Final report

# Reduce the threat of road killing to the Chinese mountain cat (*Felis bieti*)

Yueqiao Kong, Sheng Li*

## Overview

As the continuous development of society, the road construction process is accelerated. The gradually complex road network and the increasing traffic flow have become one of the main reasons for the decline of wildlife populations. Roads and traffic can impede migration and gene flow, lead to habitat fragmentation, and even lead to road kill of animals.

Chinese mountain cat (*Felis bieti*) is the only felid species endemic to China. This species is naturally in low density with elusive habits, resulting in rather few occurrence records reported from wild. However, we found a stable population of Chinese mountain cat in Menyuan Hui Autonomous County in Qinghai Province. The habitat of this species here is bisected by two major freeways and is further crisscrossed by numerous smaller roads connecting local settlements and villages. We suspect that this population are facing specific threats such as road kill.

Our project investigated the road-kill of Chinese mountain cats and assessed other threats to their survival through attaching satellite collars to ten cats and doing in-home interview. We also designed and spread banner and brochure to local residents, raising their awareness about conservation of Chinese mountain cat. Additionally, we set up ten publicity signs at road-crossing hotspots and vehicle-strike sites of Chinese mountain cats, reminding drivers reducing the speed of vehicles when entering key habitats of this species.

## Target species

**Scientific Name**: *Felis bieti*
**English Name**: Chinese mountain Cat
**Conservation Status**: Vulnerable
**Brief introduction**:

Chinese mountain cat is a small felid endemic to China. It is listed as Vulnerable (VU) in the IUCN Red List and Critically Endangered (CR) in China's Red List. It was uplisted to Class-I National Key Protected Wildlife in China last year. It is distributed in the eastern and northern edge of the Qinghai-Tibet Plateau at low density. In a long time, they are only sporadically recorded in Qinghai, Gansu and Sichuan provinces, whereas the status of their population and threats are mostly unknown. Our team confirm a population of Chinese mountain cat that survive near the towns in Menyuan County of Qinghai Province, which motivates our research interests about this elusive cat. They were found to persist in a mosaic landscape composed of urban areas, farmlands, plantation and natural landscapes fragmented by highway and county roads.

## Study area

The study area located in a basin between the Qilian Mountains to the north and the Daban Mountains to the south. It covers ~116000 ha and has an average altitude of ~3000 m a.s.l. The study area consists of a mosaic of human settlements, seasonally cultivated farmland, scrubland, pastures along foothills and scattered reforestations, and is found to be an unexpected habitat for the Chinese mountain cats. The study area is intersected by the two main national road

(G338 & G227), some provincial roads and a lot of county roads. National road G338 are partly fenced with an unbridgeable fence for wildlife.

## Collar data collection

Movement data were collected from 10 Chinese mountain cats: seven females and three males (Table 1). All ten cats were captured using baited cage traps, immobilized and fitted with satellite tracking collars equipped with activity sensors. The procedure was under the supervision of veterinarians to ensure the safety of cats. The collars return data at a 20-min, 1-h or 2-h fix interval.

Table 1. Summary of the 10 Chinese mountain cats fitted with satellite tracking collars.

| Animal ID | Sex | Time period | Tracking days | Number of effective locations |
|---|---|---|---|---|
| PKU001 | female | 2021.03-2022.10 | 586 | 26436 |
| PKU002 | female | 2021.03-2022.10 | 585 | 34760 |
| PKU003 | female | 2021.03-2022.10 | 581 | 35700 |
| PKU004 | male | 2021.03-2022.10 | 502 | 20744 |
| PKU005 | male | 2021.03-2021.05 | 64 | 2055 |
| PKU006 | female | 2021.10-2022.07 | 377 | 20372 |
| PKU007 | female | 2021.10-2022.10 | 291 | 15652 |
| PKU008 | male | 2021.10-2022.10 | 376 | 21578 |
| PKU009 | female | 2021.10-2022.10 | 370 | 18224 |
| PKU010 | female | 2021.10-2021.11 | 47 | 997 |

## Home range and habitat selection of Chinese mountain cats

We calculate the home range of ten collared cats. We use Minimum Convex Polygon (MCP) to estimate 95% and 100% home range of Chinese mountain cats (Table 2).

