

## Mid-term report

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

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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. It is listed as Class-I National Key Protected Wildlife in China and assessed as Vulnerable (VU) in the IUCN Red List. Chinese mountain cats are distributed in the eastern of the Qinghai-Tibet Plateau, at rather low density, and mostly found in Qinghai, Gansu and Sichuan provinces in China. Our study area locates in Menyuan Hui Autonomous County in northeastern Qinghai Province, which was recently confirmed harboring a valid population of Chinese mountain cats.

#### 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	2021.03-2022.05	436	15853
PKU002	female	2021.03-2022.05	435	22278
PKU003	female	2021.03-2022.05	431	25053
PKU004	male	2021.03-2022.05	352	12340
PKU005	male	2021.03-2021.05	64	2031
PKU006	female	2021.10-2022.05	230	9894
PKU007	male	2021.10-2022.05	227	12006
PKU008	female	2021.10-2022.05	226	13750
PKU009	female	2021.10-2022.05	225	7234
PKU010	female	2021.10-2021.11	56	551

## 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 <sup>2</sup> )	100% MCP (km <sup>2</sup> )
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<sup>2</sup> (95% MCP) and 5.36 km<sup>2</sup> (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.

## 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 1&2, Table 3).

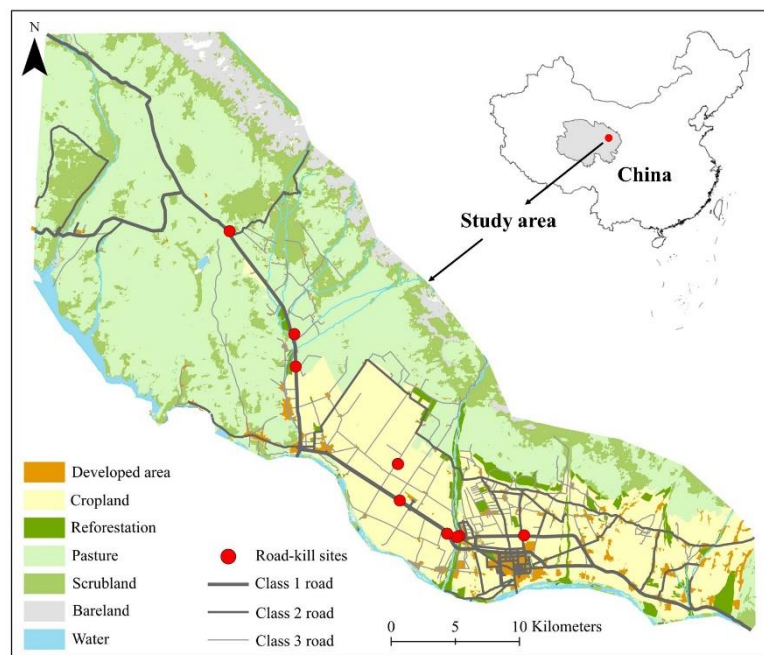


Figure 1. Road-kill sites in study area.



Figure 2. 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

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 3).

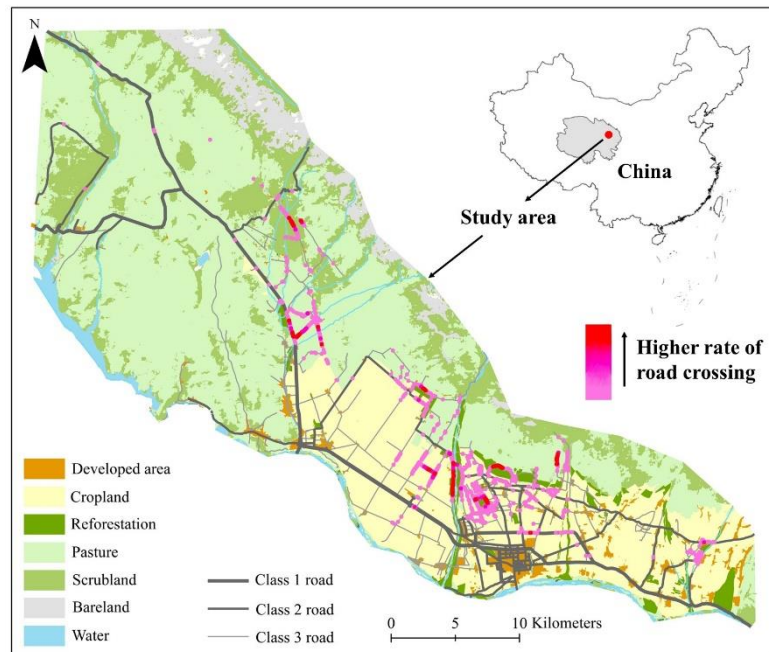


Figure 3. Road-crossing rate of Chinese mountain cats in study area.

### Primary conclusions and next step

We can find that although Chinese mountain cats preferred to cross smaller, less trafficked roads in areas with lower speed cars, but they were mostly killed on main roads in area with higher speed cars. So, in the future, we will collaborate with local agencies to set up publicity signs and speed bumps in the area where Chinese mountain cats are most commonly killed when cross the highway, to reduce the speed of vehicles entering key habitats. Meanwhile, we will design, produce and spread brochures of Chinese mountain cat to local residents and drivers at highway service areas, to raise their awareness of this unique cat species and the importance of protection against road killing threats.