM, Bagley, DA, Bresette, MJ, Hollowway-Adkins, KG, Clark, D, Witherington BE (2005) Sea turtle abundance and demographic measurements in a marine protected area in the Florida Keys, USA. Herpetol Conserv Biol. 30:19–52. doi: 10.1146/annurev.energy.30.050504.164507

Herrold-Menzies, M (2006) Integrating conservation and development: What we can learn from Caohai, China. J Environ Dev. 15(4): 382–406. doi: 10.1177/1070496506294491

Hiedanpää, J (2005) The edges of conflict and consensus: A case for creativity in regional forest policy in Southwest Finland. Ecol Econ. 55(4): 485–498 doi: 10.1016/j.ecolecon.2004.12.007

Hodgson, JA, Thomas, CD, Wintle, BA and Moilanen, A (2009) Climate change, connectivity and conservation decision making: back to basics. Journal of Applied Ecology. 46: 964-969. doi:10.1111/j.1365-2664.2009.01695.x

Hooke, J (2003) Coarse sediment connectivity in river channel systems: a conceptual framework and methodology. Geomorphology. 56, 79-94. https://doi.org/10.1016/S0169-555X(03)00047-3.

Ho, SPS, Lin, GCS (2003) Emerging Land Markets in Rural and Urban China: Policies and Practices. China Q. 175:681–707. doi: 10.1017/S0305741003000407

Hockett, KS, Marion, JL, Leung, YF (2017) The efficacy of combined educational and site management actions in reducing off-trail hiking in an urban-proximate protected area. J Environ Manage. 203:17–28. doi: 10.1016/j.jenvman.2017.06.073

Hoekstra, JM, Boucher, TM, Ricketts, TH, Roberts C (2005) Confronting a biome crisis: Global disparities of habitat loss and protection. Ecol Lett. 8:23–29. doi: 10.1111/j.1461-0248.2004.00686.x

Huang, Z, Yu, X, Liang, W (2012) Population genetic structure of golden pheasant Chrysolophus pictus in the Qinling Mountains, China. Anim Biol. 62:231–243. doi: 10.1163/157075611X618183

Imran, S, Alam, K, Beaumont, N (2014) Environmental orientations and environmental behaviour: Perceptions of protected area tourism stakeholders. Tour Manag. 40:290–299. doi: 10.1016/j.tourman.2013.07.003

IUCN (2019) IUCN. https://www.iucn.org/commissions/world-commission-protected-areas/our-work/mountains

Jenkins, CN, Joppa, L (2010) Expansion of the global terrestrial protected area system. Biol Conserv. 142:2166–2174. doi: 10.1016/j.biocon.2009.04.016

Li, J (2018) The calender effect of tourism activity in the Cuihuashan and the Qinling wildlife park, Xi'an, Master thesis, Shaanxi Normal University

Kazmierow, BJ, Hickling, GJ, Booth, KL (2000) Ecological and human dimensions of tourism-related wildlife disturbance: White herons at waitangiroto, New Zealand. Hum Dimens Wildl. 5(2):1–14 doi: 10.1080/10871200009359176

Kidd, AM, Monz, C, D'Antonio, A, Manning, R, Reigner, N, Goonan, K, Jacobi, C (2015) The effect of minimum impact education on visitor spatial behavior in parks and protected areas: An experimental investigation using GPS-based tracking. J Environ Manage. 162:53–62. doi: 10.1016/j.jenvman.2015.07.007

Kim, MK, Daigle, JJ (2012) Monitoring of Vegetation Impact Due to Trampling on Cadillac Mountain Summit Using High Spatial Resolution Remote Sensing Data Sets. Environ Manage. 50:956–968. doi: 10.1007/s00267-012-9905-7

Kleiman, DG, Reading, RP, Miller, BJ, Clark, T, Scott, J, Robinson, J, Wallace, R,Cabin R, Felleman, F (2000) Improving the evaluation of conservation programs. Conserv. Biol. doi: 10.1046/j.1523-1739.2000.98553.x

Kohle, T, Gige,r M, Hurni, H, Ott, C, Wiesmann, U, Wymann, VDS, Maselli, D (2010) Mountains and Climate Change: A Global Concern. Mt Res Dev. 30:53–55. doi: 10.1659/mrd-journal-d-09-00086.1

Kollmair, M, Gurung, G, Hurni, K, Maselli, D (2005) Mountains: Special places to be protected? An analysis of worldwide nature conservation efforts in mountains. Int J Biodivers Sci Ecosyst Serv Manag. 1:181–189. doi: 10.1080/17451590509618091

Körner, C. and Ohsawa, M (2005) Mountain systems. In Millennium Ecosystem Assessment: Ecosystems and Human Well-Being, vol.1. Island Press, Washington, DC. pp681–716

Lambin, EF (1997) Modelling and monitoring land-cover change processes in tropical regions. Prog Phys Geogr. doi: 10.1177/030913339702100303

Leman, M, Reedman A., Pei, C (2008) Geo-heritage of East and Southeast Asia. Ampang, Kuala Lumpur. pp: 21–22

Leung, YF, Spenceley, A, Hvenegaard, G, Buckley, R (2015) Tourism and Visitor Management in Protected Areas Guidelines for sustainability. Best Practice Protected Area Guidelines

Leung, Y, Marion, JL (2000) Recreation Impacts and Management in Wilderness: A State-of-Knowledge Review. In: Wilderness science in a time of change conference

Leung YF, Marion JL (1999) Assessing trail conditions in protected areas: Application of a problem-assessment method in Great Smoky Mountains National Park, USA. Environ Conserv. 26(4): 270–279doi: 10.1017/S0376892999000399

Lew, AA, Han, GS (2015) Mountaineering Tourism. Routledge, New York. pp:22–23

Lewis, C (2006) HCI and cognitive disabilities. Interactions. doi: 10.1145/1125864.1125880

Li, RN (2004) Problems in Fund Operation of Forest Parks and Its Countermeasures. For Econ. 18:48–49

Li, W, Ge, X, Liu, C (2005) Hiking trails and tourism impact assessment in protected area: Jiuzhaigou Biosphere Reserve, China. Environ Monit Assess. 108:279–293. doi: 10.1007/s10661-005-4327-0

Liu, C, Li, J, Pechacek, P (2013) Current trends of ecotourism in China's nature reserves: A review of the Chinese literature. Tour Manag Perspect. 7:16–24. doi: 10.1016/j.tmp.2013.03.001

Liu, DQ (2007) Chinese domestic tourism during 2001–2005 and development trend and prediction in 2006–2010 (I, II). J Beijing Union Univ 5(7276):5

Liu, J, Li, S, Ouyang, Z, Tam, C, Chen, X (2008) Ecological and socioeconomic effects of China's policies for ecosystem services. Proc Natl Acad Sci. 105:9477–9482. doi: 10.1073/pnas.0706436105

Liu, J, Linderman, M, Ouyang, Z, Tam, C, Chen, X (2001) Ecological degradation in protected areas: The case of Wolong nature reserve for giant pandas. Science. doi: 10.1126/science.1058104

Lockwood, M (2010) Good governance for terrestrial protected areas: A framework, principles and performance outcomes. Journal of Environmental Management. 91:

754–766.