Table 2. Home range size the 10 Chinese mountain cats fitted with satellite tracking collars.

| Animal ID | Sex | 95% MCP ($km^2$) | 100% MCP ($km^2$) |
|---|---|---|---|
| PKU001 | female | 11.3808 | 14.5783 |
| PKU002 | female | 2.8695 | 4.2425 |
| PKU003 | female | 3.4003 | 7.5930 |
| PKU004 | male | 2.0586 | 2.9380 |
| PKU005 | male | 1.7649 | 3.0518 |
| PKU006 | female | 2.5695 | 6.7501 |
| PKU007 | male | 0.3154 | 1.9778 |
| PKU008 | female | 2.5450 | 6.2869 |
| PKU009 | female | 0.7820 | 1.4721 |
| PKU010 | female | 2.7511 | 4.6673 |
| Total | —— | 3.0437 | 5.3558 |
| Total female | Female | 3.4384 | 5.8973 |
| Total male | male | 2.1228 | 4.0922 |

The average home range size of ten Chinese mountain cats is 3.04 $km^2$ (95% MCP) and 5.36 $km^2$ (100% MCP), home range size of female is larger than that of male. 48% of the locations distributed within reforestation, followed with 31% within farmland, and 21% within scrubland.
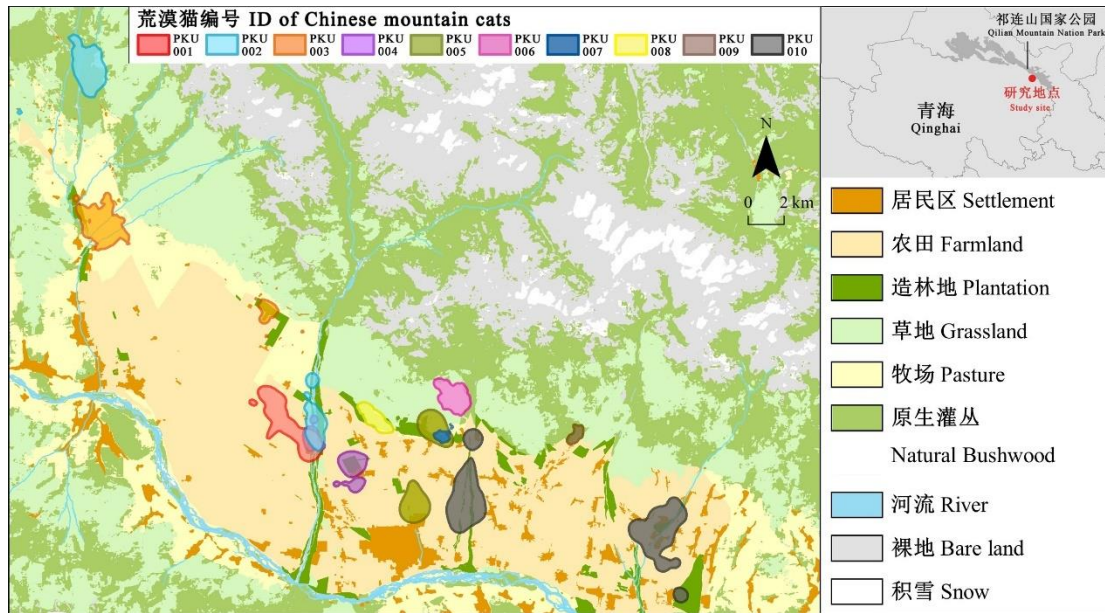
**Figure 1. Home range of ten Chinese mountain cats attached with satellite collars in Menyuan.**

