Supplementary Materials

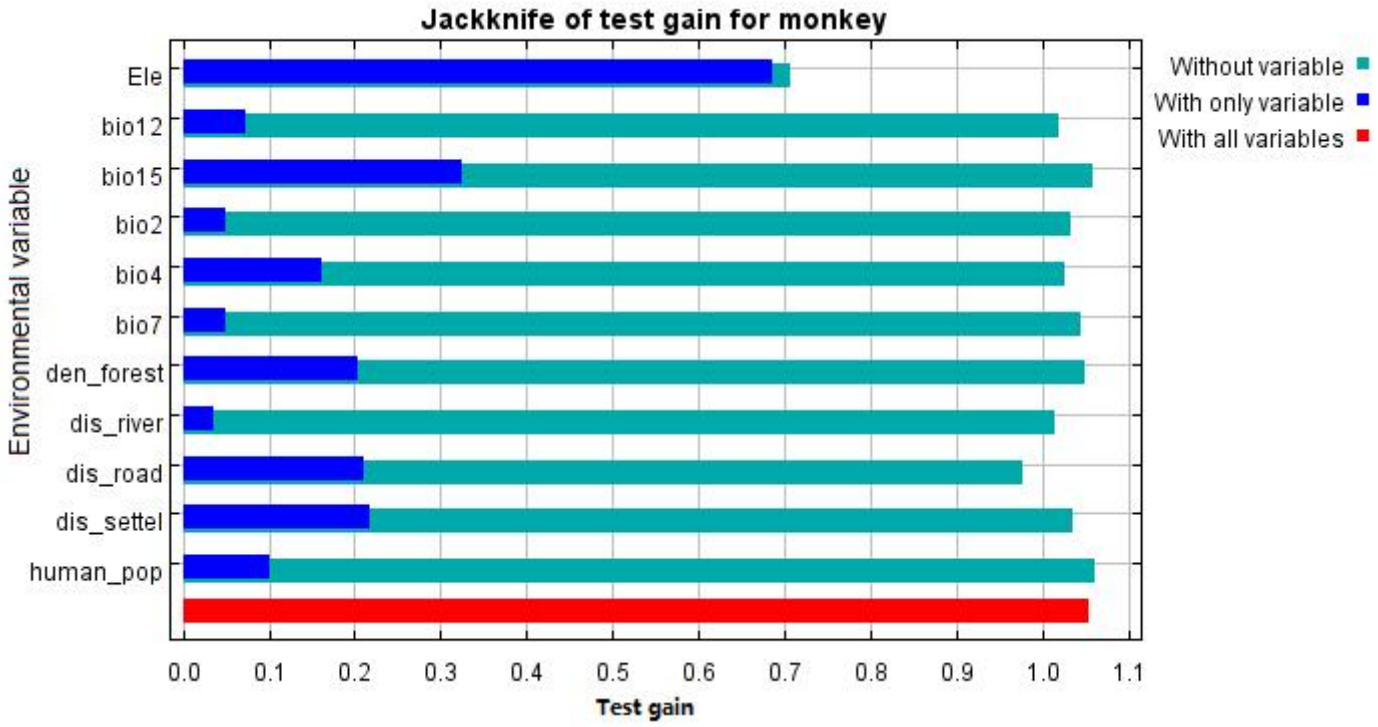
Supplementary Text

Habitat suitability model

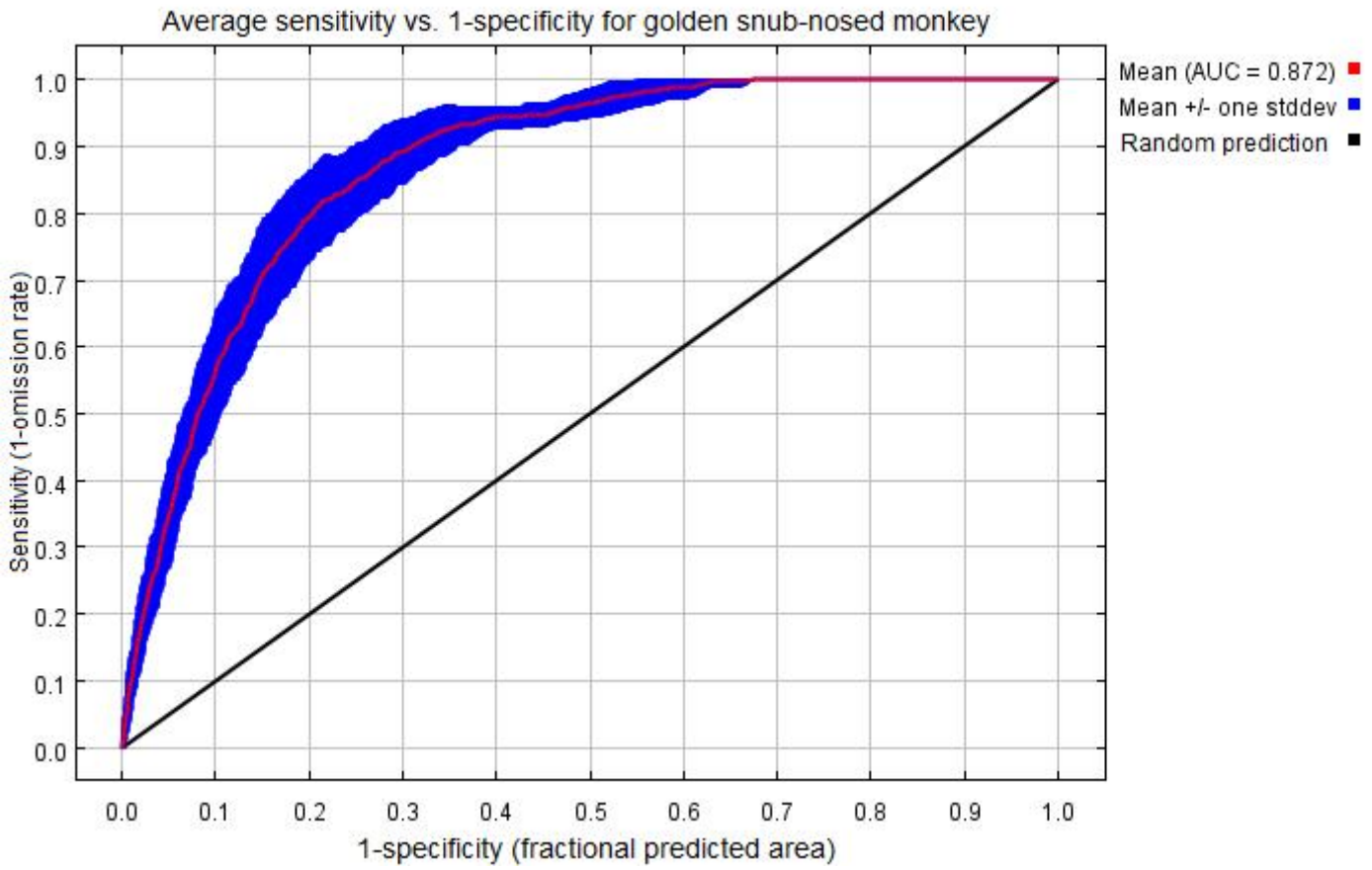
A total of 188 GPS coordinates of golden snub-nosed monkeys were collected. To reduce spatial bias, we randomly selected one record per 1×1 km cell to filter occurrence locations. Thus, 179 records were used in the habitat suitability model.

Nineteen bioclimatic characteristics from the WorldClim database (https://www.worldclim.org/) were used to identify prospective suitable habitat for the species under present climatic conditions (average from 1950 to 2000) and future climatic conditions (2061 to 2080) to capture possible changes in available habitat. The future climate data predictions used were comprised of IPCC-CMIP6 climate projections from three general circulation models (GCMs): i.e., BCC-CSM1-1, CNRM-CM6-1, and CNRM-ESM2-1. For each GCM, we used four shared socioeconomic pathway (SSP) scenarios (i.e., 126, 245, 370, and 585) to represent the most optimistic and most pessimistic emission scenarios, driven by different socioeconomic assumptions. Models were also constructed using other environmental factors, such as elevation, human population density, forest density, distance to the nearest human settlement, distance to the nearest main river (defined as a stream above Class III in China), and distance to the nearest main road (defined as a road above the county level). Rivers, roads, and villages were derived from a 1:1 000 000 map of China (http://atgcc.sbsm.gov.cn), and the forest cover layer was derived from the European Space Agency (ESA) land-cover dataset and converted to a forest density layer using the “Density” module in ArcGIS v10.7. We did not analyze changes in non-climatic variables during the 2070s as they were not available for that period. We determined correlations among variables and excluded one variable from each significantly correlated ($|r| > 0.8$) pair to eliminate strong collinearity (Supplementary Table S6).