López, E, Bocco, G, Mendoza, M, Duhau, E (2001) Predicting land-cover and land-use change in the urban fringe A case in Morelia city, Mexico. Landsc Urban Plan. 55(4):271–285 doi: 10.1016/S0169-2046(01)00160-8

Loucks, C, Ricketts, TH, Naidoo, R, Lamoreux, J, Hoekstra, J (2008) Explaining the global pattern of protected area coverage: Relative importance of vertebrate biodiversity, human activities and agricultural suitability. J Biogeogr. 35:1337–1348. doi: 10.1111/j.1365-2699.2008.01899.x

Marion, JL, Leung, YF (2001) Trail Resource Impacts and An Examination of Alternative Assessment Techniques. J Park Recreat Admi. 19:17–37

Marion JL, Leung Y-F (2004) Environmentally sustainable trail management. Environ Impacts Ecotourism 229–243

Marion, JL, Leung, YF, Eagleston, H, Burroughs, K (2016) A Review and Synthesis of Recreation Ecology Research Findings on Visitor Impacts to Wilderness and Protected Natural Areas. J For. 114:352–362. doi: 10.5849/jof.15-498

Marion, JL, Wimpey, J (2017) Assessing the influence of sustainable trail design and maintenance on soil loss. J Environ Manage. 189:46–57. doi: 10.1016/j.jenvman.2016.11.074

Marion, JL, Wimpey, J (2007) Environmental impacts of mountain biking: science review and best practices. Manag Mt Biking, IMBA's Guid to Provid Gt Riding Int Mt Bicycl Assoc Boulder. 94–111

Marzano, M, Dandy, N (2012) Recreationist behaviour in forests and the disturbance of wildlife. Biodivers Conserv. 21:2967–2986. doi: 10.1007/s10531-012-0350-y

Mc Keever, PJ, Zouros, N (2005) Geoparks: Celebrating earth heritage, sustaining local communities. Episodes. 28:274–278. doi: 10.18814/epiiugs/2005/v28i4/006

McCleave, J, Espiner, S, Booth, K (2006) The New Zealand people-park relationship: An exploratory model. Soc Nat Resour. 19:547–561. doi:

10.1080/08941920600664001

Monz, CA, Marion, JL, Goonan, KA, Manning, R, Wimpey, J, Carr, C (2010) Assessment and Monitoring of Recreation Impacts and Resource Conditions on Mountain Summits: Examples From the Northern Forest, USA. Mt Res Dev 30:332–343. doi: 10.1659/MRD-JOURNAL-D-09-00078.1

Nagendra, H, Pareeth, S, Ghate, R (2006) People within parks - Forest villages, land-cover change and landscape fragmentation in the Tadoba Andhari Tiger Reserve, India. Appl Geogr. 26(2): 96–112. doi: 10.1016/j.apgeog.2005.11.002

Naughton-Treves, L, Holland, MB, Brandon, K (2005) The role of protected areas in conserving biodiversity and sustaining local livelihoos. Annu Rev Environ Resour. 30(1):219–252. doi: 10.1146/annurev.energy.30.050504.164507

Nepal, SK (2002) Mountain ecotourism: Global perspective on challenges and opportunities. doi: 10.1016/B978-0-7506-1845-8.50121-6

Nepal, SK (2002). Involving indigenous peoples in protected area management: Comparative perspectives from Nepal, Thailand, and China. Environmental Management 30 (6): 748–763.

Nepal, SK, Chipeniuk, R (2005) Mountain tourism: Toward a conceptual framework. Tour Geogr. 7(3):313–333. doi: 10.1080/14616680500164849

Newsome, D, Dowling, R, Leung, YF (2012) The nature and management of geotourism: A case study of two established iconic geotourism destinations. Tour Manag Perspect. 2–3:19–27. doi: 10.1016/j.tmp.2011.12.009

Ng, SL, Leung, YF, Cheung, SY, Fang, W (2018) Land degradation effects initiated by trail running events in an urban protected area of Hong Kong. L Degrad Dev. 29:422–432. doi: 10.1002/ldr.2863

Njole, M (2011) Tourism for sustainable local livelihood and nature conservation, A Case of Lake Manyara National Park. (Ph.D thesis)

Nowlan, GS, Bobrowsky, P, Clague, J (2004) Protection of geological heritage: A North

American perspective on Geoparks. Episodes. 27(3):172–176. doi: 10.18814/epiiugs/2004/v27i3/003

Nyaupane, GP, Thapa, B (2006) Perceptions of environmental impacts of tourism: A case study at ACAP, Nepal. Int J Sustain Dev World Ecol. 13:51–61. doi: 10.1080/13504500609469661

Patubo, BG (2010) Environmental impacts of human activity associated with geocaching.