We collected habitat and disturbance data over four seasons, and employed linear-mixed models and logistic regression to examine the effect of those variables on their habitat utilization. Both male and female cats are restricted to areal shelter habitats such as small-scale plantations and scrublands. The cat's occurrence probability far from shelter habitats was higher in summer than in winter, probably due to high shelter and prey resource provided by crops. They spend more time on pasture in winter when livestock are absent. These indicated that shelter habitats, especially the plantations, are one of the key factors determining the occurrence of Chinese mountain cats in human-dominated landscapes.
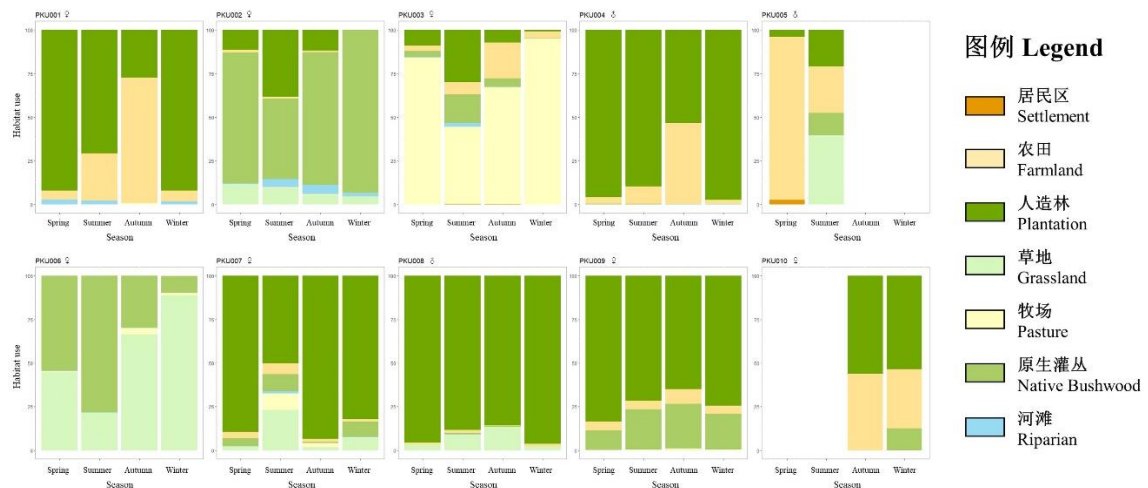


**Figure 2. Habitat utilization of ten Chinese mountain cats attached with satellite collars in Menyuan.**

## Roadkill sites of Chinese mountain cats

From May 2020 to July 2022, we recorded 11 road-kill Chinese mountain cats in the study area (Figure 3&4, Table 3).
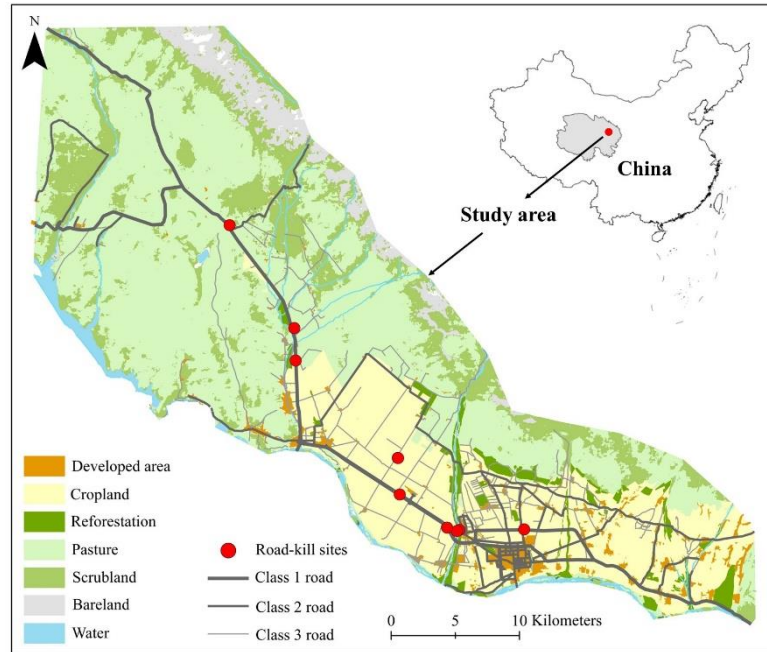
**Figure 3. Road-kill sites in study area.**



