

## **A review of Chinese researches on conservation and development in Eastern Pamirs**

### **1 Introduction**

The Eastern Pamirs, or the Chinese Pamirs, include the entire Taxkorgan County, part of Aketao County and Quqia County. It borders Afghanistan, Pakistan, Tajikistan and Kyrgyzstan and links with the Tianshan, Kunlun, Karakoram and Hindu Kush Mountains. The total area of the Chinese Pamirs is around 30,000km<sup>2</sup> and more than half of it is under protected area management.

Most of the literature about the Pamir region is in English, Russian, Chinese, and to a lesser degree German languages. However, due to reasons of language, the manifold Chinese research is hardly known or recognised by the non-Chinese speaking scholars.

In order to provide an overview of Chinese literature in this field for a wider audience this paper tries to briefly summarise the relevant work on the Chinese Pamirs in the fields of flora, fauna, climate change and impacts, socioeconomic characteristics, ethnography, natural resources and environments, so as to provide a small window for non-Chinese speakers to learn about the existing knowledge in the region.

### **2 A typology of Chinese literature on the Eastern Pamirs**

This review covers the peer-reviewed journal articles, theses and dissertations for Master and Ph.D. degrees and book publications based on original field studies or analysis of original data. They were identified by searching through the National Science Library, Chinese Academy of Sciences (<http://www.las.ac.cn>) and the China Network for Knowledge and Information (<http://www.cnki.net>) using the key words "Taxkorgan, Kashgar, Pamirs, Kunlun Mountains, Marco Polo Sheep, Ibex, South Xinjiang". All the identified documents were again screened for their relevance to the topics of conservation and development in the Pamirs or Taxkorgan with the aim to select only literature that has a direct reference to these areas. However, articles about the western Karakoram were also included in case they had a reference to Taxkorgan. Altogether, 113 journal articles, 17 M.Sc. thesis, 4 Ph.D. thesis and 15 books have been identified with high relevance to the Chinese Pamirs and parts of the Karakoram, especially, Taxkorgan. These have been classified in broad subject areas as displayed in Table 1 for an overview.

Table 1: Overview: A typology of Chinese literature on the Eastern Pamirs (own design)

Dimensions	No. of publications, subjects and exemplary references
<b>Botany &amp; vegetation</b>	Total: 43 Including 21 articles, 11 M.Sc. thesis from Shihezi University, and 1 survey report, on general survey; floral distribution and plant biodiversity; and taxonomic studies of Cruciferae, Pedicularis spp.; Leguminosae; Oxytropis spp.; Gramineae; Compositae; Astereae; Sympelalae; Ranunculaceae; Astragalus spp.; Polygonaceae; Rosaceae; Archichlamydae; Sympeladae; Scrophulariaceae; Gentianaceae; Carex family; Bryophytes. Example: Qiu (2005); Xu (2011)
<b>Wildlife &amp; conservation</b>	Total: 18 15 articles, 1 Ph.D. dissertation, and 2 books, on Faunal resources and distribution; Population size, habitats and status of Marco Polo sheep ( <i>Ovis ammon polii</i> ), Ibex, snow Leopard, blue sheep, fish resources 12 of them have a focus on Taxorgan County or Taxkorgan Nature Reserve. Examples: Gong et al. 2007; Yu et al. (2009); Wang (2012)
<b>Sociology &amp; Development</b>	Total: 23 Including 12 articles, 10 books and 1 Ph.D. dissertation, on Physical features of Tajiks; Iodine deficiency; Tajik society, gender relations, religion, and tourism, disaster and risk management, and explorations of local niche products. Examples: Liu (2014); Luo & Zhao. (2004); Qurban (2011); Wang (2014)
<b>Geology &amp; Hydrology</b>	Total : 23 Including 20 articles, 1 M.Sc. thesis, and 2 books, on rock formation, tectonic movement, geological structures; mineral resources and river runoff, and hydropower potential. 13 having a focus on Taxkorgan. Examples: Mansirik et al. (2008); Li (2013)
<b>Climate &amp; change</b>	Total:23 Including 20 articles, 2 M.Sc. thesis, 1 Ph.D. thesis There are 15 on overall Xinjiang, 4 on South Xinjiang, 2 on Tarim River Basin, 1 on Kashgar Prefecture, and 1 on Taxorgan and its close proximity. Temperature & precipitation (11): Snowfall & spatial distribution (6); Surface CO <sub>2</sub> /H <sub>2</sub> O(1); and Extreme Events(5) Examples: Abasi et al. (2012); Liu et al. (2008); Tao et al.(2014)
<b>Climate change impacts</b>	Total: 19 Including 15 articles, 3 M.Sc. thesis and 1 Ph.D. thesis, dealing climate change impacts on general environment (2), sandstorm occurrences (3), agriculture (6), water resources & glaciers (6), Frozen soil/Frost(2). By area, 10 on overall Xinjiang, 7 on South Xinjiang, and 2 for Pamirs. Representatives: Guo & Shi (2008); Yang (2012); Liu et al. (2008)

## **2.1 Botany & biodiversity**

Modern botanical and vegetative studies (Xu 2007, Xinjiang Survey Team of Chinese Academy Sciences 1979) on the Chinese Pamirs and Karakoram started from the 1950s onwards. Systematic botanical studies have been made by survey teams from different institutions of the Chinese Academy of Sciences (in 1959, 1974, and 1978), the Xinjiang General Bureau of Agricultural Reclamation (in 1978) as well as individual researchers from different universities and research institutions of China.