Pettigrew, M, Xie, Y, Kang, A, Rao, M, Goodrich, J, Liu, T, Berger, J, (2012) Human-carnivore conflict in China: A review of current approaches with recommendations for improved management. Integr. Zool. doi: 10.1111/j.1749-4877.2012.00303.x

People and the planet (2008) http://www.peopleandtheplanet.com/index.html@lid=26706&section=41&topic=26.html. Accessed 19 Jan 2019

Pickering, CM (2010) Ten factors that affect the severity of environmental impacts of visitors in protected areas. Ambio. 39(1): 70–77. doi: 10.1007/s13280-009-0007-6

Pickering, CM, Buckley, RC (2003) Swarming to the Summit - Managing tourists at Mt Kosciuszko, Australia. Mt Res Dev Mt Res Dev. 23(3):230–233 doi: 10.1659/0276-4741(2003)023[0230:STTS]2.0.CO;2

Price, MF (2015) Mountains: A Very Short Intoduction, 1st edn. Oxford University Press, New York. pp:1–5

Priskin, J (2003) Tourist perceptions of degradation caused by coastal nature-based recreation. Environ Manage. 32(2):189–204 doi: 10.1007/s00267-002-2916-z

Protected Planet (2017a) https://www.protectedplanet.net/c/increased-growth-of-protected-areas-in-2017. Accessed 22 Dec 2017

Protected Planet (2017b) https://protectedplanet.net/search?country=China&q=China. https://protectedplanet.net/search?country=China&q=China. Accessed 22 Dec

2017

Qinling Zhongnanshan UNESCO Global Geopark (2012) Qinling Zhongnanshan UNESCO Global Geopark. http://www.qlzns.com/ynews/show-382.html

Qu, G (2000) Dream and Expectation: Past and Future of China's Environment. Beijing

Raik, DB, Wilson, AL, Decker, DJ (2008) Power in natural resources management: An application of theory. Soc Nat Resour. 21:729–739. doi: 10.1080/08941920801905195

Redpath, SM, Gutiérrez, RJ, Wood, KA, Youn,g JC (2015) Conflicts in conservation: Navigating towards solutions. Cambridge University Press. doi: 10.1017/9781139084574

Ren, F, Simonson, L, Pan, Z (2013) Interpretation of Geoheritage for Geotourism – a Comparison of Chinese geoparks and National Parks in the United States. Czech J Tour. 2(2):105–125. doi: 10.2478/cjot-2013-0006

Roca, E, Villares, M, Ortego, MI (2009) Assessing public perceptions on beach quality according to beach users' profile: A case study in the Costa Brava (Spain). Tour Manag. 30(4) 598–607. doi: 10.1016/j.tourman.2008.10.015

Rodrigues, AS, Andelman, S, Bakarr, MI, Bakarr, Boitani, L, Brooks, TM, Cowling, RM, Fishpool, LDC, da Fonseca, GAB, Gaston, KJ, Hoffmann, M, Long, JS, Marquet, PA, Pilgrim, JD, Pressey, RL, Schipper, J, Sechrest, W, Stuart, SN, Underhill, LG, Waller, RW, Watts, MEJ, Xie, Y (2004) Effectiveness of the global protected area network in representing species diversity. Nature. 428:9–12. doi: 10.1038/nature02459.1.

Gustavo, SA, Jonathan, R (2012) Protected Areas and Local Communities: an Inevitable Partnership toward Successful Conservation Strategies? Ecol Soc. 17: doi: 10.5751/ES-05216-170414

Saito H, Ruhanen L (2017) Power in tourism stakeholder collaborations: Power types and power holders. J Hosp Tour Manag 31:189–196. doi:

10.1016/j.jhtm.2017.01.001

Sandbrook, CG (2010) Local economic impact of different forms of nature-based tourism. Conserv Lett. 3:21–28. doi: 10.1111/j.1755-263X.2009.00085.x

Schelhas, J, Sherman, RE, Fahey, TJ, Lassoie, JP (2002) Linking community and national park development: A case from the Dominican Republic. Nat Resour Forum. 26(2) 140–149 doi: 10.1111/1477-8947.00014

Scholte, P (2003) Immigration: A Potential Time Bomb under the Integration of Conservation and Development. Ambio. 32:58–64. doi: 10.1579/0044-7447-32.1.58

Shemweta, DTK, Kidegesho, J, (2000) Human-wildlife conflicts in tanzania: what research and extension could offer to conflict resolution. Proc 1st Univ Wide Conf. doi: 10.1007/s00217-011-1591-9

Shen, X, Lu, Z, Li, S, Chen, N (2012) Tibetan Sacred Sites : Understanding the Traditional Management. Ecol Soc. 17:13. doi: 10.1108/02580540610675425

Slaymaker, O, Embleton-Hamann, C (2015) Mountains. In:Geomorphology and Global Environmental Change. Cambridge University Press, pp:37-70. doi: 10.1017/CBO9780511627057.003

Solton, S, Shadie, P, Dudley, N (2013) IUCN WCPA Guidelines for Applying Protected Area Management Categories

Soutullo, A, De Castro, M, Urios, V (2008) Linking political and scientifically derived targets for global biodiversity conservation: Implications for the expansion of the global network of protected areas. Divers Distrib. 14:604–613. doi: 10.1111/j.1472-4642.2007.00445.x

Sun, GN, Ma, LJ (2007) An analysis of touris climate comfortable degree and yearly variation of tourists traffic in Xi'an. Tourism tribune. 22(7):34–39

Tao, R, Su, F, Liu, M, Cao, G (2010) Land leasing and local public finance in China’s regional development: Evidence from prefecture-level cities. Urban Stud. 47(10)

2217–2236. doi: 10.1177/0042098009357961

Tao W, Hongying, B (2017) Variation of vegetation NDVI in response to climate changes and hunman activities in Qinling Mountains. 35:778–789

Tessema, ME, Lilieholm, RJ, Ashenafi, ZT, Leader-Williams, N (2010) Community attitudes toward wildlife and protected areas in Ethiopia. Soc Nat Resour. 23:489–506. doi: 10.1080/08941920903177867

Teye, V, Sirakaya, Sönmez S, (2002) Residents' attitudes toward tourism development. Ann Tour Res. 29:668–688. doi: 10.1016/S0160-7383(01)00074-3

The State Council (2017) http://www.gov.cn/shuju/2017-08/20/content_5219043.htm

The Xi'an Organizing Committee for the 15th ICOMOS General Assembly (2005) Brief introduction to Xi'an

Tischendorf, L and Fahrig, L (2000) On the usage and measurement of landscape connectivity. Oikos. 90:7-19. doi:10.1034/j.1600-0706.2000.900102.x

Tomczyk, AM, Ewertowski, MW, White, PCL, Kasprzak, L (2017) A new framework for prioritising decisions on recreational trail management. Landsc Urban Plan. 167:1–13. doi: 10.1016/j.landurbplan.2017.05.009