**Figure 4. Chinese mountain cat killed by vehicle on the road in study area.**

**Table 3. Summary of the road-killed Chinese mountain cats in Menyuan, Qinghai Province**

| ID | Time | Road kill sites | Landcover |
|---|---|---|---|
| 1 | 2020.05.01 | Class 2 roads | Reforestation and farmland |
| 2 | 2020.08.11 | Class 2 roads | Reforestation and farmland |
| 3 | 2020.11.08 | Class 1 roads | Farmland |
| 4 | 2021.06.03 | Class 1 roads | Reforestation and farmland |
| 5 | 2021.08.31 | Class 1 roads | Scrubland |
| 6 | 2021.10.10 | Class 3 roads | Farmland |
| 7 | 2021.12.27 | Class 3 roads | Farmland |
| 8 | 2021.12.31 | Class 1 roads | Farmland and pasture |
| 9 | 2021.12.31 | Intersection of Class 1&2 roads | Farmland |
| 10 | 2022.01.06 | Intersection of Class 1&2 roads | Farmland |
| 11 | 2022.06.20 | Class 3 roads | Farmland |

Most of the road-kill sites are distributed in the Class 1 road, the national road G338 and

G227. Surrounding landcover of road-kill sites consist mainly of farmland and reforestation, which the Chinese mountain cats utilize mostly.

## Road-crossing sites prediction and publicity signs installation

We identified Chinese mountain cat road crossing locations by intersecting the cat paths with the road network, and got 4609 locations (Table 4). Most of them are distributed on Class 3 roads.

**Table 4. Summary of road crossing of collared Chinese mountain cats**

| Road classification | Description | Count of road crossing |
| --- | --- | --- |
| Class 1 roads | National road, 8 lanes, speed limit of 80km/h, fenced with an unbridgeable fence partly and has street lamps | 513 |
| Class 2 roads | Provincial road, 4−6 lanes, without street lamps | 282 |
| Class 3 roads | County road, 1-2 lanes, without street lamps | 3,814 |
| Total | —— | 4609 |

To identify the preference of road crossing behavior of Chinese mountain cats, we use resource selection function. We firstly sampled 1000 locations in total road crossing locations and generated 1000 random locations along the road network. Then, we created a multi-scale road crossing resource selection function and predict the probability of a Chinese mountain cat road crossing on the road network in the study area.

We found Chinese mountain cats preferred to cross smaller, less trafficked roads in areas with lower speed limits, less human development and more shadows like reforestation, scrubland, and farmland in summer and autumn (Figure 5).
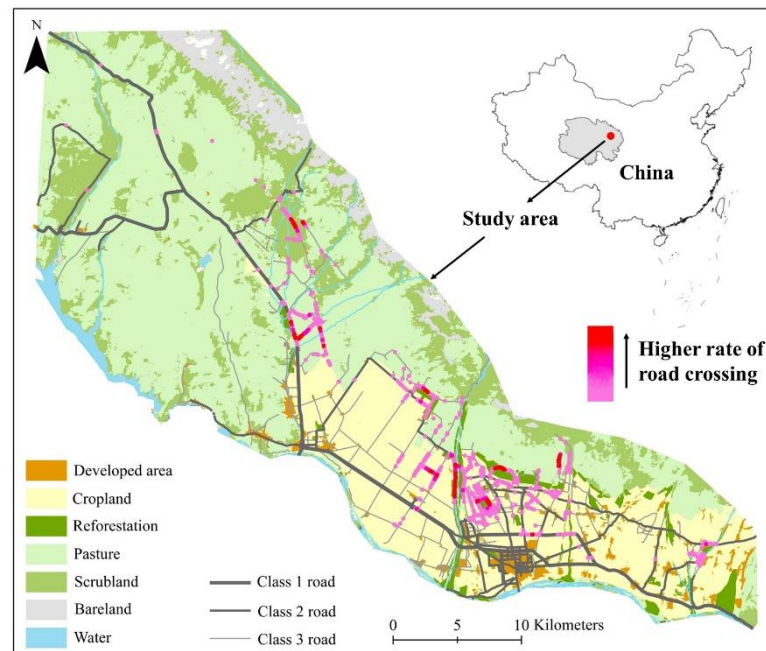