From 1987 to 1992, scientists from China (Chinese Academy of Sciences and other universities), France and Pakistan made a joint expedition for Karakoram-Kunlunshan (including Taxkorgan and parts of the Chinese Pamirs) that focused on four thematic areas: regional geological evolution, landmass uplift and environmental changes, floristic composition and biological resources, and natural environment and spatial differentiation. The survey resulted in a book series on all these different areas.

Supported by the National Science Fund of China (NSFC), Prof. Yan Ping and his team from Shihezi University has made consistent and systematic studies on the plant floristics and taxonomy of the Chinese Pamirs and Taxkorgan area of the Karakoram through extensive field trips in the past twenty years (Qiu 2005; Xu 2011; Yang et al. 2008). The associated scientists are the major contributors of papers, theses and dissertations in this field over the recent years. According to their findings, the Chinese Pamirs have 953 species from 303 genera and 59 families of higher plants while the Karakoram region has 659 species from 205 genera and 47 such families.

Surveys on rangeland resources in the Chinese Pamirs (Su 2013) also started from the 1950s. The most recent and intensive survey commenced in 1979 and lasted to late 1980s. The survey was organised by the central government, implemented by livestock departments of the provinces with technical support from the Chinese Academy of Sciences and the Chinese Academy of Agriculture Science. This large scale survey resulted in the development and publication of the 1:1 million Chinese Rangeland Map, Grassland Resources and Plant Resources on Chinese Grassland.

## **2.2 Fauna studies & conservation**

Apart from the aforesaid Karakoram-Kunlunshan Comprehensive Survey, several major species-wise surveys of fauna in the Pamirs have been developed in the past 30 years, with a particular focus on the Marco polo sheep, ibex and snow leopard. Out of the 15 articles, nine are related to Marco polo sheep, six related to argali and two on ibex. There is one

doctoral dissertation focusing on the snow leopard. Taxkorgan Nature Reserve is the focal area, but several studies covered the whole Chinese Pamirs.

In 1985 and 1986, George Schaller et al. (1987), surveyed the large mammals, in the newly established Taxkorgan Nature Reserve and its adjacent area. Their estimation of the number of Marco Polo sheep living in the Kalaqiku Valley as their major area of distribution amounts to be less than 150.

Gong et al. (2007) from CAS studied the population size, distribution area and habitat availability of the Marco sheep in the Taxkorgan Nature Reserve. Their study indicated that Marco Polo sheep were distributed only in 25.29% of the total area of the reserve and its total available suitable habitat is only 484km<sup>2</sup> or 3.03% of the total reserve area. The estimated the total number of Marco Polo Sheep to be around 1,500-1,700.

Ablimit et al. (2010) surveyed the population of Marco Polo sheep and ibex in the Muztag area in 2009 and reported that the 708.5km<sup>2</sup> of studied area had a population density of 1.44 ind./ km<sup>2</sup> for Marco Polo sheep and 0.558 ind./ km<sup>2</sup> for ibex.

The most systematic study on the Marco Polo sheep covering the whole Chinese Pamirs was carried out by the Northwest Institute for Endangered Wildlife (Yu et al. 2009) from 1997 to 2007 through a project funded by the State Forestry Administration of China. Their study suggested that the Marco Polo sheep in China was mainly distributed in a very narrow strip close to the Chinese border with neighbouring Pakistan, Afghanistan, Tajikistan and Kyrgyzstan (mainly in Taxkorgan and Aktao counties). They developed the first map of Marco Polo sheep's distribution in China and estimated that the Marco Polo sheep's total population in China to be around 3000.

Wang Jun (2012) studied the ecological niche and population size of the snow leopard in Taxkorgan Nature Reserve from 2009 to 2011, using Infrared camera tracking. Within in a 41 km<sup>2</sup> area (located within Maryang Township), three to six snow leopards were captured by the cameras, indicating a density of 7.14-14.29 individuals/km<sup>2</sup> within the surveyed area. In the same study, he also found that 24.6% of the food of the snow leopards was from domestic animals such as yaks, goats and sheep.

All the studies pointed to issues of habitat shrinking and degradation due to infrastructure development and grazing and conflicts between wildlife and domestic animals and the need for transboundary collaboration for effective conservation.

### 2.3 Sociology & development

The number of articles based on original socio-economic studies is rather limited. Most of the articles in this respect are more general discussions on development issues (technologies, policies, strategies or plans). However, there are a few monographs based on well-designed field surveys of the Tajik communities in Taxkorgan County (Liu 2014; Wang 2014; Luo & Zhao 2004; Qurban 2011).