Tomczyk, AM, White, PCL, Ewertowski, MW (2016) Effects of extreme natural events on the provision of ecosystem services in a mountain environment: The importance of trail design in delivering system resilience and ecosystem service co-benefits. J Environ Manage. 166:156–167. doi: 10.1016/j.jenvman.2015.10.016

Törn, A, Tolvanen, A, Norokorpi, Y, et al (2009) Comparing the impacts of hiking, skiing and horse riding on trail and vegetation in different types of forest. J Environ Manage. 90:1427–1434. doi: 10.1016/j.jenvman.2008.08.014

UNEP-WCMC (2007) Areas 2007

UNEP-WCMC, IUCN, NGS (2018) Protected Planet Report 2018

UNESCO List of UNESCO global geoparks.

http://www.unesco.org/new/en/naturalsciences/environment/ea%0Arthsciences/unescoglobal -geoparks/list-of-unescoglobal-geoparks/%0A. Accessed 13 Aug 2019

UNESCO World Heritage Centre (2008) https://whc.unesco.org/en/syndication. Accessed 19 Jan 2019

UNESCO (2017) http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/. Accessed 24 Jan 2019

Vedeld, P, Jumane, A, Wapalila, G, Songorwa, A (2012) Protected areas, poverty and conflicts. A livelihood case study of Mikumi National Park, Tanzania. For Policy Econ. 21:20–31. doi: 10.1016/j.forpol.2012.01.008

Viviroli, D, Dürr, HH, Messerli, B, Meybeck, M, Weingartner, R, (2007) Mountains of the world, water towers for humanity: Typology, mapping, and global significance. Water Resour Res. 43:1–13. doi: 10.1029/2006WR005653

Walpole, MJ, Goodwin, HJ (2001) Local attitudes towards conservation and tourism around Komodo National Park, Indonesia. Environ Conserv. 28(2):160–166 doi: 10.1017/S0376892901000169

Wang, F, Zhang, X, Yang, Z, Luan, F, Xiong, H, Wang, Z, Shi, H (2014) Analysis on spatial distribution characteristics and geographical factors of Chinese National Geoparks. Cent Eur J Geosci 6:279–292. doi: 10.2478/s13533-012-0184-x

Wang, G, Innes, JL, Wu, S, Krzyzanowski, J, Yin ,Y, Dai, S, Zhang, X, Liu, S (2012) National park development in China: Conservation or commercialization? Ambio. 41:247–261. doi: 10.1007/s13280-011-0194-9

Watson, AE, Cole, DN, Turner, DL, Reynolds, PS (2000) Wilderness recreation use estimation: a handbook of methods and systems. Gen. Tech. Rep. - Rocky Mt. Res. Station. USDA For. Serv. doi: 10.1007/s13280-011-0194-9

Watchtower Online Library (2005) https://wol.jw.org/en/wol/d/r1/lp-e/102005202. Accessed 19 Jan 2019

Weckerle, CS, Yang, Y, Huber, FK, Li, Q (2010) People, money, and protected areas: The collection of the caterpillar mushroom Ophiocordyceps sinensis in the Baima Xueshan Nature Reserve, Southwest China. Biodivers Conserv. 19(9):2685–2698. doi: 10.1007/s10531-010-9867-0

Weiler, B, Moyle, BD, Wolf, ID, (2017) Assessing the Efficacy of Communication Interventions for Shifting Public Perceptions of Park Benefits. J Travel Res 56:468–481. doi: 10.1177/0047287516646472

Weingartner, R, Pearson, C (2001) A Comparison of the Hydrology of the Swiss Alps and the Southern Alps of New Zealand. Mt Res Dev. 21:370–381. doi: 10.1659/0276-4741(2001)021[0370:ACOTHO]2.0.CO;2

West, P, Igoe, J, Brockington, D (2006a) Parks and Peoples: The Social Impact of Protected Areas. Annu Rev Anthropol. 35:251–277. doi: 10.1146/annurev.anthro.35.081705.123308

West, P, Igoe, J, Brockington, D (2006b) Parks and Peoples: The Social Impact of Protected Areas. Annu Rev Anthropol. doi: 10.1146/annurev.anthro.35.081705.123308

Whole, E, Brierley, G, Cadl, D, Coulthard, TJ, Covin, T, Fryirs, K., Grant, G, Hilton, RG, Lane, S., Magilligan, FJ, Meitzen, KM, Passalacquz, P, Poeppl, RE, Ratgburn, SL, and Skar, L (2019) Connectivity as an emergent property of geomorphic systems. Earth Surface Processes and landforms. 44: 4-26. Doi: 10.1002/esp.4434.

William, AJ (2006) Impacts of camping and trampling on Australian alpine and subalpine. (Ph.D thesis)

William, EH, David, N. Cole CAM (2015) Wildland Recreation: Ecology and Management, third. John Wiley & Sons, Ltd, West Sussex, UK. pp: 251–277

Wittemyer G, Elsen P, Bean WT, (2008) Accelerated Growth at Protected Population Area Edges. Science 321(5885):123–126. doi: 10.1126/science.1158900

Wolf, ID, Hagenloh, G, Croft, DB (2012) Visitor monitoring along roads and hiking

trails: How to determine usage levels in tourist sites. Tour Manag. 33:16–28. doi: 10.1016/j.tourman.2011.01.019

Wong, K, Fu, D, Li, CY, Song, HX (2007) Rural migrant workers in urban China: Living a marginalised life. Int J Soc Welf. 16:32–40. doi: 10.1046/j.1523-1739.2000.99452.x

Worldatlas (2019) https://www.worldatlas.com/articles/how-much-of-the-world-s-land-mass-is-mountainous.html

WTTC (2018) Economic Impact 2018

Xiao, K, Wahid U, Momotaz, N, Nihei T (2018) Reviewing Establishment of Legal System for Geoparks in China 2 . The Previous Laws Before the Establishment of Geoparks. 3:16–22. doi: 10.11648/j.larp.20180301.13

Xu, J, Chen, L, Lu Y, Fu B (2006) Local people's perceptions as decision support for protected area management in Wolong Biosphere Reserve, China. J Environ Manage. 78:362–372. doi: 10.1016/j.jenvman.2005.05.003

Xu, J, Melick, DR (2007) Rethinking the effectiveness of public protected areas in southwestern China. Conserv. Biol. doi: 10.1111/j.1523-1739.2006.00636.x

