FINAL REPORT

Assessment of the Traffic Disturbance to Tibetan Antelopes in Hoh-Xil National Nature Reserve

(Project No.F200205)

Period covered: May 1, 2005 – May 20, 2006

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1. SUMMARY

The Tibetan antelope (*Pantholops hodgsonii*), otherwise known as chiru is one of the world's most endangered species.Chiru are virtually exclusive to the Tibetan Plateau, though they occasionally wander into India's Ladakh region. It is listed as endangered animal by the World Conservation Union (IUCN) and has been listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1979. The People's Republic of China gives them the highest level of legal protection under its Wildlife Protection Law, prohibiting chiru hunting and trade in chiru parts without government permission.

Chiru are noted for their poaching massacre, and that their fine wools were smuggled and weaved to high-priced scarves and shawls for rich women in western countries. In the last one century, hunt grazing was the main threat to this species. These years the actions of governments and wildlife protection organisations have brought poaching under control. But there are still other dangers, the deterioration of the antelope's natural habitat and the degradation of the environment are continuing threats to the survival of the species. Tibetan Antelopes habitat in the vast expanse of 880,000 square kilometers in Qinghai-Tibet Plateau. Hoh Xil is one of the main distribution areas of the chiru. Each year, flocks of Tibetan antelopes will move to *Zhuonai Lake* and *Taiyang Lake* to give birth. The Qinghai-Tibet Highway and the newly built Qinghai-Tibet railway are both on their migrating corridor. In order to ensure the chiru pass through the railway safely, 15 passages were built in Hoh-Xil, but still no wildlife crossing structure over the highway. From 2004 a monitoring project was started to evaluate the efficiency of wildlife passages in migration season of Tibetan Antelopes, supported by the Military of Railway and BP Conservation Program. Till now we have continued monitoring the migration of this chiru population for three years, recorded all the passes of chiru through their main migration corridors, and the road and rail disturbance to them. In 2004, the main structure of wildlife corridors along Qinghai-Tibet Railway was finished but the rail bed was still in construction . We recorded 1660 individuals moved in Hoh Xil through Wubei Bridge(*Hoh-xil Passage*, which is an under bridge corridor), and 2303 in return migration, among them 1/3 were new born babies, about 56% using crossing structures, the others over passed the railway directly. The human activities in construction of the railway and road traffic both had great impact on migration of Tibetan Antelopes. In 2005, with the support of BPCP follow-up award and Rufford Small Grant we continued the project, and it was the first year that all 15 wildlife passages put into use. From May 31st to July 30th, 1509 chiru individuals' passes were detected at *Wubei Bridge*, including females, sub-adult

females and 8 new-born babies. In return migration till our fieldwork finished, 2182 individuals were recorded to cross the Qihinghai-Tibet highway, among which 88.5% used wildlife corridors, 11.5% over passed the rail bed. The efficiency of wildlife passages increased. The main disturbances were road traffic and the human activities brought by the Qinghai-Tibet highway. On July 1st, 2006, the Qinghai-Tibet railway began trail operations. In our fieldwork of this migration season, we recorded 2122 chiru moved from their winter ground to their summer calving ground and 2854 in return. The Tibetan Antelopes passed through the railway smoothly using wildlife corridors, but were greatly affected by the busy traffic on highway and the disturbance of hundreds of tourists to Lhasa.

This project is not only a monitoring project but also a conservation plan. Together with the staff from the Reserve Management Office, we cleared the rubbish under the bridge, limited the activities near passages, assisted in stopping the traffic to help the chiru cross the road. Our monitoring results and recommendations were provided to Bureau of Forestry, transportation department. It will be used to make conservation plan for the next migration season.

Key words:Assessment, Traffic Disturbance, Migration, Tibetan Antelopes

2. INTRODUCTION

The Tibetan antelope (*Pantholops hodgsonii*), otherwise known as chiru is one of the world's most endangered species, endemic to the Tibetan plateau. On the plateau, chiru distribute throughout much of Tibet, Qinghai Province and along the southern part of Xinjiang Uygur Autonomous Region. They are virtually exclusive to the Tibetan Plateau, though they occasionally wander into India's Ladakh region (Wu & Feng, 1996, Schaller et al, 1998). The Tibetan Antelope is listed as Endangered animal by the World Conservation Union (IUCN) （EN 2d ver.3.1, 2001）and have been listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1979. The People's Republic of China gives them the highest level of legal protection under its Wildlife Protection Law (State Forestry Administration of China, 1998), prohibiting chiru hunting and trade in chiru parts without government permission.

The habitat of Tibetan Antelopes lies above 4,000 meters in elevation, but in parts of Xinjiang they formerly occurred as low as 3,250 m. They prefer flat to rolling topography and alpine steppe or similar semiarid plant associations. The current range of Tibetan Antelopes can be divided into two large areas: A northern part of about 490,000 km2 and a central part of about 115,000 km2. The distribution was probably continuous previously, but more recently, fragmentation and contraction of the population ranges in Qiang Tang Country and eastern Qinghai Province has occurred, and the southern and western margins of the former distribution ranges, such as the Dong Co Valley, are now devoid of chiru (Schaller 1998).

Although the chiru has been studied intermittently (Feng, 1991; Harris and Miller, 1995; Schaller,1998;Fox and Bardsen,2005;Schaller et al. ,2005; Schaller et al. ,2006),many aspects of its life remains little known till now. There are no accurate estimates of Tibetan antelope numbers from the past, although a few early explorers had made some occasional observations (Schaller, 1998). In 1900, the historical population of Tibetan Antelopes may have been a robust 1 million, estimates by Schaller based on the limited information available. (Schaller, 1998). Despite legal protection and trade bans, the burgeoning Western market for shahtoosh caused a dramatic increase in chiru poaching in the late 1980s and early 1990s—Schaller estimates in ***Wildlife of the Tibetan Steppe*** (1998) that "tens of thousands of animals must have been killed" to supply the trade during that time. In a report issued in December 1998, China's State Forestry Administration (SFA) cited Schaller's estimate that fewer than 75,000 chiru remained in the wild in 1995, which represents a population decline of greater than 85 percent.

Seasonal migration and sexual segregation are considered as main characteristics of Tibetan Antelope ecology and reproduction. The movement pattern of chiru is quite complex, both resident and migratory populations exist. Resident populations make only local movements, but also adopt seasonal sexual segregation during calving seasons (Schaller, 1998). In migratory population, there are differences between the movement patterns of the females and males. Field investigations indicated that chiru ranges are divided into distinct wintering and calving areas. Each summer, female adults and their female offspring of last year will move between their winter mating grounds and summer calving grounds, while males tend to remain near their wintering grounds. In late June to July single calves are born. The grasslands surrounding *Zhuonai* and *Taiyang* lakes have been identified as major calving grounds of Tibetan antelopes, located in the northwest of Hoh-xil National Nature Reserve (Feng, 1991b), where the climate is moderate, and the water and grass are abundant. Schaller reported that there were at least four and possibly more major migratory populations on the Tibetan plateau (Schaller, 1998). Hoh Xil is one of the most important calving grounds of the four populations mentioned above. Females of the subpopulation studied here migrates from Sanjiangyuan to Hoh Xil each summer, then return by fall.

Recent study on genetic variation among current population of chiru (Ruan, 2005) suggested high degrees of gene flow among all the sampled populations based on mitochondrial DNA control region sequences analysis. It was inferred that though the winter range of different population are separated, but the populations do have gene exchanges through their calving ground. During the course of migration for calving, it is more probable that a number of individual females from the original location translocated (Silvester and Peter 1999), thereby helping to promote gene exchange between populations of different localities. The migration of chiru may play a significant role in the course of gene exchange. So the protection of migration route is quite important.

Among all migration populations of Tibetan Antelopes, the one we studied was the most seriously affected by human activities. Until recent years, this population and their migration route was affected by poachers, but the population now is one of the best protected in China. The newly built Qinghai-Tibet Railway parallels the existing Qinghai-Tibet highway, and both cut across the study population’s migration corridor on the boundary between Hoh Xil Nature Reserve and Sanjiangyuan Nature Reserve (Xia and Yang 2004a,b,c), about 130-150 kilometers from the calving ground. In order to ensure the Tibetan Antelopes and other species pass through the railway smoothly, 15 passages were designed in the reserve, but no corridors have been built across the highway (Yang and Xia, 2003). "Passageways" -- trestle bridges, mostly -- have been incorporated into the railway's design at key points along the route where the antelopes are believed to cross during their seasonal migration to grazing

grounds. At these locations, the antelopes could theoretically use underpasses to traverse the rail route without risking crossing over the tracks. But wildlife experts doubt that the antelope will actually use the underpasses, since their instincts may instead prompt them to climb up to the high ground of the rail bed and have a wary look around before proceeding. From 2004 a monitoring project was started to evaluate the efficiency of wildlife passages in migration season of Tibetan Antelopes, supported by the Military of Railway and BP Conservation Program. During 2004-2006 we recorded the passes of chiru through their main migration corridors. Monitor the impacts of transportation infrastructure on this migratory herd of Tibetan Antelope and mitigating those impacts is extremely important.