**Figure 5. Road-crossing rate of Chinese mountain cats in study area.**

We installed ten publicity signs at the area where Chinese mountain cats are most commonly used to cross the roads and the road-kill hotspots, reminding divers reducing the speed of vehicles (Figure 6).
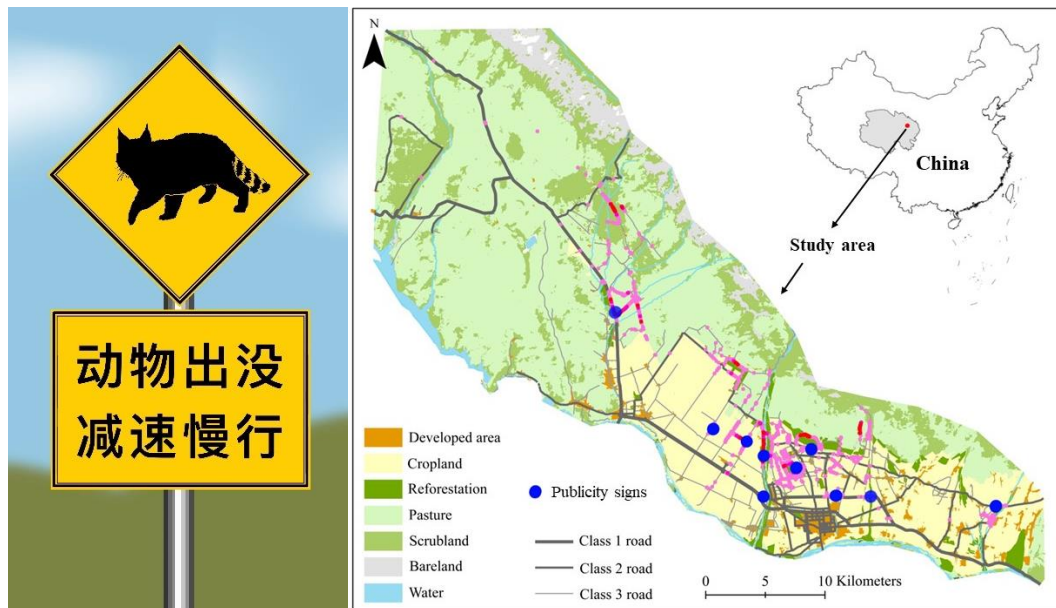
**Figure 6. Publicity signs installed to reminding drivers reducing the speed to protect Chinese mountain cats.**

## Interview and awareness raising actions

We did a questionnaire investigation to 20 homes (Figure 7).



**Figure 7. We are doing an interview about the conservation of Chinese mountain cat.**

The questionnaire covered six aspects:

1) Witness of Chinese mountain cats by residents;

2) The threat factors of the cats (road killing, crossbreeding with domestic cats, rodent poisoning, hunting) and the attitude of local residents;

3) How do they know about the cats;

4) The conflict between human and cats;

5) The residents' attitude towards the cats;

6) Protection actions of residents.

The questionnaire is as follow (in chinese)