Xu, J, Yeh, A, Wu, F (2009) Land commodification: New land development and politics in China since the late 1990s. Int J Urban Reg Res. 33(4):890–913 doi: 10.1111/j.1468-2427.2009.00892.x

Yan, Y, Zhang, Y, Yang, W, Guo, W (2016) Features of geological heritage and development value in qinling zhongnanshan world geopark. Int J Simul Syst Sci Technol. 17:12.1-12.11. doi: 10.5013/IJSSST.a.17.12.12

Yang, GF, Chen, ZH, Tian, MZ, Wu, F, Wray, R, Ping, Y (2011) On the growth of national geoparks in China: Distribution, interpretation, and regional comparison. Episodes. 34:157–176. doi: 10.18814/epiiugs/2011/v34i3/003

Yang, W, Yan, Y, Zhang, Y, Guo, W, Zha, F (2018) Geoheritages in the Qinling Orogenic Belt of China: Features and comparative analyses. Geol. J 53:398–413. doi:

10.1002/gj.3161

Yeh, ET (2009) Greening western China: A critical view. Geoforum. 40(5):884–894. doi: 10.1016/j.geoforum.2009.06.004

Young, JC, Marzano, M, White, RM, (2010) The emergence of biodiversity conflicts from biodiversity impacts: Characteristics and management strategies. 19(14): 3973–3990 Biodivers Conserv. 19:3973–3990. doi: 10.1007/s10531-010-9941-7

Young, NMH (2017) Economic impacts of geotourism and geoparks in China. Globle Eco Asia-Pacific Conference 2017, Adelaide.

Qi, ZX, Xu, WH, Xiong, XY, Ouyang, ZY, Zheng, H, Gan, DX (2011) Assessment of potential habitat for Ursus thibetanus in the Qinling Moun-tains. Biodivers Sci. 19:343–352. doi: 10.3724/SP.J.1003.2011.10288

Zhang, L, Luo, Z, Mallon, D, Li, C, Jiang, Z (2017) Biodiversity conservation status in China's growing protected areas. Biol Conserv 210:89–100. doi: 10.1016/j.biocon.2016.05.005

Zhang, YB, Wang, YZ, Phillips, N, Ma, K, Wang, W (2017) Integrated maps of biodiversity in the Qinling Mountains of China for expanding protected areas. Biol Conserv. 210:64–71. doi: 10.1016/j.biocon.2016.04.022

Zhao, SHS (2009) Area Studies (Regional Sustainable Development Review): China - Volume I. Eolss Publisher Co.Ltd., Oxford, United Kingdom. pp:10

Zhao, X, Ma, C, Xiao, L (2014a) The vegetation history of Qinling Mountains, China. Quat Int. 325:55–62. doi: 10.1016/j.quaint.2013.10.054

Zhong, L, Buckley, RC, Wardle, C, Wang, L (2015) Environmental and visitor management in a thousand protected areas in China. Biol Conserv. 181:219–225. doi: 10.1016/j.biocon.2014.11.007

Zhou, N (2004) The urbanization of national parks and its countermeasures. Urban Plan Forum 1 57–61:

Zimmerer, KS, Galt, RE, Buck, MV. (2004) Globalization and Multi-spatial Trends in

the Coverage of Protected-Area Conservation (1980–2000). AMBIO A J Hum Environ. 33(8):520–529 doi: 10.1579/0044-7447-33.8.520

Zinda, JA (2017) Tourism dynamos: Selective commodification and developmental conservation in China's protected areas. Geoforum. 78:141–152. doi: 10.1016/j.geoforum.2015.08.004

Zouros, N (2000) The European Geoparks Network. Episodes, 27:165–171. doi: 10.18814/epiiugs/2004/v27i3/002

Zouros, N, Martini, G (2003) Introduction to the European Geoparks network. In: NHM of Lesvos Petrified Forest. pp 17–21

Appendices

Appendix 1. Explanation of protected area (PA) definition (prepared based on IUCN, 2008)

Phrases	Explanation	Examples and further details
Clearly defined geographical space	Land, inland water, marine and coastal areas or a combination of two or more of these are included. There are three dimensions of "Space". For example, when the airspace above a protected area is protected from low-flying aircraft or a certain water depth is protected. "Clearly defined" means an area spatially defined with agreed and demarcated borders which sometimes can be defined by physical features that mover over time (e.g., river banks) or by management actions (e.g., agreed no-take zones)	**Wolong Nature Reserve** in China (category Ia, terrestrial); **Lake Malawi National Park** in Malawi (category II, mainly freshwater); **Masinloc and Oyon Bay Marine Reserve** in the Philippines (category Ia, mainly marine) are examples of areas in very different biomes but all are protected areas.
Recognized	Protection can include a range of governance type declared by people or identified by the state. But such sites should be in some ways recognized (particularly through listing one the World Database on Protected Areas - WPDA).	**Anindilyakwa Indigenous Protected Area (IPA)** was self-declared by aboriginal communities in the Groote Eylandt peninsula. It is one of many self- declared IPAs recognized by the government.
Dedicated	Specific binding commitment to conservation in the long term, through e.g.: 1. International conventions and agreements 2. National, provincial and local law 3. Customary law 4. Covenants of NGOs 5. Private trusts and company policies 6. Certification schemes.	Cradle Mountain – **Lake St Clair National Park** in Tasmania, Australia (category II, state); **Nabanka Fish Sanctuary** in the Philippines (community conserved area); **Port Susan Bay Preserve** in Washington, USA (private) are all protected areas, but their legal structure differs considerably.
Managed	Refers to the assumption that some active steps can be taken to conserve the natural and possible other values for which the protected area was established; "managed " can include a decision to leave the area untouched is this is the best conservation strategy	**Kaziranga National Park** in India (category II) is managed mainly through poaching controls and removal of invasive species; islands in the **Archipelago National Park** in Finland are managed using traditional farming methods to maintain species associated with meadows. Flinders

Appendix 1 (continued). Explanation of protected area (PA) definition (prepared based on IUCN, 2008)