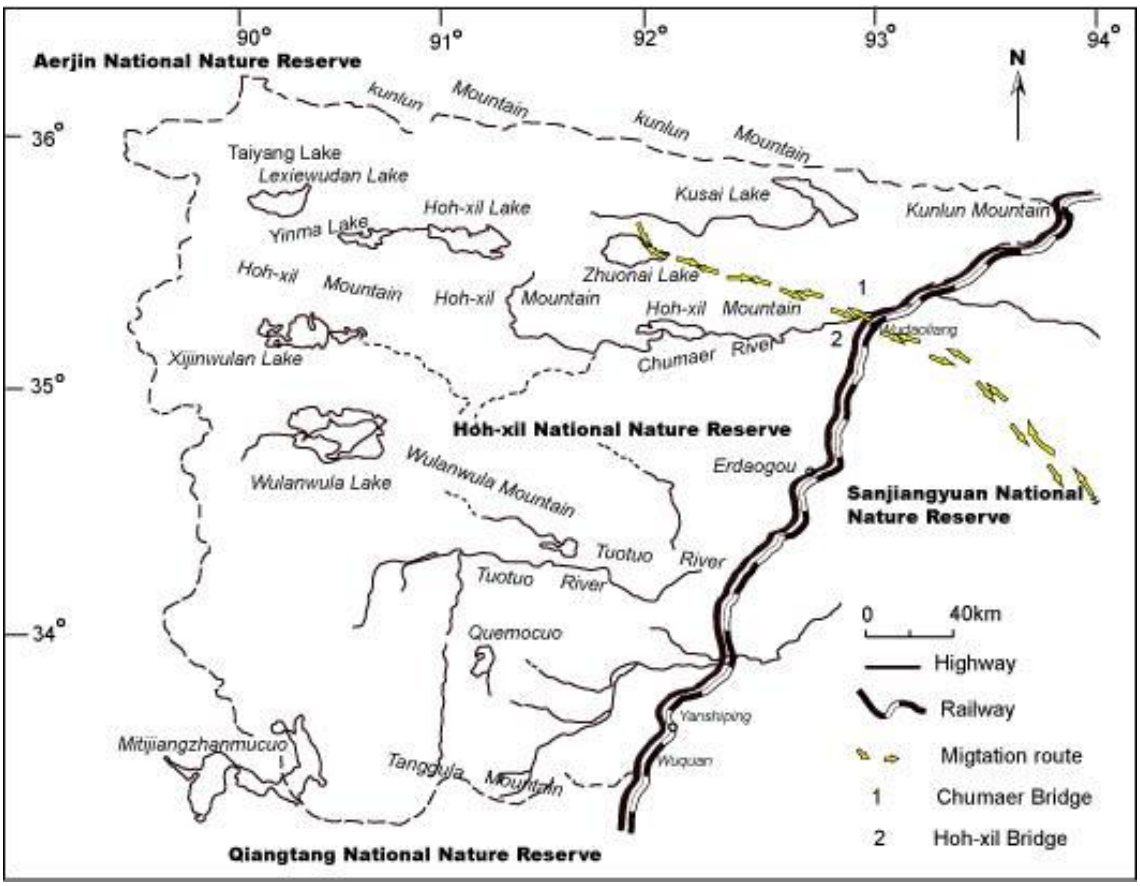

Fig.1 Distribution and migrating route of Tibetan Antelopes in Hoh-xil nature reserve

3. STUDY AREA

The Hoh Xil National Nature Reserve is located in the territory of Qinghai Province. On the Qinghai-Tibet Plateau, it extends from the Tanggula Mountains in the south to the Kunlun Mountains in the north, with an average altitude of 4,500 meters above sea level (Liu & Yin, 1993). The reserve is a hostile land of cold, thin air, typically a forbidden zone for man. The topography is rolling hills and shallow gullies; habitat is high altitude steppe, alpine meadow and gravel-filled gullies, entirely without trees or shrubs.

Fig 2. Hoh-xil and wild animals in the reserve.

Whole working area covered 257 kilometers from Kunlun Mountain to Tuotuo River. Fieldwork was conducted along the newly built Qinghai-Tibet Railway and the parallel highway on the boundary of Hoh-xil Reserve and the adjacent Sanjiangyuan Reserve. The main monitoring area covered a thirty kilometer stretch of concentrated migration from Chumaer River to Wudaoliang, including *Chubei* Overpass corridor, *Chumaer* Underpass Passage (*Chumaer* Bridge), *Hoh-xil* Wildlife Passage (*Hoh-xil Bridge*) and some other crossing structures not specifically designed for wildlife.

Fig 3. Newly built Qinghai-Tibet Railway and the parallel highway.

3.1 Crossing structures

Chumaer Bridge – Main wildlife corridors in this area, used to be the main migration corridor. The main structure was finished in 2003 and put into use in 2004. The distance between highway and railway is about 800 meters. From 2004 to 2006, the construction was halted in each migration season of chiru, but the workers were not removed from the working sites. The surface of land under the bridge was destroyed by construction machinery and was not restored till 2005.

Fig 4. Chumaer Bridge.

Chubei Passage -This overpass passage is about 2 km southwest of Chumaer Bridge, near Chumaer River, and the situation is similar to Chumaer Bridge. Unfinished construction and human activities are main impact factors.

Fig 5. Chubei Passage.

Hoh-xil Bridge – An underpass bridge, which has become the main corridor for Tibetan Antelopes. The main construction completed in June 2004. There is an open area between the highway and the railway.

Fig 6. Hoh-xil Bridge.

Wudaoliang Railroad Bridge - North of Wubei Corridor. Although it was not designed for Tibetan Antelopes passage, but may be one corridor for migration. The structure is similar to Wubei Bridge and a bit far from the highway, with a large open area near the passage. The main construction sites located near the bridge in construction period during 2001-2005.

Fig 7. Wudaoliang Railroad Bridge

Kulun Mountain Wildlife Passage- Wild life Passage designed for large mammals. A tunnel with an underpass bridge.

Fig 8. Kulun Mountain Wildlife Passage

Budongquan Wildlife Passage- An underpass bridge designed for large mammals.

Fig 9. Budongquan Wildlife Passage

Wuli Bridge- Underpass bridge. It is not designed as wildlife corridors, but could be used by the animals.

Fig 10. Wuli Bridge

Other small bridges and culverts – Most of these structures are about 1-2m in height, and 5-10m long. They are dark, narrow corridors, and the land surface under the bridge is not cleared of debris or restored.

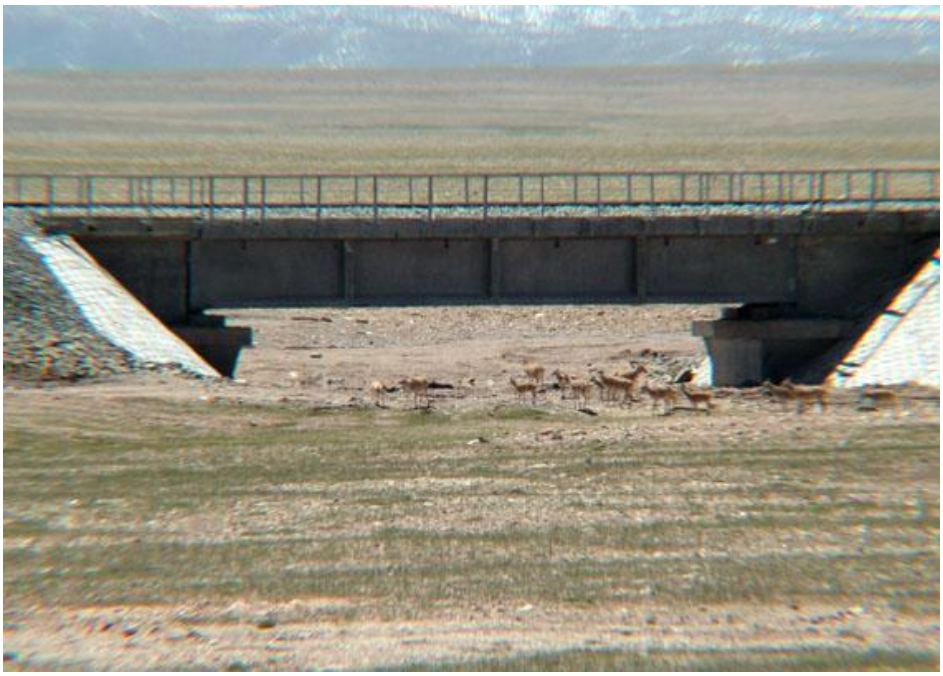

Fig 11. Small bridges.

Fig 12.Culverts.

3.2 The Qinghai-Tibet Highway

Qinghai-Tibet Highway (Xining-Lhasa section of No.109 National Trunk Highway) starts form Xining of Qinghai Province on the north and ends at Lhasa of Tibet. The highway was first built in 1950 and opened on December 25, 1954. Being one of the highways in the world, it crosses the Kunlun Mountain, Hoh Xil and Tanggula mountains and the beautiful Zangbei Plateau with the average elevation of above 4,500 meters. Since 1991, the road conditions have tangibly improved and basically reached Class 2 highway criteria. The total length of the highway is 1900km, with the roadbed being 10-meter wide, and an incline of less than 7%. The speed limit of drive is 80 km per hour.