| | | |
|---|---|---|
| 问卷编号： | GPS 定位： | |
| 调查时间： | 调查地点： | 调查员： |

## 受访者基本信息

姓　名 ＿＿＿＿　年　龄 ＿＿＿＿　性　别 □男 □女 民　族 ＿＿＿＿＿

联系电话 ＿＿＿＿＿＿

职业：□牧民　□农民　□工人　□护林员　　□干部　□其他：

文化程度：□小学以下　□初中 □高中或中专　□大专及本科 □研究生及以上

### 受访者家庭基本信息

您家里成员人数＿＿＿＿＿＿人，其中长期在家居住的人数＿＿＿＿＿人；

农田总面积：＿＿＿＿＿＿＿＿＿（归属自家/大队） 作物种类：＿＿＿＿＿＿＿＿＿

播种时间：＿＿＿＿＿＿＿＿ 收割时间：＿＿＿＿＿＿＿＿

草场总面积：＿＿＿＿＿＿＿＿

冬季牧场面积：＿＿＿＿＿＿＿，夏季牧场面积：＿＿＿＿＿＿

放牧时人是否在场：□是　　　□否

牲畜类型及数量：＿＿＿＿＿＿＿＿

1. 您家去年家庭总收入大约是多少？
   - □　2 万元以下
   - □　2-5 万元
   - □　5-10 万元
   - □　10-20 万元
   - □　20 万元以上
2. 您家主要的经济来源是什么？（可多选）
   - □　国有企事业单位正式岗位工资
   - □　国有/民营企事业单位临时岗位工资
   - □　国家或地方政策补贴
   - □　放牧/牲畜买卖
   - □　农业生产和销售
   - □　虫草等珍稀药草采集
   - □　个体经营（如:牧家乐、旅游商品售卖等旅游相关领域）
   - □　个体经营（非旅游业）
   - □　外出务工
   - □　无固定收入
   - □　其他
3. 您家庭是否正在接受政府的帮扶补助，或享受优惠政策？
   - □　生态公益岗位（一户一岗）
   - □　草畜平衡
   - □　禁牧
   - □　建档立卡户
   - □　灾害补偿
   - □　其他：＿＿＿＿
   - □　未享受任何政策补贴

## 知识

K1：您是否见过这种动物（展示图片）？

□　是，接 K2

□　否，根据图片介绍荒漠猫的基本情况，接 K6

K2：您最近一次看到这种动物的时间是？ _____

K3：您在什么地方看到过这种动物？
☐ 村庄
☐ 田地
☐ 牧场
☐ 山上
☐ 人造林地
☐ 其他_____

K4：您看到这种动物时，它的状态为：
☐ 个体，行为：_____
☐ 群体，行为：_____
☐ 尸体，死因：_____

K5：您认为在您居住环境附近的荒漠猫，近几年的数量变化趋势是？
☐ 变少了
☐ 变多了

K6：您是否知晓荒漠猫为保护动物？
☐ 是
☐ 否

K7：您是否见过野生动物被车辆碾压？
☐ 是，接 K8
☐ 否，接 K9

K8：被碾压的动物为 _____ ，目击的时间及地点为_____

K9：（展示家猫/疑似杂交猫的图片）您认为荒漠猫与家猫有什么区别吗？
☐ 毛色（荒漠猫体背部多灰棕或沙黄色）
☐ 体型（荒漠猫更大）
☐ 眼睛颜色（荒漠猫多呈淡蓝色或黄绿色）
☐ 耳朵（荒漠猫具耳端短毛）
☐ 尾巴（荒漠猫尾部末梢多黑环）
☐ 捕猎行为（荒漠猫显示出更强的捕食性、猎捕范围更广）
☐ 其他：_____