Phrases	Explanation	Examples and further details
Legal or other effective means	Means that protected areas must either be gazetted (that is, recognised under statutory civil law), recognised through an international convention or agreement, or else managed through other effective but non-gazetted means, such as through recognised traditional rules under which community conserved areas operate or the policies of established non-governmental organizations.	**Flinders Range National Park** in Australia is managed by the state authority of South Australia; **Attenborough Nature Reserve** in the UK is managed by the county Nottinghamshire Wildlife Trust in association with the gravel company that owns the site; and the **Alto Fragua Indiwasi National Park** in Colombia is managed by the Ingano peoples.
to achieve	A new element that was not included in the definition of 1994. Many protected area managers have strongly requested this. It implies some level of effectiveness which will progressively be recorded on the World Database on Protected Areas and over time will become an important contributory criterion in identification and recognition of protected areas.	Parties are being asked by the **Convention on Biological Diversity** to carry out management effectiveness assessments.
Long-term	The management of protected areas should be perpetual and not as a short-term or temporary management strategy.	Temporary measures, such as short-term grant- funded agricultural set-asides, rotations in commercial forest management or temporary fishing protection zones are not protected areas as recognized by IUCN.
Conservation	Refers to the in-situ maintenance of ecosystems and natural and semi- natural habitats and of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species (see definition of agrobiodiversity in the Appendix), in the surroundings where they have developed their distinctive properties.	**Yellowstone National Park** in the United States (category II) has conservation aims focused in particular on maintaining viable populations of bears and wolves but with wider aims of preserving the entire functioning ecosystem.
Nature	Refers to biodiversity, at genetic, species and ecosystem level, and often also refers to geodiversity, landform and broader natural values.	**Bwindi Impenetrable Forest National Park** in Uganda (category II) is managed primarily to protect natural mountain forests and particularly the mountain gorilla. The **Island of Rum National Nature Reserve** in Scotland (category IV) was set up to protect unique geological features.

Appendix 1 (continued). Explanation of protected area (PA) definition (prepared based on IUCN, 2008

Phrases	Explanation	Examples and further details
Associated ecosystem services	Means here ecosystem services that are related to but do not interfere with the aim of nature conservation. These can include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits.	Many protected areas also supply ecosystem services: e.g., **Gunung Gede National Park** in Java, Indonesia (category II) helps supply fresh water to Jakarta; and the **Sundarbans National Park** in Bangladesh (category IV) helps to protect the coast against flooding.
Cultural values	Includes those that do not interfere with the conservation outcome (all cultural values in a protected area should meet this criterion), including in particular: 1. those that contribute to conservation outcomes (e.g., traditional management practices on which key species have become reliant); 2. those that are themselves under threat.	Many protected areas contain sacred sites, e.g., **Nyika National Park** in Malawi has a sacred pool, waterfall and mountain. Traditional management of forests to supply timber for temples in Japan has resulted in some of the most ancient forests in the country, such as the protected primeval forest outside **Nara**. The **Kaya** forests of coastal Kenya are protected both for their biodiversity and their cultural values.

Appendix 2. Categories of PAs defined by IUCN

Categories	Description	Primary objective	Distinguishing features
Ia: Strict nature reserve	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.	● To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/ or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.	● Have a largely complete set of expected native species in ecologically significant densities or be capable of returning them to such densities through natural processes or time-limited interventions; ● Have a full set of expected native ecosystems, largely intact with intact ecological processes, or processes capable of being restored with minimal management intervention; ● Be free of significant direct intervention by modern humans that would compromise the specified conservation objectives for the area, which usually implies limiting access by people and excluding settlement; ● Not require substantial and on-going intervention to achieve its conservation objectives; ● Be surrounded when feasible by land uses that contribute to the achievement of the area's specified conservation objectives; ● Be suitable as a baseline monitoring site for monitoring the relative impact of human activities; ● Be managed for relatively low visitation by humans; ● Be capable of being managed to ensure minimal disturbance (especially relevant to marine environments).

Appendix 2 (continued). Categories of PAs defined by IUCN

Categories	Description	Primary objective	Distinguishing features
Ib: Wilderness area Category	Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition. Before	● To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.	● Be free of modern infrastructure, development and industrial extractive activity, including but not limited to roads, pipelines, power lines, cellphone towers, oil and gas platforms, offshore liquefied natural gas terminals, other permanent structures, mining, hydropower development, oil and gas extraction, agriculture including intensive live- stock grazing, commercial fishing, low-flying aircraft etc., preferably with highly restricted or no motorized access. ● Be characterized by a high degree of intactness: containing a large percentage of the original extent of the ecosystem, complete or near-complete native faunal and floral assemblages, retaining intact predator-prey systems, and including large mammals. ● Be of sufficient size to protect biodiversity; to maintain ecological processes and ecosystem services; to maintain ecological refugia; to buffer against the impacts of climate change; and to maintain evolutionary processes. ● Offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet and non- intrusive means of travel (i.e., non-motorized or highly regulated motorized access where strictly necessary and consistent with the biological objectives listed above).

Appendix 2 (continued). Categories of PAs defined by IUCN

Categories	Description	Primary objective	Distinguishing features
II: National park Category	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.	● To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.	Category II areas are typically large and conserve a functioning "ecosystem", although to be able to achieve this, the protected area may need to be complemented by sympathetic management in surrounding areas. ● The area should contain representative examples of major natural regions, and biological and environmental features or scenery, where native plant and animal species, habitats and geodiversity sites are of special spiritual, scientific, educational, recreational or tourist significance. ● The area should be of sufficient size and ecological quality so as to maintain ecological functions and processes that will allow the native species and communities to persist for the long term with minimal management intervention. ● The composition, structure and function of biodiversity should be to a great degree in a "natural" state or have the potential to be restored to such a state, with relatively low risk of successful invasions by non-native species. Role
III: Natural monument or feature	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.	● To protect specific outstanding natural features and their associated biodiversity and habitats.	Category III protected areas are usually relatively small sites that focus on one or more prominent natural features and the associated ecology, rather than on a broader ecosystem. They are managed in much the same way as category II. The term "natural" as used here can refer to both wholly natural features (the commonest use) but also sometimes features that have been influenced by humans.