Qinghai-Tibet Highway is a major passage between Tibet and hinterland, undertakes transport of over 85% inbound Materials and over 90% outbound materials, plays an important role in Tibet economic development and social stability. Among the four highways to Tibet Plateau, the road condition of Qinghai- Tibet highway is the best due to weather condition and landscape. In the rainy season, the coach, trucks and other transportation vehicles all selected this route due to safety consideration, brought more traffic pressure on the highway.

Fig 13. The busy traffic on Qinghai-Tibet Highway in summer.

3.3 The Qinghai-Tibet Railway

The Qinghai-Tibet railway is the China's first highland railway; it is 1956 km in whole length, with the newly built section between Golmud and Lhasa owning 1118 km. The construction of Xining-Golmud Section started in 1958 and was opened on May 1984. On June 29th, 2001, the construction of the Qinghai-Tibet Railway (Golmud to Lhasa section) began; it is built along the Golmud River, goes across the Kunlun Mountain, through Hoh Xil and Fenghuo Mountain, across Tuotuo River and into Tangula Mountain, passes along the Damxiong and Yangbajing Valley, with the final destination being Lhasa, the capital of the Tibet autonomous region. The newly built Qinghai-Tibet railway has a 965-kilometer section with an elevation above 4,000 meters and a 550-kilometer section featuring permafrost. The railway goes through three national nature reserve, Sanjiangyuan National Nature Reserve, Hoh-xil National Nature Reserve in Qinghai Province and QiangTang National Nature Reserve in the Tibet autonomous region. To protect the animals and plants, railway bridges and culverts and 33 animal passages are built, and this is the first time wildlife corridors used in China. All corridors were put into use in 2005, and the railway start operations on 1st July, 2006.

Fig 14. The newly built Qinghai-Tibet Railway began trail operations on 1st July, 2006.

4. AIMS AND OBJECTIVES

4.1 Project aims

This project aims to reduce the impact of traffic on migration of Tibetan Antelopes in Hoh-xil National Nature Reserve by assessing disturbances to the migration of chiru caused by the railway and the highway, and study the conservation status of the species using field-monitoring techniques. Results from this study may diagnose any potential problems with transportation development at an early stage and provide solutions to reduce conflict between development and conservation.

4.2 Objectives

1) More reliable information on behavioral ecology and migration of chiru are available.

   We will Monitor migration of the chiru when they pass through newly-built railway and highway, recording the disturbance and behaviour of chiru caused by vichels, human activites and the infrastructure itself. The record of migtation of chiru and their behaviour caused by the traffic disturbance will provide scientific information on behaviour ecology.

2) Ddisturbance caused by the transportation facility are identified.

   The assessment of the disturbance caused by traffic will help the department of transportation to identified conflicts between development and conservation, and provided solutions for them to reduce the collision between transportation and animals.

3) A reasonable conservation plan for the species is generated.

   The results of the project will provide right information, tools, policies and spirit to solve the problems caused by traffic and for making a conservation plan.

4) Mornitoring techniques and field skill of the local students and residents are improved.

   Training will provide mornitoring techniques for local students and residents, and together with the local staff of the Department of Forest and constructor of the Qinghai-Tibet railway.

5) The management and conservation of the chiru and their habitat are advanced.

   A detail final report on conservation status of Tibetan antelopes will submitted to related organizations, which will help the policy maker and management of reserve to advance their work.

6) The links with the local staff of the Department of Forest, transportation angency and NGOs are strengthened or created.

7) Public awareness of the species is improved.

5. METHODS

5.1 TRAINING: This is an important part of our project. Before the field survey start, we conducted a training course in field monitoring techniques and some fieldwork skills for the local staff, people from transportation angency, local students and volunteers from NGOs of HXNR. In the first-year project, we found some of the volunteers lack of basic knowledge of the species and field skills. After the project finished, we will presented our results and some problems in the field work for someone invloved and young students from universities or high school, who are the conservationist of next generation.

5.2 FIELD SURVEY: In the follow-up project, field work was improved. We monitored the migration of chiru during the whole migration season from late May to early September, recorded the movement pattern of the chiru populations along the rail line and highway, including all wildlife passages and other transportation facilities along the highway. Simple and efficient methods were used in monitoring and evaluating the impact of traffic.

Video Cameras and Time Lapse Video Recorder: We have already set two fixed working sites along the railway in 2003. Automatic video cameras were used in two under bridge passages on the main migrating route to record the passage of chiru, it also could help to observe the behavior that may indicate hesitancy or stress in animals using the crossing way. 90% of the antelopes crossed the railway by using the two bridges or over pass the rail bed between which. The equipment can work 8-10 hours continuously with sun power supply during the daytime. Video cameras were mounted beside the bridge in different direction.

Counts: We also counted the number of chiru which pass through the crossing structures and those acrossed the railway not using the passages. Counts was carried out with 15-45X spotting scope in the daytime, as Tibetan Antelopes rest at night. The group size in migration was also recorded. A group was defined as all individuals within 50 meters of each other.Yearlings and adults are difficult to differentiate at a distance, and only composition of those herds for which determinations are judged to be reliable were included in subsequent analysis of herd composition.

Dynamic monitoring: This is mainly used to monitor the chiru which cross the highway and overpass the rail bed directly or out of the concentrated migration corridor near our fixed working sites. We will drive a vehicle to inspect all the crossing structures along the rail line and highway during the whole migrating seasons. Video camera was used to record the behavior of the antelopes. The traffic flow on the highway will also be recorded every day.

6. OTHER PROJECT COMPONENTS

6.1 Supporting institutions

Rufford Small Grant

Institute of Zoology Chinese Academy of Sciences

China Ministry of Railways

6.2 Local participation and approval

Institute of Zoology Chinese Academy of Sciences

Administrative Bureau of the Hoh-xil Nature Reserve

Bureau of Forestry, Qinghai Province (BFQH)

China Ministry of Railways

In the past years we have got fully support of the organizations mentioned above, and cooperated in designing the passages and monitoring the migration of chiru. In the follow-up project, the staff of BFQH and Reserve will be involved as team members, that will greatly improve our relationship.

Hoh-Xil Nature Reserve is almost uninhabited. In the first-year field work, The China Ministry of Railways who was the major stake-holder in this area provided us wilth accommodation, some monitoring equipments and help us set up two working sites near the passages. We have contacted with MOR, they promised to give us necessary help.

6.3 Government permission

No animals will be handled in this project, special government permission will not be needed. We have made contacts with the officers of HXNR and got fully supporting by BFQH and MOR.

6.4 Public Awareness and Education

With the effort of conservationists, Tibetan Antelopes have received a great deal of attention not only from government but also from public recent years. We have published several articles in popular journal on basic knowledge of chiru and given presentations of our project in high school and universities, the response was very active and really inspiring we, most of them want to know even more about this endangered and lovely animal. The data of the fieldwork will be presented back to the public and related government units we mentioned

above, which will improve the level of public awareness in China. The results will also be presented to the scientific community and some non-government organization. The training course will provide valuable field working skills to the staff of MOR and the reserve.

6.5 Priority of work in the global/regional/local context

Tibetan Antelopes is endemic to China, and world endangered. Little has known in its behavior ecology. The migration of chiru and its habitat are lack of research. With process of the *Development of West China*, the conflict between development and conservation is more and more acute, but no sufficient and reliable information for the transportation agency and policy maker to make an efficient action plan to solve the problems caused by traffic. Our work will be great help in advance the local management in regional conservation. The lessons learned from this project will be valuable to diagnose a potential problem in an early stage for the future on infrastructure development, improve the conservation of Tibetan Antelopes and other species in China, even in global stage.

6.6 Outputs

- An detailed research report on assessment of traffic disturbance on migration of chiu.
- Continue the evaluation of wildlife crossing Structures.
- A scientific paper covering behaviour and impact of infrastructure on migration of Tibetan Antelopes
- Recommendations to the policy makers and transportation angecy on conservation of the species, such as build crossing structure in Qihai-Xizang highway.
- Articles on introduction and result of our project will be published on some newspapers and popular science journals.

6.7 Assumptions

- Effect of climate change may affect the food supplies and delay or advance the migration of chiru some time, but it will not significantly affect our project.
- Poaching may impact the migration of chiru directly, but these years, it is almost under control. Our working area is along the highway, most poaching happened in the hinterland of the reserve, so it has little impact on our project.

7. MONITORING RESULTS

7. 1 Migration from winter range to summer calving ground (From Sanjiangyuan to Hoh-xil)

During late May to early June, Sanjiangyuan population migrated from *Sanjiangyuan* Reserve into Hoh-xil National Nature Reserve for calving. From May 31st to July30th, 2005, 1509 chiru passes were recorded to cross the Qinghai-Tibet railway and highway, including pregnant female, yearling female and 8 new offspring. All chiru crossed the railway through Hoh-xil wildlife corridors. In 2004, 1660 chiru individuals were recorded to use this crossing structure. We continued monitoring the migration in 2006, on May 17th, the first group of chiru passed through the *Wubei Bridge* then crossed the highway, about two weeks earlier than past three years (2003-2005). The number in 2006 increased to 2122 in migration to the calving ground (Table 1, Fig 17).