K10：您家里是否养猫？
☐ 是，喂养方式：散养/圈养
☐ 否

K11：您家里是否养狗？

☐ 是，喂养方式：散养/圈养

☐ 否


K12：您是否见过家猫与荒漠猫相处？

☐ 是

☐ 否


K13：您是否见过荒漠猫与家猫杂交产下的个体？

☐ 是

☐ 否


K14：（展示野生动物图片，多选）您是否见过这些野生动物？见到其的地点为？

☐ 赤狐

☐ 藏狐

☐ 狗獾

☐ 猪獾

☐ 艾鼬

☐ 雪豹

☐ 旱獭

☐ 狼

☐ 豹猫

☐ 棕熊


K15：您家中是否发生过家畜/家禽被野生动物抓走的情况？

☐ 是，接 K16

☐ 否，接 K18


K16：您家被抓走的动物为_____，野生动物为_____，抓走的位置为_____


K17：您认为家禽/家畜被野生动物抓走的依据是？

☐ 亲眼看见

☐ 留下的痕迹，_____

☐ 无依据

☐ 其他：_____


K18：您是否听说过村里有打猎行为？

☐ 是，打猎行为出现的时间节点为_____，接 K19

☐ 否，接 K21


K19：您是否抓捕/看到别人抓捕过荒漠猫？

☐ 是，接 K20

☐ 否，接 K21


K20：您听说过/使用过捕猎荒漠猫的工具为？

- ☐ 卡子
- ☐ 网套
- ☐ 围栏
- ☐ 毒饵
- ☐ 其他：_____

K21：您以前是否听说过荒漠猫皮毛和其他身体部位的交易？
- ☐ 是，听说的时间及产品价格_____
- ☐ 否

K22：您是否在自家草场/农田中进行过灭鼠行为？
- ☐ 是，接 K23
- ☐ 否，接 K26

K23：您灭鼠的目的为：_____

K24：您家草场/农田中灭鼠的形式为？
- ☐ 公家组织，集体执行
- ☐ 自己执行

K25：（多选）您常用的灭鼠方法包括哪些？
- ☐ 投放毒药
- ☐ 饲养家猫
- ☐ 放置捕鼠夹、粘鼠板等
- ☐ 其他_____。

K26：您认为灭鼠对荒漠猫是否有影响？
- ☐ 有影响
- ☐ 无影响
- ☐ 不清楚

K27：您认为荒漠猫数量的增长是否对您家的生计造成影响？
- ☐ 有影响
- ☐ 无影响
- ☐ 不清楚

**态度**

请对下列问题进行打分，打分阈值为 1~5 分，其中否定回答（非常不愿意/不在意）为 1 分，肯定回答（非常愿意/在意）为 5 分。

A1：您是否愿意在居住环境附近看见荒漠猫？

A2：您觉得荒漠猫对本地的生态保护有帮助吗？

A3：您对别人抓捕荒漠猫的态度是怎样的？

A4：您是否乐意看到外地人来村里观赏荒漠猫？

A5：您是否愿意参与支持荒漠猫保护工作？

A6：如果将荒漠猫作为推动村庄生态旅游发展的契机，可能有机会丰富村民的收入来源，提高村庄知名度；但也可能面临游客侵扰等问题。综合评估收益与成本，您是否愿意支持村庄发展荒漠猫特色的生态旅游？

A7：您认为生态科普等现行生态保护措施的实施效果怎样？

A8：投毒灭鼠可能会对荒漠猫产生二次伤害，从而威胁到荒漠猫的生存。您是否在意这些行为对荒漠猫等野生动物可能造成的影响和潜在伤害？

A9：您是否认为保护荒漠猫对本地发展是有益的？

## 实践

P1：如果您在野外看到荒漠猫，有何反应？
- ☐ 感觉到有危险，躲避荒漠猫
- ☐ 受到惊吓，驱赶荒漠猫
- ☐ 跟看到家猫一样，感觉很正常，不躲避也不驱赶
- ☐ 其他：

P2：（多选）如果您看到荒漠猫在路边被车辆碾压，您会怎么做？
- ☐ 移走尸体
- ☐ 提醒司机
- ☐ 告知交通管理部门
- ☐ 不会采取任何行动
- ☐ 其他：

P3：（多选）如果您看到有人在抓捕荒漠猫，或发现荒漠猫相关制品的交易行为，您会怎么做？
- ☐ 提醒劝阻捕猎者
- ☐ 告知动物保护部门
- ☐ 不会采取任何行动
- ☐ 其他：

P4：如果荒漠猫的数量持续增加，影响到您的正常生活，您会采取什么措施？
- ☐ 投毒
- ☐ 驱赶
- ☐ 下套抓捕荒漠猫
- ☐ 告知野生动物管理部门进行处置
- ☐ 不关心
- ☐ 其他：

补充：

您认为在荒漠猫保护方面，怎样做会更好？

您对现行保护政策及其配套的相关补贴有哪些意见和建议？

The results reveal a high cat witness rate near plantation, farmland and pasture. The residents have a high awareness of Chinese mountain cats, and popular science plays a great role. According to interview, we found that some local residents use rodent poison which might kill Chinese mountain cats if they eat the poisoned rodent. We told the residents that Chinese mountain cats could help us control the rodent on farmlands. We also bought them some glue board traps to catch rodent without doing harm to cats.

We used banner during our interview (see documents). We also designed and spread conservation brochure about Chinese mountain cat to at least 80 local residents (Figure 8). Both banner and brochure are in Chinese and focus on the conservation knowledge about Chinese mountain cat.



**Figure 8. The brochure focusing on conservation knowledge of Chinese mountain cat.**

## Steel trap cleaning

We found a Chinese Mountain cat got its foreleg caught in a steel trap (Figure 9). We were unable to catch this injured cat. But we found 3 traps in plantation and farmlands and cleaned them out together with local forest rangers.



**Figure 9. The Chinese mountain cat caught in a steel trap.**