Appendix 2 (continued). Categories of PAs defined by IUCN

Categories	Description	Primary objective	Distinguishing features
IV: Habitat/ species management area	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.	● To maintain, conserve and restore species and habitats.5 Other objectives: ● To protect vegetation patterns or other biological features through traditional management approaches; ● To protect fragments of habitats as components of land- scape or seascape-scale conservation strategies; ● To develop public education and appreciation of the species and/or habitats concerned; ● To provide a means by which the urban residents may obtain regular contact with nature.	Category IV protected areas usually help to protect, or restore: 1) flora species of international, national or local importance; 2) fauna species of international, national or local importance including resident or migratory fauna; and/or 3) habitats. The size of the area varies but can often be relatively small; this is however not a distinguishing feature. Management will differ depending on need. Protection may be sufficient to maintain particular habitats and/or species. However, as category IV protected areas often include fragments of an ecosystem, these areas may not be self-sustaining and will require regular and active management interventions to ensure the survival of specific habitats and/or to meet the requirements of particular species.
V: Protected landscape/ seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.	● To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.	● Landscape and/or coastal and island seascape of high and/ or distinct scenic quality and with significant associated habitats, flora and fauna and associated cultural features; ● A balanced interaction between people and nature that has endured over time and still has integrity, or where there is reasonable hope of restoring that integrity; ● Unique or traditional land-use patterns, e.g., as evidenced in sustainable agricultural and forestry systems and human settlements

Appendix 2 (continued). Categories of PAs defined by IUCN

Categories	Description	Primary objective	Distinguishing features
VI: Protected area with sustainable use of natural resources Category	Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.	● To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.	● Category VI protected areas, uniquely amongst the IUCN categories system, have the sustainable use of natural resources as a means to achieve nature conservation, together and in synergy with other actions more common to the other categories, such as protection. ● Category VI protected areas aim to conserve ecosystems and habitats, together with associated cultural values and natural resource management systems. Therefore, this category of protected areas tends to be relatively large (although this is not obligatory). ● The category is not designed to accommodate large-scale industrial harvest. ● In general, IUCN recommends that a proportion of the area is retained in a natural condition，which in some cases might imply its definition as a no-take management zone. Some countries have set this as two-thirds; IUCN recommends that decisions need to be made at a national level and sometimes even at the level of individual protected areas.

Appendix 3. China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
1	Danxiashan	Shaoguan City Guangdong Province	N25°02'25" E113°44'16"	2004	2015	292	multi-layered red sedimentary rocks of sandstone and conglomerate
2	Zhangjiajie	Zhangjiajie City, Hunan Province	N29°18'50" E110°26'24"	2004	2015	398	an integrated Geopark, with sandstone peak forest landforms predominating most of the area and karst caves, water bodies and other landforms covering the remaining terrain
3	Yuntaishan	Jiaozuo City, Henan Province	N35°17'41" E113°14'58"	2004	2015	556	a series of geological relics that have unique scientific significance and aesthetic values as the record of local geological history.
4	Wudalianchi	middle-north part of Heilongjiang Province	N48°28'55" E126°12'10"	2004	2015	720	geoheritages of Cambrian, Cretaceous and Quaternary; fourteen young and old volcanoes; undamaged typical volcano geology and geomorphology; "Natural Volcano Museum" and a "Living Textbook on Volcanoes".
5	Songshan	Henan Province 3.6 billion years of geologic history.	N34°29'22" E112°55'15"	2004	2015	464	3.6 billion years of geologic history; the Archean, Proterozoic, Mesozoic and Cenozoic strata well outcropped; almost the entire Earth history; reputed by geologists as "five generations under one roof".

Appendix 3 (continued). China’s 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
6	Shilin	Shilin County Yunnan Province	N24°45'20" E103°16'47"	2004	2015	350	a unique topography and natural geographic feature on earth; a unique landscape aesthetic; hailed as a "wonder of the world"; the most diverse forms of karst, the tall pillar-like limestone, sword-shaped limestone, mushroom-shaped limestone and tower-like limestone
7	Huangshan	Anhui Province	N29°41'26", E118°19'34"	2004	2015	12,000	famous for its steep peaks of Mesozoic granite rising 1,000 meters high; granites of the Yanshanian period widely distributed along the west coast of the Pacific; an ideal place to demonstrate the formation mechanism of granite geomorphology
8	Lushan	Jiangxi Province	N29°33'30" E115°59'09"	2004	2015	500	a unique multi-genetic complex landscape made up of typical east China mountain quaternary glaciations, horst fault-blocking, metamorphic core complex structures and water erosion landforms; representing basic rules of three stages of the earth’s development history:
9	Hexigten	Inner Mongolia Autonomous Region	N43°14'49" E117°30'12"	2005	2015	1,750	unique, beautiful, systematic and comprehensive geoheritage, which represents major geoheritage types in the central Inner Mongolia

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
10	Taining	Taining County Fujian Province	N26°53'55" E117°10'36"	2005	2015	492.5	composed mainly of volcanic rock; generally, very steep with medium height; Shaxian Formation is exposed in the marginal areas of the red basin and has a low-even/gentle hilly landform
11	Xingwen	Yibin, Sichuan province	N28°18'35" E105°03'19"	2005	2015	156	limestones of different ages; widely distributed; Xingwen-type karst landform unique to the area's particular geography, geology, climate and environment.
12	Yandangshan	Zhejiang Province	N28°21'07" E121°05'40"	2005	2015	298.8	an ancient Cretaceous rhyolitic volcano.; strong crustal movement recorded complete geological evolution of volcanic eruptions - collapse - resurrection and uplift in Mount Yandangshan
13	Jingpohu	Ning'an Heilongjiang Province	N43°58'23" E129°02'04"	2006	2015	1,400	one of the most significant volcano fields in Eastern China; around Daganpao at the northwestern park distributes Jingbo volcanoes erupting three times before present, with 4 multiple volcanic cones and a single volcanic cone, 12 craters in total
14	Leiqiong	Qiongzhou	N19°56'37" E110°12'39"	2006	2015	3,050	the Leiqiong Rift Volcanic Belt.