Table 1. Summary of chiru passes at Qinghai-Tibet Highway and Railway in migration to the calving ground (2005-2006)

Date		May						June																	Total
		17	18	24	25	30	31	5	6	7	8	9	10	13	14	15	20	21	22	23	24	26	27	29	30	
Number of individuals	2005	0	0	0	0	0	134	0	0	0	0	0	0	183	0	0	310	151	18	339	77	38	72	54	133	1509
	2006	80	34	21	70	83	0	40	477	264	298	116	5	331	100	98	0	0	0	0	0	105	0	0	0	2122

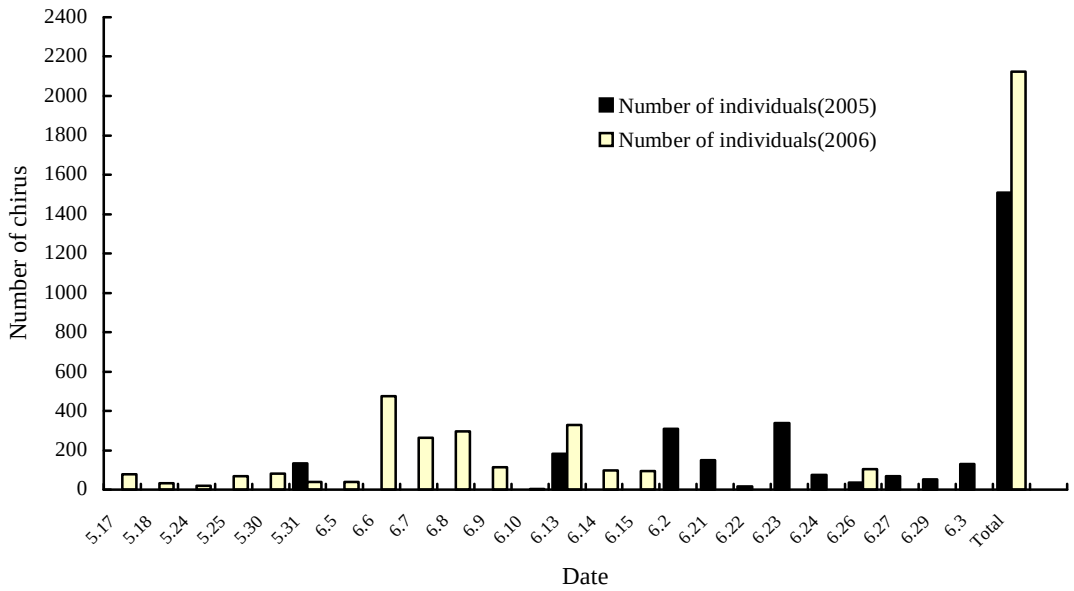

Fig17. Summary of chiru passages at Hoh-Xil Passage in migration to the calving ground (2005-2006)

7. 2 Migration from calving ground to the winter range

Antelopes came back with new born offspring. Our working sites were set about 300 km from the calving ground, when the chiru returned, the babies were at least one month old. In return migration of 2005, 2182 individuals were recorded. The number in 2004 and 2006 is 2303 and 2854, respectively.

We also observed the composition of the return population, 66 populations were sampled randomly, the ratio of offspring to total varied in different groups from 16.67%-55.56%, with a total average of 35.24 (Table 3). This ratio was 34.73% in 2004 and 32.12% in 2006.

Table 2. Summary of chiru passes in return migration (2005-2006)

Date		July				August																				Total
		23	24	27	31	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	21	22	23	25	
Number of individuals	2005	0	0	0	0	0	0	100	0	0	0	31	0	525	0	250	87	0	34	174	132	6	320	250	247	26	2182
	2006	29	25	7	51	16	7	0	367	17	8	232	105	374	809	150	16	70	255	45	206	65	0	0	0	0	2854

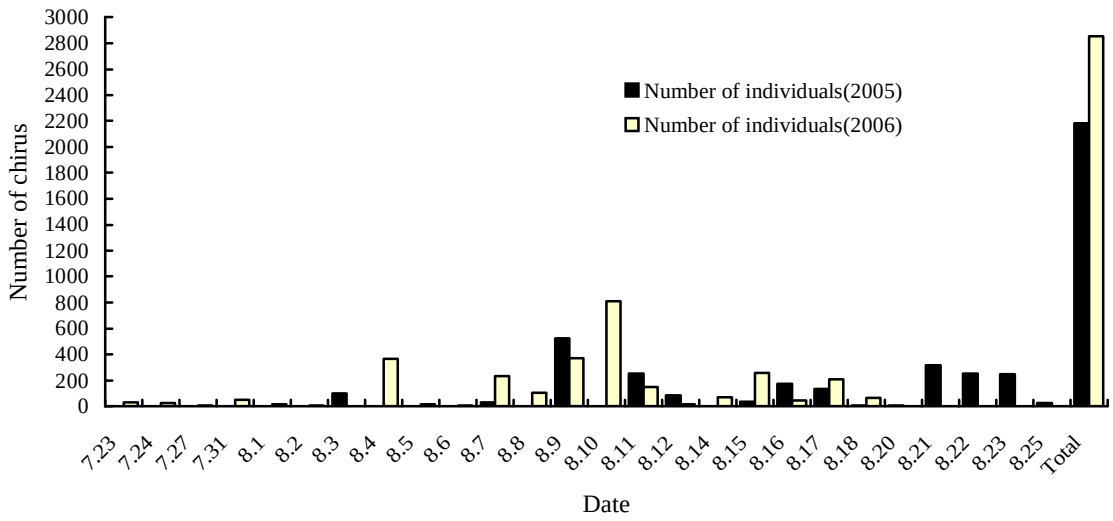

Fig. 18 Summary of chiru passes in return migration (2005-2006)

Table 3. Population composition in return migration, 2005

Group	Adult and Sub-adult female	New born Offspring	Offspring/ Total (%)	Group	Adult and Sub-adult female	New born Offspring	Offspring/ Total (%)
1	56	27	32.53	36	3	3	50.00
2	5	2	28.57	37	74	30	28.85
3	38	22	36.67	38	60	49	44.95
4	9	7	43.75	39	19	8	29.63
5	61	23	27.38	40	4	5	55.56
6	30	24	44.44	41	25	12	32.43
7	6	5	45.45	42	19	9	32.14
8	5	1	16.67	43	34	13	27.66
9	21	11	34.38	44	59	22	27.16
10	14	8	36.36	45	5	5	50.00
11	42	40	48.78	46	13	9	42.86
12	3	3	50.00	47	10	4	28.57
13	10	6	37.50	48	3	3	50.00
14	29	15	34.09	49	38	23	37.70
15	15	9	37.50	50	23	8	25.81
16	36	21	36.84	51	50	35	41.18
17	105	41	28.08	52	35	32	47.76
18	19	17	47.22	53	5	3	37.50
19	5	4	44.44	54	2	2	50.00
20	4	3	42.86	55	11	5	31.25
21	7	6	46.15	56	21	8	27.59
22	46	29	38.67	57	79	36	31.30
23	18	10	35.71	58	4	4	50.00
24	24	15	38.46	59	15	9	37.50
25	6	3	33.33	60	210	75	40.54
26	13	7	35.00	61	37	17	31.48
27	77	37	32.46	62	4	2	33.33
28	55	36	39.56	63	12	5	29.41
29	22	8	26.67	64	19	20	51.28
30	20	8	28.57	65	14	14	50.00
31	31	10	24.39	66	11	12	52.17
32	85	56	39.72	Σ	1928	1049	35.24
33	39	17	30.36				
34	9	7	43.75				
35	45	29	39.19				

7.3 Efficiency of wildlife corridors and other crossing structures

The Efficiency of wildlife corridors is defined as the number of successful passes divided by the total number of individuals. Our monitoring results showed that from 2004-2005 all Tibetan Antelopes used the Hoh-xil Passage in migration to the calving ground, the efficiency of the corridor was 100%. In 2006, we found the antelopes began to use other wildlife passage

and bridges. In return migration of 2005, we detected 251 individuals overpass the rail bed, occupying 11.5%, all the other passes were recorded at Hoh-xil Passage, the efficiency was 88.5%. While only 56.1% used this corridor on the return trip in 2004. In 2006, we recorded 39 individuals cross over the rail bed, 2815 antelopes used crossing structures to pass through the railway, including Hoh-xil Passage, Wudaoliang Railroad Bridge and some other bridges in Budongquan, Wuli and Kunlun Mountain. The passage use was increased to 98.63%. The use of crossing structures appeared to be negatively associated with the presence of construction material, un-removed equipments, transportation vehicles, the proximity between highway and railway, and human activities.