As a part of the research programme on the economic development of the ethnic minorities initiated by the China Nationality University, Wang and his team developed a detailed study of the Tuo Ge Lun Xia Village of Taxkorgan County at three levels: the village level, household level and individuals (Wang 2014). Their work described in a detailed manner the demography (1430 people), village history, agricultural production and farming systems and their changes, livestock production, forestry, business and cultural customs of the village.

Another similar study was conducted by Luo & Zhao (2004) of Yunnan University, focusing on Tezlaph Village (165 households and 1105 people) of Taxkorgan. This study was part of the University's research programme on Villages of Ethnic Minorities of China. The study also focused on the village history, its utilisation of local natural resources, demography, economy, social organisation and village politics, as well as marriage and family, legal and social control systems, language culture, education, customs, science and technology, public health and religious practice. In contrast to the study of Wang (2014) which took a more descriptive approach, Luo & Zhao (2004)'s work used a comprehensive analytical approach and focused on an analysis of changes in village society.

Against the background of the Chinese government initiative to relocate people for conservation or development purposes, Liu (2014) studied the migration and adaptation of the Tajik communities. Up to July 2005, over 393 households and 2,071 people from over 15 townships were relocated to a newly established town called Abati. Liu (2014) studied in detail how the newly settled people culturally adapt to the new physical environment and its ecological context, their farming practices, living surroundings and community environments.

Qurban (2011) was without doubt the most prolific scholar on Chinese Tajiks. Born in Taxkorgan, Qurban is a professor at Xinjiang University and has over 20 publications on different aspects of the Tajik communities in Chinese Pamirs.

## 2.4 Climate change & adaptation

Literature on climate change, impact and adaptation in the Pamirs is mostly based on the analysis of the measured data on climatic factors over the past 50-60 years. Very few articles on impacts and adaptation were based on field studies.

Abasi et al. (2012)'s analysis of the climate variations in Kashgar region during 1960-2010 is the one most relevant to the Pamir region. Using meteorological data from five stations, including the one in Taxkorgan, they analysed changes of the major climatic variables in the past 50 years. Their analysis showed that there was a significant warming across the prefecture. The annual mean, the maximum and minimum temperatures have all increased over the period. In the plains, the increase is more visible in winter while in mountains areas such as Taxkorgan the increase is more visible during autumn season. Rainfall also increases over the period, albeit more in mountains than in the plains. Taxkorgan witnessed a steady increase from 71.2mm to 96.4mm per year, mostly occurring during the summer months.

According to Liu et al. (2008), there was an increase in both mean annual temperature ( $0.24^{\circ}\text{C}/10\text{a}$ ) and precipitation ( $3.59\text{mm}/10\text{a}$ ) in Taxkorgan from 1961 to 2006. Temperature increase is more significant during Spring ( $0.23^{\circ}\text{C}/10\text{a}$ ) and Autumn seasons ( $0.4^{\circ}\text{C}/10\text{a}$ ), whereas precipitation increase is most significant during Summer ( $4.27\text{mm}/10\text{a}$ ).

Liu et al. (2008) analysed relationships between temperature and precipitations changes in Taxkorgan and the runoff changes at the Yarkang River using the climate data from Taxkorgan Meteorological Station and the hydro data from the Kaqun Hydrological Station downstream. Temperature was identified as the main factor causing runoff changes in the downstream river (Liu et. al.2008). The correlation coefficient of temperature and runoff was 0.81 while that between annual precipitation and runoff was -0.57. When precipitation was equal, the runoff increased with rising temperature; when temperature was equal, the runoff decreased with an increase in precipitation.

Yang (2012) analysed the four-decade changes of the 1,253 glaciers in the eastern Pamirs during 1972-2011 and their relationship to climate change. During the study period, 680 glaciers have retreated, four disappeared completely and 16 advanced. Summer temperature and annual precipitation have been determined as the two key factors controlling glacier change in the area.

There exists a lot of Chinese literature on the impacts of climate change on agriculture. However, almost all of them refer to rather general discussions (Guo & Shi 2008) and there

is a clear dearth of field-based studies on climate change and its effects on local communities and their adaptation.

### 3 Gaps & ICIMOD planned surveys

There exist altogether insufficient field-based studies on local climate change impacts and adaptation strategies, as well as on thematic development issues, such as poverty, gender relations, value chain analysis, land tenure relations and land use, and local participation in resources management at community levels. There is also not enough information on pasture resources and their uses by domestic animals and wildlife. However, such information is very important for policy making in conservation and management. Furthermore, no Chinese literature was identified that dealt with issues of transboundary cooperation for wildlife conservation.

Against this background, ICIMOD is currently planning to work with its country partners in Afghanistan, China, Pakistan and Tajikistan to carry out a rapid survey over the course of 2016 and 2017 about the range resources and uses in the Hindu Kush Karakoram-Pamir landscape. The survey will collect information on available pasture resources, seasonal uses of the resources by domestic animals and wildlife and the contribution of livestock management to the household economy. It is hoped that such information will provide a solid scientific basis for planning and implementing country-wise reserve management activities and promoting transboundary collaborations.

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