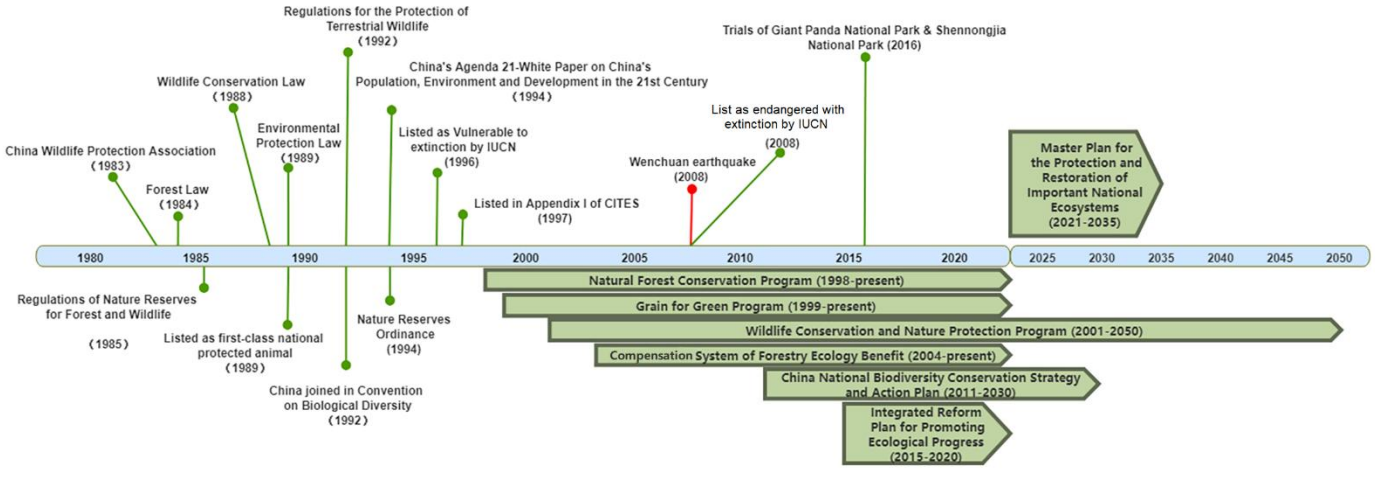
We separated the golden snub-nosed monkey occurrence data into a training set (75%) to construct the model and a test set (25%) to evaluate the model. We performed jackknife tests to determine the relevance of environmental variables and used a subsample approach in MaxEnt to validate the habitat suitability model. The area under the receiver operating characteristic curve (AUC) was used to assess MaxEnt model performance. The MaxEnt model generally showed good predictive performance (test AUC: 0.872±0.021) (Supplementary Figure S2). Our habitat model produced continuous values between 0 and 1, which were used to estimate the likelihood of golden snub-nosed monkey occurrence. Using the threshold values that optimized training sensitivity and specificity, we converted these values to predictions of presence or absence.



Supplementary Figure S1 Jackknife test of variable importance in MaxEnt model of golden snub-nosed monkeys



Supplementary Figure S2 Receiver operating characteristic (ROC) curve (average test AUC for replicate runs is 0.872 and standard deviation is 0.021)



Supplementary Figure S3 Timeline of key political/socioeconomic/natural events and programs that directly and/or indirectly affect golden snub-nosed monkeys

Supplementary Table S1 Population and habitat status of golden snub-nosed monkeys based on current research

	roxellana	*qinlingensis*	*hubeiensis*	Total
Population estimates				
MLS	114-146（4-7）	62 (6)	12	188-220 (10-13)
Numbers	15880-18190	5240-5760	1590-2180	22710-26130
Proportion inside reserves	~95%	90%	100%	~95%
Habitat characteristics				
Reserves (km^2)	16907.41	2923.75	913.77	20744.93
AOO (km^2)	456.00-584.00	248.00	48.00	752.00-880.00
EOO (km^2)	50976.52	4254.55	124.86	55355.93

Numbers in brackets represent represent the number of golden snub-nosed monkey MLS that live in areas that are not protected reserves.