Table 4. Efficiency of different crossing structures in migration to and from the calving ground (2004-2006)

Structure Name	year	Number of Individuals crossing the railway		Efficiency of crossing structures/ over passing the rail bed	
		To calving ground	From calving ground	To calving ground	From calving ground
Number of individuals using crossing structures	2004	1660	1291	100%	56.06%
	2005	1509	1931	100%	88.50%
	2006	2122	2815	100%	98.63%
Number of individuals over pass the rail bed	2004	0	1012	0	43.94%
	2005	0	251	0	11.50%
	2006	0	39	0	1.37%

7.4 Disturbance to migration of Tibetan Antelopes

The railway structure itself - The railway itself is a physical barrier and the impact of the huge structure on Tibetan Antelopes activities is apparent. When Tibetan Antelopes faced this infrastructure, they hesitated under the sharp slope of the rail bed and gathered into large groups, which was not observed before the construction of the railway. Though the "passageways" – mainly trestle bridges - have been built at key points along the migration route, the Tibetan Antelopes instead may climb up to the high ground of the rail bed and have a wary look around before proceeding, in the same way in which they cross the highway.

Destruction to land surface- The destruction to land surface under the wildlife corridors and along the rail line is another major impact of Tibetan Antelopes activities. Tibetan Antelopes are very sensitive animals and any change on the land surface may affect or even stop the Tibetan Antelopes from moving. They seemed very careful with anything happened on the land surface, although they sometimes ignored the train running over their head.

Predators- When the Tibetan Antelopes accumulated under the bridge, it provided an

opportunity for the wolves. Chasing by wolves sometimes affected the use of the corridors, scattering the Tibetan Antelopes.

Traffic flow on highway- We recorded the traffic flow on Qinghai-Tibet highway during the most concentrated migration period from 2004 to 2006. In 2005 the average traffic flow was 63.7/hour in the daytime, the peak occurred in 15:00-16:00pm (Table 5, Fig. 19), the flow reached 70.41/hour. In 2004, when the railway was still in construction, the day traffic flow was 74.61/hour on average, and in 2006 it decreased to 57.48/hour.

Table 5. The traffic flow on Qinghai-Tibet highway, and crossing attempts made by chiru in return migration, 2005

Time period	Average traffic flow (per hour)		
	2004	2005	2006
7:00-8:00	-	52	48.13
8:01-9:00	-	61.66	58.42
9:01-10:00	72	63	75.9
10:01-11:00	69.33	68.67	72.23
11:01-12:00	74.93	64.42	50.5
12:01-13:00	69.35	55.34	57.85
13:01-14:00	98.40	72.25	66.33
14:01-15:00	87.0	70.09	53.17
15:01-16:00	80.53	74.58	58.69
16:01-17:00	75.40	70.41	62.37
17:01-18:00	65.40	66.84	58.50
18:01-19:00	63.20	56.84	47.60
19:01-20:00	65.15	52	37.57
Average	74.61	63.7	57.48

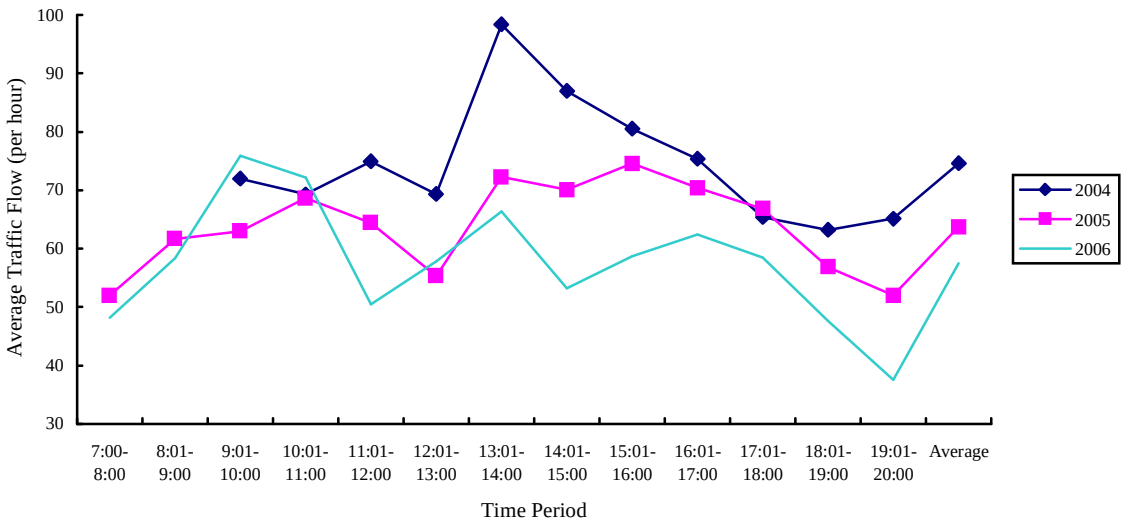

Fig.19 The traffic flow in Qinghai-Tibet highway, 2004- 2005

8. DISCUSSTION

8.1 Disturbance to migration of chiru.

8.1.1 Rail disturbance

The results indicated that the railway structure itself have significant impacts on movement of Tibetan Antelopes, but do not disrupt their migration corridors after the wildlife passages putting into use. In main construction period of 2003-2004, most of bridges and wildlife passages were still in building, about 1/3 of chiru failed to cross the railway and gave birth near the rail bed on their way to the calving ground. The main structure of wildlife corridors finished in 2004 and put into use in 2005, all chiru crossed the railway successfully from then on.

According to railway construction planners and the Qinghai Environmental Protection Bureau, the area affected by the rail bed's construction is to be returned to its original condition, and we saw some turf transplanted back to the rail bed. In fact the swathe of tundra disrupted by railway construction is quite narrow. The most worrisome sites are the intermittent staging areas and sand quarries located off to the side of the railway construction site. During the migration of 2003, the Tibetan Antelopes did not use the corridors partly due to this reason. In 2005, as the main structure of the railway in Hoh-xil has been finished, most of sand quarries and material were moved off, and the condition of passage improved. Where such construction debris still occurs under the crossing structures or along the railway, this affects the use of passages. In 2006, all equipments and construction sites removed from the migration corridor and the land surface under the passage restored, the condition of crossing structures was greatly improved. The Qinghai-Tibet railway began rail operation on July 1st, from the monitoring results, we can see the disturbance or train is not significant, all chiru crossed the railway in return migration and the passage use improved.

With three years' of experience, the chiru began to adapt themselves to the new circumstances. The learning ability of chiru gave us strong impression, they even adjusted their migration route to use the wildlife passage. In 2004, the chiru running along the rail bed after crossing the road, accumulated into large herd and hesitated under the crossing structure. In 2006, with two years of adaptation we saw chiru running directly to the wildlife passage, and pass through the bridge quickly. But long-term monitoring work is still necessary, the data is not sufficient to get the conclusion whether the wildlife passages is successful of not, it is the first year that the railway operated, the efficiency may changed annually and new problems may accrue.

8.1.2 Road disturbance

Road can significantly impact chiru migration. The road disturbance included traffic flow, human activities, features of the roadbed and etc.

The Qinghai-Tibet highway is another physical limitation to chiru migration. Road is a formidable barrier and a source of mortality for wildlife, which is often associated with vehicle damage (Murphy E. 2005, Forman et al. 2003).In migration season from 2004-2006, we recorded 8 chiru killed by road traffic . With the road upgraded, the speed limit of drive is increased, which may cause more wildlife-vehicle collisions.

Fig 20. Road killed chiru on Qinghai-Tibet Highway.

It’s difficult to distinguish whether the disturbance on chiru caused by road or railway in the narrow zone between railway and highway, especially in return migration.

The Qinghai-Tibet Highway is the most important transportation lifeline to Tibet Plateau. To take advantage of the short summer work season on high plateau, the construction period concentrated during June to September, increased the already busy road traffic in the migration season of Tibetan Antelopes.

We hoped the situation will be advantaged when the railway put into use. By 2007, 16 trains will shuttle between Golmud and Lhasa every day, the railway will offer a safer, convenient and reasonably-priced means of travel for Tibetan people and tourists, it can carrying nearly eight million tons of cargo annually, coal, cement, oil and other essential raw materials will be transported to Tibet from China's resource-rich regions by train instead of

road transportation. The flow may be reduced. From Table5 and Fig 19, we can see the traffic flow decreased after the construction period of railway finished.

8.1.3 Direct Disturbance

The construction of the Qinghai-Tibet Railway and the nearby highway brought human activities to the reserve. In all disturbances to migration of chiru, human activities might be the most serious one, which including activities of tourists, construction workers of the railway and other persons brought by highway. Tibetan Antelopes are active in the daytime, could not avoid the disturbance of human activities. The migration season is in summer, which is the busiest period for construction of the railway and other activities on the Plateau. In 2004-2005, the main disturbance is caused by construction workers. During the short concentrated period both in westward migration and their return trip, all construction activities was limited near the main passages, but the activities of tourists and truck drivers were not under control, and greatly affected the migration. Little information exists about chiru's sensitivity to human activities. But in our field survey, we found the traffic flow and tourists greatly affected the corridor use and their attempts to cross the highway.

In 2006, an increase in tourists to Tibet poses a threat to the migration of Tibetan antelopes. The operation of Qinghai-Tibet Railway has helped promote Tibet as a tourism destination, but the transportation ability was limited, the highway was still an important path to the Tibet to most of tourists. The attempts of crossing highway or railway made by chiru were often interrupted by exciting tourists. We recorded a large group of 450 chiru in return migration near Qinghai-Tibet highway, they hesitated near the highway for 8 days and could not cross the road due to the tourists' chasing, attempts to feeding and photographing. Increase of the human presence associated with railways and highways may be the main threat to this species now and in the future, even greater than the infrastructure itself.