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
15	Taishan	Shandong province	N36°16'01" E117°04'16"	2006	2015	158.63	the Taishan Group-Complex of basic igneous rocks characterized by Komatiite and Precambrian multiphase intrusive rocks, a typical Cambrian section, neotectonic movement and distinct landforms of great geological significance
16	Wangwushan-Daimeishan	Henan Province	N35°15'57" E112°34'17"	2006	2015	986	a complete set of the geo-historical record from Neoarchean to Cenozoic conserved; records of the evolution history of North China craton clearly displayed; the ideal place to research the geological evolution of North China, even worldwide.
17	Fangshan	Beijing and Hebei Province	N39°43'59", E115°55'02"	2006	2015	954	very rich geological remains and a complete series of rock formations developed over 3,500 million years.
18	Funiushan	Henan Province	N33°26'06" E112°10'53"	2006	2015	1,522	The geomorphic landscapes in the Funiushan UNESCO Global Geopark demonstrate tectonic movement – particularly a diversity of granitic geomorphic types in orogenic belts.
19	Zigong	Zigong City Sichuan Province	N29°19'29" E104°45'56"	2008	2015	1,630.46	the extremely abundant dinosaur fossils and other vertebrate fossils, a typical Jurassic section and natural and cultural heritage related to salt production.

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
20	Longhushan	Jiangxi Province	N28°06'04" E116°57'57"	2008	2015	996.63	Danxia landforms as well as volcanic landforms and tectonic landforms; boasting typical late mature stage Danxia landforms, with a full display of a complete development series of young-stage, mature stage, and old-stage Danxia landforms.
21	Alxa Desert	Alxa League Inner Mongolia Autonomous Region	N41°59'34" E101°04'48"	2009	2015	683.74	world's first desert geopark; the second largest desert in China; the highest sand hills and largest sounding sand area in the world more than 140 lakes in the desert, supplied with an ancient culture and charmed Mongolian customs
22	Qinling Zhongnanshan	Xi'an, Shaanxi Province	N33°51'05" E108°47'01"	2009	2015	1074.85	abundant geological heritage sites, splendid landscapes, varieties of biological species, favorable environment and plentiful historic culture
23	Ningde	Ningde, Fujian Province,	N26°39'41" E119°31'35"	2010	2015	2660.34	a typical area of the active continental marginal zone in the circum-Pacific belt; the Late Jurassic to Early Cretaceous dacitic-rhyolitic igneous rocks widespread

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
24	Leye Fengshan	Guangxi Zhuang Autonomous Region	N24°34'11" E106°44'26"	2010	2015	930	primarily sedimentary with more than 60% of 3000m thick Devonian to Permian carbonate rocks. It forms an "S"-shaped structure and a rhombus configuration in the karst areas of Leye and Fengshan counties respectively.
25	Tianzhushan	Anqing City Anhui Province	N30°31'28" E117°03'31"	2011	2015	413.14	abundant UHP metamorphic rocks, among which diamond-bearing eclogite and coesite-bearing eclogite are the most representative and record the geological evolution process of the deep subduction orogenic collision and the retracing of the continental crust
26	Hong Kong	Hong Kong	N22°21'50" E114°22'30"	2011	2015	150	well-outcropped acidic volcanic hexagonal rock columns, of which the average diameter is 1.2 meters, and which are distributed over a land-and-sea area of 100 square kilometers
27	Sanqingshan	Shangrao City, Jiangxi Province	N28°48'22" E117°58'20"	2012	2015	229.5	an exceptional and gorgeous mountain body of granite rocks located on the suture zone of palaeo-plates (Suzhou–Dexing Translithospheric Fracture Zone).

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
28	Shenongjia	Shennongjia Forestry District Hubei Province	N31°44'43" E110°40'52"	2013	2015	1022.72	having experienced multiple tectonic movements, forming a very special alpine structural landform; Shennong Peak, with an altitude of 3,106.2 m, the highest peak in central China.
29	Yanqing	The northwestern part of Beijing	N40°42'53" E116°24'00"	2013	2015	620.38	Yanqing UNESCO Global Geopark has experienced a long geological history and created abundant geoheritage sites.
30	Mount Kunlun	Qinghai-Tibet Plateau hinterland	N35°49'12" E94°52'48"	2014	2015	7,033	experienced multiple times of complicated crustal evolution, ocean development, as well as ocean-land transformation, developing a tectonic mix of Mesoproterozoic-Neoproterozoic-Jurassic strata, with active and intense magmatic activities
31	Dali-Cangshan	Yunnan province	N25°46'48" E100°42'00"	2014	2015	933	a young mountain formed only 50 million years ago, however, the rocks that make up the mountain are more than 2 billion years old.

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
32	Dunhuang	Anxi-Dunhuang Graben Basin	N40°13'59" E092°52'60"	2015	2015	2,067	The most representative geoheritage is the Yardang-Desert-Gobi landforms, which constitute typical landforms in the extremely arid region of China and the Mogao Grottoes, a World Heritage Site, which were excavated in the Quaternary strata and perfectly embody the combination of geoheritage and culture.
33	Zhijindong Cave	Bijie City Guizhou Province	N26°45'00" E105°55'59"	2015	2015	170	many dispersive and independent underground rivers and surface rivers have captured and diverted constantly, thus constituting three independent multilayer geomorphic units, namely, Zhijindong Cave, Qijiehe River and Dongfenghu Lake
34	Arxan	Xing'an League Inner Mongolia Autonomous Region	N47°10'27", E119°56'20"	N/A	2017	3,653.21	As a volcanic-tectonic unit, it is part of the Datong-Daxing'anling Cenozoic volcanic zone; abundant geomorphological landforms (volcanoes, granite peaks and rivers) and water landscapes

Appendix 3 (continued). China's 37 UNESCO Global Geoparks

No.	Name	Localization	Coordination	Global Geopark Designated Year	UNESCO Global Geopark Designated Year	Area km^2	Main Features
35	Keketuohai	Xinjiang Uygur Autonomous Region	N47°19'05" E090°01'35"	N/A	2017	2337.9	an important role in understanding the geological evolution of the area including the Altai orogenic belt and magma intrusion; the Altay granitic geomorphologic landscape; referred to as China's Yosemite
36	Guangwushan-Nuoshuihe	Bazhong Sichuan Province	N32°18′42″; E106°38′11″	N/A	2018	1818	sedimentary sequence of the northern Yangtze tectonic plate, karst landforms, waterfalls and ponds as well as tectonic landforms; an important place for analyzing the geological evolution of the peripheral basins of the Tethys, Central Orogenic Belt, Daba Mountains Orogenic Belt and Sichuan Basin, and the Yangtze Block.
37	Huanggang Dabieshan	Hubei Province	N30°43'46"; E115°03'13"	N/A	2018	2625.54	Lofty mountains with breathtaking views: the result of years of weathering and erosion