Supplementary Table S2 Estimated size of golden snub-nosed monkey populations in China over time

Subspecies/ Year	**1998 (kirkpatrick)**	**2002 (Li *et al*)**	**2008 (IUCN)**	**2009 (SFA)**	**2015 (IUCN)**	**2019 (This survey)**
roxellana	/	10800	10970-11000	6500	10970-11000	15880-18190
qinlingensis	/	3800-4000	3800-4000	4400	4400	5240-5760
hubeiensis	/	600	600-1000	1100	1100	1590-2180
Total	15000	15200-15400	15370-16000	12000	16470-16500	22710-26130

Supplementary Table S3 List of nature reserves with golden snub-nosed monkeys (data obtained from National Specimen Information Infrastructure; http://nsii.org.cn/node/822**)**

Province	County（district）	Name	Classes	Area (ha)
Sichuan	Dujiangyan	Longxi-Hongkou National Nature Reserve	National	31000
	Pengzhou	Baishuihe National Nature Reserve	National	30150
	Chongzhou	Anzihe National Nature Reserve	National	10141.4
	Dayi	Heishuihe Nature Reserve	Provincial	31790
	Mianzhu/Shifang	Jiudingshan Nature reserve	Provincial	61640
	Pingwu	Xiaohegou Nature reserve	Provincial	28227
	Pingwu	Wanglang National Nature Reserve	National	32297
	Pingwu	Xuebaoding National Nature Reserve	National	63615
	Pingwu	Yujiashan Nature Reserve	County	894
	Pingwu	Laohegou Nature Reserve	County	11000
	Beichuan	Xiaozhaizigou National Nature Reserve	National	44384.7
	Beichuan	Piankou Nature Reserve	Provincial	19730
	Beichuan/Anxian	Qianfoshan National Nature Reserve	National	11083
	Qingchuan	Maozhai Nature Reserve	Provincial	20800
	Qingchuan	Tangjiahe National Nature Reserve	National	40000
	Qingchuan	Dongyanggou Nature Reserve	Provincial	30760
	Tianquan	Labahe Nature Reserve	Provincial	23437.3
	Baoxing	Fengyongzhai National Nature Reserve	National	39039
	Jiuzhaigou	Jiuzhaigou National Nature Reserve	National	64297
	Jiuzhaigou	Baihe National Nature Reserve	National	16204.3
	Jiuzhaigou	Wujiao Nature Reserve	Provincial	37014
	Wenchuan	Wolong National Nature Reserve	National	200000
	Wenchuan	Caopo Nature Reserve	Provincial	55612.1
	Heishui	Sandagu Nature Reserve	Provincial	62319.3
	Songpan	Baiyang Nature Reserve	Provincial	76710
	Songpan	Huanglong National Nature Reserve	National	55050.5
	Songpan	Longdishui Nature Reserve	County	25854.6
	Maoxian	Baodinggou Nature Reserve	Provincial	89883.6
	Xiaojinxian	Siguniangshan National Nature Reserve	National	56000
	Lixian	Miyaluo Nature Reserve	Provincial	160731.7
	Kangding	Jintangkongyu Nature Reserve	Provincial	26908.6

Province	County（district）	Name	Classes	Area (ha)
Shanxi	Zhouzhi	Zhouzhi National Nature Reserve	National	56393
	Zhouzhi	Laoxiancheng National Nature Reserve	National	12611
	Zhouzhi/Taibai/Meixian	Taibaishan National Nature Reserve	National	56325
	Zhouzhi/Taibai/Meixian	Huangbaiyuan National Nature Reserve	National	21865
	Taibai	Niuweihe Nature Reserve	Provincial	13492
	Yangxian	Changqing National Nature Reserve	National	29906
	Foping	Foping National Nature Reserve	National	29240
	Foping	Guanyinshan National Nature Reserve	National	13534
	Ningshan	Pingheliang National Nature Reserve	National	21152
	Ningshan	Tianhuashan National Nature Reserve	National	25485
	Ningshan	Huangguanshan Nature Reserve	Provincial	12372
	Ningqiang	Qingmuchuan National Nature Reserve	National	10200
Gansu	Wenxian/Wudu	Baishuijiang National Nature Reserve	National	183799
	Wudu	Yuhe National Nature Reserve	National	51058
Hubei	Shennongjia	Shennongjia National Nature Reserve	National	70467
	Badong	Badong National Nature Reserve	National	20909.99

Supplementary Table S4 Descriptions of variables used for species distribution modeling

Variable	Description
Bio1	Annual Mean Temperature
Bio2	Mean Diurnal Range (Mean of monthly (max temp - min temp))
Bio3	Isothermality (BIO2/BIO7) (* 100)
Bio4	Temperature Seasonality (standard deviation*100)
Bio5	Max Temperature of Warmest Month
Bio6	Min Temperature of Coldest Month
Bio7	Temperature Annual Range (BIO5-BIO6)
Bio8	Mean Temperature of Wettest Quarter
Bio9	Mean Temperature of Driest Quarter
Bio10	Mean Temperature of Warmest Quarter
Bio11	Mean Temperature of Coldest Quarter
Bio12	Annual Precipitation
Bio13	Precipitation of Wettest Month
Bio14	Precipitation of Driest Month