Fig 21. An increase in tourists brought by highway poses a threat to the migration of Tibetan antelopes.

8. 2 Evaluation of different crossing structures

The Efficiency of wildlife corridors is defined as the number of successful passes divided by the total number of individuals. All Tibetan Antelopes passed through the crossing structure on their migration to the calving ground. In return migration, the efficiency of corridors greatly increased from 56.06% to 98.63% during the observation period of 2004 to 2006, with the condition of the corridor improved. The using of crossing structures affected mainly by unclear construction material, un-removed equipments, transportation vehicle, the distance between highway and railway, human activities.

Among the 15wildlife corridors in Hoh-xil National Nature Reserve, Chumaer Bridge and Wubei Bridge are designed mainly for chiru migration, which on the main migration route. But we found more wildlife passages and other crossing structures were used in 2006 (Table 6), with the improvement of the environment along the railway

Table 6. Efficiency of different crossing structures over the Qinghai-tibet Railway

Structure Name	Structure Type	year	Number of Individuals crossing the railway		Efficiency of the structure	
			To calving ground	From calving ground	To calving ground	From calving ground
Chumaer Bridge	under pass wildlife passage	2004	0	41	0	1.78%
Hoh-xil Bridge	underpass wildlife passage	2004	1660	1248	100%	54.19%
		2005	1509	1931	100%	88.50%
		2006	1796	2343	84.64%	82.10%
Wudaoliang Rail Road Bridge	underpass bridge	2006	40	0	1.89%	0
Chubei Passage	overpass wildlife passage	2006	34	0	1.60%	0
Kunlun Mountain Wildlife Passage	tunnel and underpass bridge	2006	47	115	2.21%	4.03%
Budongquan Wildlife Passage	underpass wildlife passage	2006	100	7	4.71%	0.25%
Wuli Bridge	underpass bridge	2006	105	350	4.95%	12.26%
Other Small Bridges	underpass bridge	2004	0	2	0	0.09%

8.2.1 Chumaer Bridge

The human activities was the most serious factor which affected the efficiency of all crossing structures, including the tourist, builder of the railway and other human activities brought by highway. Chumaer River used to be main migrating corridors, and the bridge was

designed as wildlife corridors for chiru use, but the efficiency of the Chumaer Bridge is quite low, we have only recorded 41chiru passes under the bridge in three years of observation. The bridge itself is an underpass bridge almost the same as Hoh-xil Passage in structure, the difference is the less distance between highway and railway, and the surface of land was destroyed by the construction machine and not restored till now. We saw some raw material such as sand, brick were not cleared. The builder of the railway lived in camp just near the bridge. Workers were not removed from the working sites till 2005; their activities affected the using of passages. The migration was affected both by the railway and by the traffic on highway in this narrow area.

8.2.2 Chubei Passage

This overpass passage is about 2km southwest of Chumaer Bridge, near Chumaer River, the situation is similar to Chumaer Bridge, the unfinished construction and human activities are main impact factors. When the railway was still in construction during 2004-2006, it was not used by chiru. In return migration of 2006, a group of 34 antelopes were detected over pass this corridor.

8.2.3 Wubei Bridge

The monitoring results show Wubei bridge was the most effective corridor in migration season(fig 6). The efficiency increased annually. In the main construction period of 2003, the bridge was still in building, the rail bed near the passage was not covered with stone which is used for protecting the rail bed. Only 400-450 individuals using the built-in passages. In June 2004, the main structure of the corridor was completed, all chiru went through the bridge in migration to the calving ground and 54.19% used the passage in return migration. The workers were removed from the working sites, together with most of the machines, but still something left or unclear under the bridge which decreased the efficiency of that year. From 2005, with the improvement of the condition in environment near the passage, the efficiency of the corridor increased to over 80%. There is another advantage of this passage - the open area between highway and railway, providing chiru enough space to stay and being kept away from the noisy road.

8.2.4 Wudaoliang Railroad Bridge

This bridge is in north of Wubei Corridor, though it is not designed for chiru passage, but it began to be one corridor for migration. In 2006, a small group of 40 individuals were detected under the bridge. The structure is similar to Wubei Bridge and a bit far from the highway, with a large open area near the passage. In 2004 and 2005, the main construction

sites located near the bridge and part of the structure are still in built, which limited its use. But with the environment restored in this area, the efficiency of this corridor may improve in the future.

8.2.5 Kunlun Mountain Wildlife Passage, Budongquan Wildlife Passage and Wuli Bridge

The migration corridor was much wider before the construction of railway (Qiu and Feng, 2004), covered our whole working area from Kunlun Mountain to Tuotuo River. These bridges were not in the main migration corridor of chiru, but we recorded chiru passes in migration season of 2006. When the environment restored near the railway, the chiru began to use more corridors to cross the railway.

8.2.6 Other small bridges and culverts

In addition to continuity and habitat quality, studies indicate that the dimensions of corridors play an important role in determining what species occur within the corridor and potential speed with which those species pass through the corridor. Both length and width of corridors appear to play a role in the utility of landscape structures to facilitate movement (Jodi, 2006)

In Hoh-xil, this kind of structure is most used by brown bear (*Ursus arcto*s), wolf (*Canis lupus*), fox（*Vulpes ferrilata* ）and Tibetan gazelle (*Procapra picticaudata*), but unlikely used by chiru. Most of such structure is about 1-2m in height, 5-10m long. It's dark in the narrow corridor, and the land surface under the bridge is not cleared or recovered. We detected only two individual passed through a small bridge in 2004. The prospect of such structures needs further investigation in the future.

8.3 Recommendations

Based on monitoring results and evaluation of crossing structures showing above, we made following recommendations.

8.3.1 Limit the human activities within corridors

Limit human activities within corridors and limit overall human disturbance include limiting noises, light, pet and livestock activity, feeding of wildlife, and degradation of existing vegetation (Jodi, 2006). Natural and human-induced disturbance can affect the establishment, maintenance, and effectiveness of a corridor.

In the construction period, construction work was halted for the antelopes in the

concentrated migration period. From 2006 the railway put into operation, the activities of tourist, researchers and truck drivers should be limited by the manager of the reserve.

8.3.2 Advantage or modify the wildlife passages

Over 40% of chiru over cross the rail bed in return trek of 2004. Though the efficiency of wildlife corridor improved from 2005, there are still some chiru individuals over passed the rail bed. Some researcher had advised to modify the sharp slope of the rail bed and remove the stone, which covered on its surface. This will make the chiru to climb the rail bed easier but not safe for the running train and the chiru itself. We don't agree with their mind, as most of chiru began adapting to the new-built wildlife passages, the best is to lead them pass through the corridors safely and avoid from the rail accident. Due to the safety consideration, we recommend fencing in the most frequent sites of chiru over passing.

8.3.3 Multiple crossing structures should be built to facilitate wildlife movement on Qinghai-Tibet highway and mitigates the risk of wildlife deaths caused by roads.

Now there are not any crossing structures on Qinghai-Tibet Highway, and the environment is degraded due to busy traffic recent years, we could not ensure the traffic flow to be reduced in the future, stopping the traffic will cause traffic jam on the highway and economic loss, it will not solve the problem completely. The highway will be upgraded by 2008, and it will be a good opportunity to build some wildlife passages and change the route in some area. Extensive research, strategy, and design of road-crossing structures should be conducted. This should be primarily done by public transportation departments. We also recommend installing wildlife-proof fencing perforated with animal crossing structures.

8.3.4 Continuous monitoring and evaluating wildlife corridors

Monitoring corridor passage is important to allow for adaptive management when problems arise and to inform other corridor conservation efforts. Each site has its own peculiar ecological, physical, economic, and social circumstances, which will dictate the steps required to secure the site as a functional corridor. Ecological monitoring in and around the proposed corridor site should continue to ensure the desired outcomes. It is important to ensure that monitoring and evaluation are part of the corridor implementation plan, so that we can refine out techniques. Monitoring is a tool that will help direct long-term management of corridors to ensure that they remain functional, because most corridors will be affected by surrounding human activities (Jodi, 2006).

Further research on rail and road disturbance to migration of chiru should also be

conducted. The rail and road disturbance to migration of chiru are still lack of systematic monitoring and research. In the future transportation development, information will be required for the government and transportation agency in making reasonable conservation plan in construction period. The record needed to be completed and accurate, while we found past record could not be used for scientific research and analysis, because the data collection method was not scientific. The rail and road will produce long-term effect and may be main threat to migration of chiru, more problems may occur in the future. The passages are the first to be built and used in China, there is still much to be learned about the effects of development on their habitat and migration. Long-term monitoring and financial support in further research are vital in protection of chiru.

8.3.5 Develop close working relationships among local citizen groups; Enhance management of the Reserve and conservation capability building

The railway is on the boundary of two reserves, the west region is controlled by management department of Hoh-xil National Nature Reserve and the east area is managed by Sanjiangyuan National Nature Reserve. The railway and highway is in charged of transportation department. The chiru's activities covered all these areas. The cooperation of the three management departments should be enhanced in ensuring the smooth migration of chiru. Till now most of conservation actions were taken by 5 wildlife protection stations belonging to Hoh-xil Reserve, ethnic Tibetan wildlife enforcement officials were employed by the Forestry Bureau of Qinghai province, working at wildlife protection stations. Their duty is to patrol the construction sites, stop traffic when herds of antelope cross the road.

Some non-government organizations such like Green River, and other volunteer league also made some contribution to protecting the antelope, mainly in improving the public awareness of chiru, their work is well known to public through media. Each summer the volunteers from all over the country will work for the protection stations and take part in some conservation projects. Everyone with good health, work attitude and love of animals could be volunteers, no particular requirements for an applicant's age, gender or vocation. They will pay for their trip and all other living expense during the one-month working in Reserve. They are passionate young people; their efforts and passion can inspire the people around them. But we found there exist some problems in their work due to different education background of the volunteers. Most of them full of passion but lack of enough field experience, basic knowledge of chiru and wildlife conservation, this may reduce the effectiveness in coping with real problems. And there is another factor which limited the activities of the volunteers, considering Hoh Xil's harsh natural conditions and frigid winter weather; volunteers will be on patrol only from June to August. Each team will be consisted

of five or six volunteers and each volunteer will work on Plateau for only a very short period (about 10 days). It will take a week or more for them to adapt themselves to the environment of high altitude. So the most effective measure is to enhance the management of the Reserve and capability building. Most of staff of the management office in Hoh-xil is ethnic with abundant field working experience; in our fieldwork we found their work is quite efficient. They managed to strike the right tone in their relationship with the powerful construction companies - cooperating in sharing information but maintaining credible independence of action. Powerful financial support is necessary to maintain their work in the reserve.

8.3.6 Improve the public education work.

Ensure that community education programs that illustrate why conservation and restoration are important for local flora, fauna, and human communities are in place. Public schools, local radio, print media, and businesses that employ large members of local people are all good places to distribute materials that provide justification for a corridor project. These materials should give local people a sense of place, which can lead to a feeling of pride in restoring and maintaining a healthy environment (Jodi, 2006). Some signs such as “no parking”, “no feeding” can be used to caution drivers about the presence of certain wildlife species, inform the public about the resources in need of protection and to minimize negative impacts from local people in and around the corridor.

Much work has been reported on improving the public awareness of conservation the chiru, on newspaper, popular journals and websites. Till now most conservation action succeeded in making people be aware of the importance of protect the Tibetan Antelopes. But we found most of people still lack of general knowledge of the species and wildlife conservation. A college student asked me: “Why not cut off the migration of corridor of chiru? Though this may cause damage to the population in the first several years, but at last their behavior will be changed, we don’t need to spend so much money to build crossing structures for them.” We have been in touched with some of the tourists and truck drivers mentioned above in highway, most of them knew the chiru are protected animals, but they didn’t realized their behavior seriously disturbed the chiru activities. They were excited when facing a large herd of chiru which is fresh to them, could not help shouting or closing the chiru to take photos, the wildlife passages are unfamiliar to most of people in China, sometimes they approached to the bridges, because they didn’t know the use of those structures. More efforts should be made to strengthen the education in public from children to adults, for people with different education background including constructors of the railway and drivers on highway, not only in improving the awareness of chiru conservation and poaching but also on general knowledge of conservation and wildlife passages.

9. LOGIC FRAMWORK

<table>
<tr><td colspan="3">Project Title: Planning period: May 2005-May2006
Assessment of the Traffic Disturbance to
Tibetan Antelopes in Hoh-xil National Nature Reserve</td><td>Location:
Hoh-xil National Nature Reserve</td></tr>
<tr><td>Objectives/ activities</td><td>Success indicator</td><td>Means of Verification</td><td>Assumptions</td></tr>
<tr><td><u>Project purpose</u>
Reduce the disturbance of Traffic to migration of Tibetan Antelopes in Hoh-xil National Nature Reserve.</td><td>It’s difficult to evaluate it in quantity. The disturbances are complex, not easy to measure. The success may be indirectly. For example, our recommendation accepted by transportation department, conservation action is taken to reduce the disturbance, such as build wildlife passages across the highway.</td><td>Final report on assessment of traffic disturbance on migration of chiru.</td><td></td></tr>
<tr><td><u>Overall results</u>
1. More reliable information on behavioral ecology and migration of chiru are available.</td><td>Number of press articles increased including significant national and international profile</td><td>Published papers in scientific and popular journal</td><td rowspan="4">Effect of climate change may affect the food supplies and delay or advance the migration of chiru some time, but it will not significantly affect our project.

Poaching may impact the migration of chiru directly, but these years, it is almost under control. Our working area is along the highway, most poaching happened in the hinterland of the reserve, so it has little impact on our project.</td></tr>
<tr><td>2. The disturbance caused by transportation facility is identified.</td><td>Recommendation accepted by transportation agency to take some action in their construction of future planning.</td><td>Final report.</td></tr>
<tr><td>3. A reasonable conservation plan for the species is generated.</td><td>Recommendation accepted by conservation organization and related department in government</td><td>Final report.</td></tr>
<tr><td>4. Mornitoring techniques and field skill of the local students and residents are improved.</td><td>Training course.</td><td>Final report</td></tr>
</table>

5. The management and conservation of the chiru and their habitat are advanced.	More well trained staff in management department of reserve and conservation organizations.	Final report	
6. The links with the local staff of the Department of Forest, transportation angency and NGOs are strengthened or created.	Efficient net work.	Final report	
7. Public awareness of the species is improved.	Number of press articles increased including significant national and international profile.	Press cuttings files	

Summary of objectives/activities

1.1 Produce and agree a monitoring strategy for Tibetan Antelopes in Hoh-xil
1.2 Working sites were set up for long-term monitoring
1.3 Population size, composition, and the behaviour in migration were recorded.
1.4A report on behaviour ecology generated and accepted by Oryx.

2.1 The behaviour of chiru in migration and their response to the traffic were recorded.
2.2 Rail and Road disturbance were recorded.
2.3 Traffic flow on highway and the use of wildlife crossing structures were recorded.
2.4. A report on assessment of traffic disturbance (including the efficiency of the wildlife corridor) on migration of chiru was submitted to transportation department and local government, with recommendation on conservations.

3.1. A report on conservation status and the problems we found in the field work was submitted to related department in government and NGOs, to make a long-term conservation plan in cooperation.

4.1 A training workshop was held to provide mornitoring techniques and basic field skill for local students and residents, and together with the local staff of the Department of Forest and constructor of the Qinghai-Tibet railway.

5.1 A detail final report on conservation status of Tibetan antelopes was submitted to help the policy maker and management of reserve to advance their work. The well Trained local staff will bring back their experience and knowledge to their organizations, advance their work in their own region

6.1 The training and field involved staff from different organizations, the cooperation was complemented

7.1 Articles on introduction and result of our project was published on some newspapers, popular science journals and participating organizationwebsite.
7.2 The project was promoted to wider public through local and international media.

10. TIMETABLE

2005.05.01-2005.05.10 – Preparing for the training course and field work. Communicating to the related local government unit.

2005.05.11-2005.05.13– A short training course for team members (2days)

2005.0.5.14-2005.05.17– Transferring equipments and team members to the working sites.

2005.05.18-2005.05.21 – Equipments adjusting.

2005.05.21-2005.05.23- Short training course to the staff of the reserve, local resident and staff from transportation agency.

2005.05.24-2005.09.01 – Monitoring in the working sites and inspecting all the working area.

2005.09.5-2005.12 – Data analysis

2006.01-2006.04 – Report production.

2006.05-2006.09- Continuous monitoring of chiru migration, supported by MOR.

11. FINANCIAL REPORT

Project Preparation Expense	
Administration/Prospectus/ Proposal	3500
Training course	10000*
Insurance	1150
Photographic (video camera, video cameras and lenses)	16935
Cables, batteries, tapes etc	12300
Communications (mobiles phone)	2080
Maps	180.12
Telescope (4 sets)	12560
Laser Distance Measurer	5856
Field rations	1572
Sub-total	**66133.12**
Field expenses	
Accommodation 6man-120days at 20/day	14400
Living costs 6man-120days at 120/day	86400
Local assistants3man-60days at 100/day	18000
Fuel costs 0.18L/km - 30500km at 5.2/L*2 vehicle	57096
Vehicle hire 120/day *120days*2	28800
Sub-total	**204696**
Post-Project expenses:	
Administration	3500
Report production	1000
Videodisc making	800
Sub-total	**5300**
Total :	**RMB 276129.1**
Current exchange rate 1USD = 7.92 RMB	**USD34864.79**
Amount received from BPCP till now	**USD31350.00**
*** From other source**	**USD1262.63**

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10. Appendix (Photos, press cuttings and acceptance letter for scientific journals):

Chiru in migration:

Mother and babies

Cross the railway

Cross the railway

Other wildlife near Railway and Highway

Tibetan gazelle:

A nest under the Hoh-xil wildlife passage.

Tibetan wild ass

Oryx
The International Journal of Conservation

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03 March 2006

To Whom it May Concern

This letter is to indicate that the following paper

Assessment of traffic disturbance to migration of Tibetan antelopes (*Pantholops hodgsonii*) in Hoh-xil National Nature Reserve, China by Lin Xia, Qisen Yang, Zengchao Li, Yonghua Wu, Zuojian Feng

has been accepted for publication in *Oryx – the International Journal of Conservation*. It will appear in volume 40 (2006).

I remain, yours sincerely,

pp. Dr Martin Fisher, *Editor*

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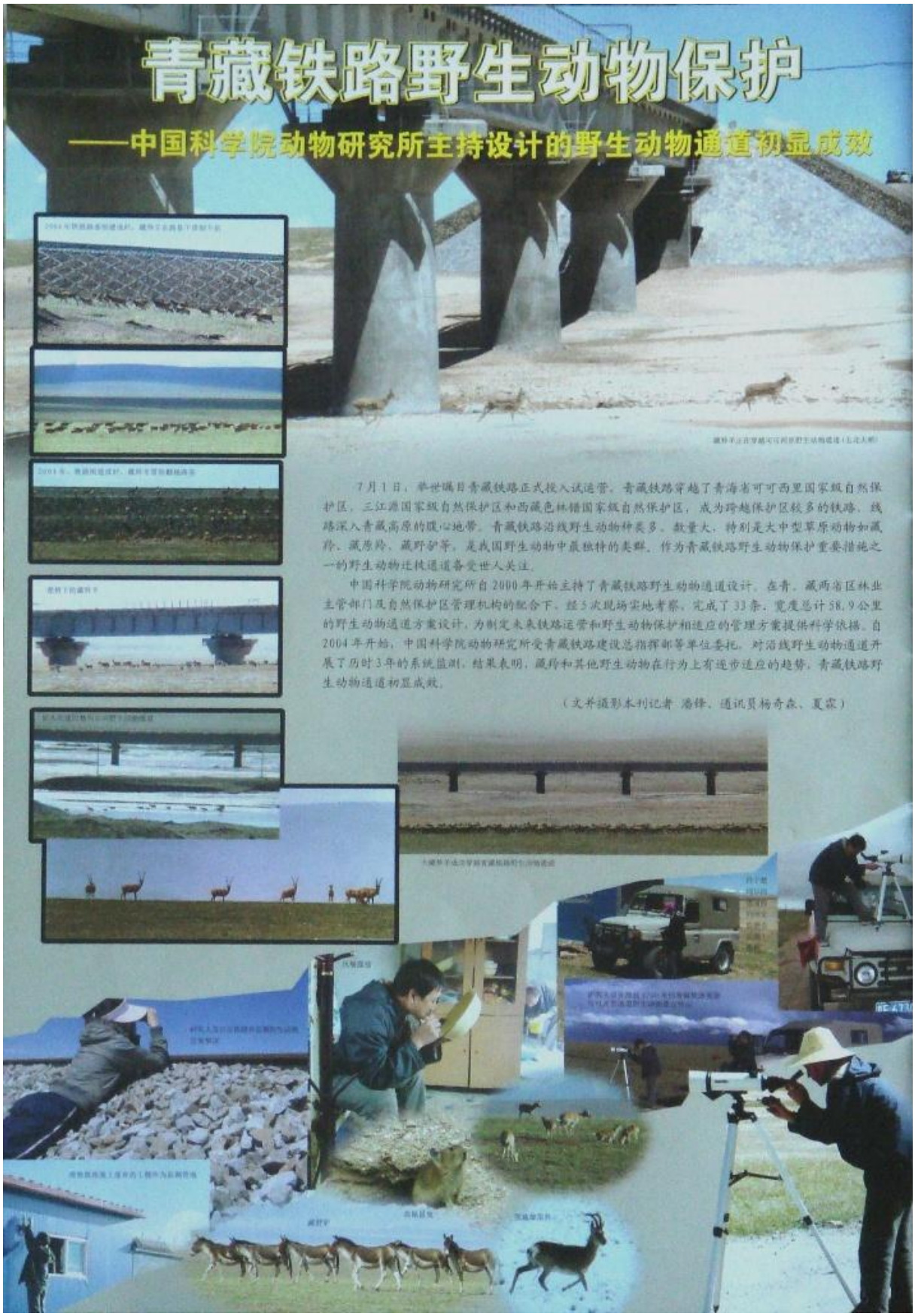
青藏铁路野生动物保护
——中国科学院动物研究所主持设计的野生动物通道初显成效
7月1日，举世瞩目青藏铁路正式投入试运营。青藏铁路穿越了青海省可可西里国家级自然保护区、三江源国家级自然保护区和西藏色林错国家级自然保护区，成为跨越保护区较多的铁路。线路深入青藏高原的腹心地带。青藏铁路沿线野生动物种类多，数量大，特别是大中型草原动物如藏羚、藏原羚、藏野驴等，是我国野生动物中最独特的类群。作为青藏铁路野生动物保护重要措施之一的野生动物迁徙通道备受世人关注。
中国科学院动物研究所自2000年开始主持了青藏铁路野生动物通道设计。在青、藏两省区林业主管部门及自然保护区管理机构的配合下，经5次现场实地考察，完成了33条、宽度总计58.9公里的野生动物通道方案设计，为制定未来铁路运营和野生动物保护相适应的管理方案提供科学依据。自2004年开始，中国科学院动物研究所受青藏铁路建设总指挥部等单位委托，对沿线野生动物通道开展了历时3年的系统监测，结果表明，藏羚和其他野生动物在行为上有逐步适应的趋势，青藏铁路野生动物通道初显成效。
（文并摄影本刊记者 潘锋，通讯员杨奇森、夏霖）

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青藏铁路通车后的“坚持”

(2006-07-11 11:10:18)

本报记者潘锋 通讯员夏霖/摄影报道

为确保青藏铁路通车后，藏羚羊等野生动物能顺利通过青藏铁路野生动物通道迁徙，中国科学院动物所研究人员定期远赴可可西里地区，对各种野生动物进行实地监测。

图为研究人员在海拔4700米的青藏铁路五道梁地区使用500倍天文望远镜进行观测。

(潘锋 夏霖)

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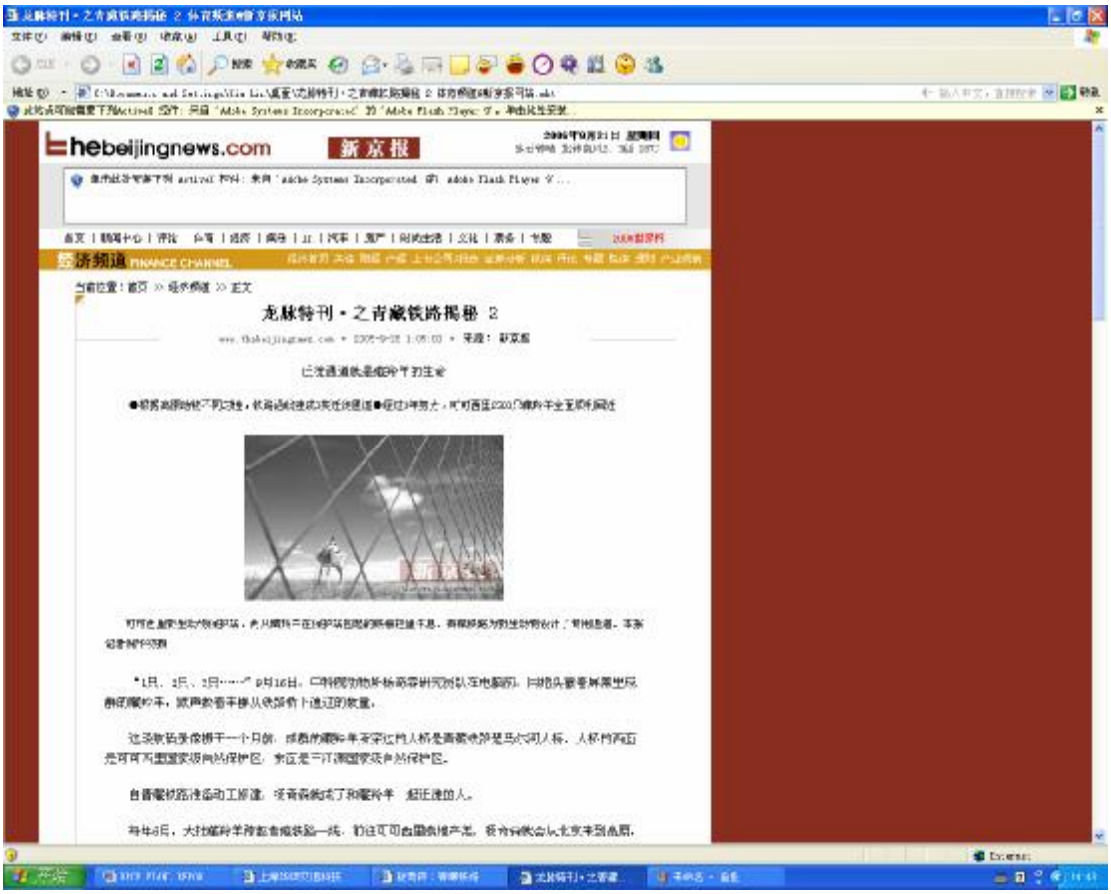
杨奇森：青藏铁路对藏羚羊影响远小于青藏公路



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