Bio15	Precipitation Seasonality (Coefficient of Variation)
Bio16	Precipitation of Wettest Quarter
Bio17	Precipitation of Driest Quarter
Bio18	Precipitation of Warmest Quarter
Bio19	Precipitation of Coldest Quarter
Ele	Elevation
Dis_road	Distance to the main road
Dis_river	Distance to the main river
Dis_settle	Distance to the human settlements
Human_pop	Proportion of human population within 1 km around the point
Den_forest	Proportion of forest within 1 km around the point

Supplementary Table S5 Analysis of relative contributions of environmental variables in MaxEnt model

Variable	Description	Percent contribution	Permutation importance
Ele	Elevation	41.9	56.1
Dis_road	Distance to the main road	17.5	12.2
Den_forest	Proportion of forest within 1 km around the point	11.4	1.6
Bio15	Precipitation seasonality (Coefficient of Variation)	11.3	3.4
Dis_settle	Distance to the human settlement	6.9	4.1
Bio12	Annual Precipitation	3.6	6.4
Dis_river	Distance to the main river	2.8	3.9
Bio4	Temperature Seasonality (standard deviation ×100)	2.3	6.1
Bio2	Mean Diurnal Range (Mean of monthly (max temp - min temp))	0.9	2.3
Human_pop	Proportion of human population within 1 km around the point	0.8	0.8
Bio7	Temperature Annual Range	0.7	3.1

Supplementary Table S6 Correlation analysis of environmental variables

Variables	Bio1	Bio2	Bio3	Bio4	Bio5	Bio6	Bio7	Bio8	Bio9	Bio10	Bio11	Bio12	Bio13	Bio14	Bio15	Bio16	Bio17	Bio18	Bio19	Ele	Dis_road	Dis_settle	Dis_river	Den_forest	Human_pop
Bio1	1.000																								
Bio2	-0.456	1.000																							
Bio3	-0.364	0.894	1.000																						
Bio4	-0.087	-0.270	-0.642	1.000																					
Bio5	0.987	-0.394	-0.351	-0.013	1.000																				
Bio6	0.980	-0.505	-0.337	-0.207	0.954	1.000																			
Bio7	-0.317	0.500	0.074	0.649	-0.203	-0.476	1.000																		
Bio8	0.986	-0.488	-0.436	0.028	0.987	0.958	-0.248	1.000																	
Bio9	0.988	-0.424	-0.282	-0.211	0.970	0.991	-0.406	0.965	1.000																
Bio10	0.988	-0.503	-0.457	0.048	0.988	0.957	-0.239	0.994	0.963	1.000															
Bio11	0.990	-0.424	-0.281	-0.213	0.971	0.992	-0.407	0.966	0.999	0.964	1.000														
Bio12	0.381	-0.354	-0.264	-0.064	0.364	0.414	-0.290	0.398	0.385	0.372	0.386	1.000													
Bio13	0.522	-0.372	-0.197	-0.232	0.494	0.582	-0.459	0.522	0.554	0.493	0.554	0.848	1.000												
Bio14	0.333	-0.306	-0.273	0.047	0.332	0.343	-0.155	0.358	0.318	0.338	0.319	0.914	0.620	1.000											
Bio15	0.028	0.134	0.324	-0.471	0.000	0.104	-0.336	-0.011	0.104	-0.032	0.103	-0.213	0.286	-0.502	1.000										
Bio16	0.500	-0.361	-0.200	-0.210	0.473	0.555	-0.431	0.505	0.528	0.473	0.528	0.874	0.988	0.657	0.246	1.000									
Bio17	0.319	-0.312	-0.297	0.081	0.318	0.322	-0.125	0.345	0.299	0.327	0.300	0.921	0.609	0.991	-0.532	0.647	1.000								
Bio18	0.406	-0.264	-0.087	-0.292	0.377	0.470	-0.434	0.403	0.445	0.367	0.445	0.880	0.971	0.666	0.265	0.983	0.656	1.000							
Bio19	0.319	-0.312	-0.297	0.081	0.318	0.322	-0.125	0.345	0.299	0.327	0.300	0.921	0.609	0.991	-0.532	0.647	1.000	0.656	1.000						
Ele	-0.951	0.547	0.539	-0.159	-0.953	-0.907	0.181	-0.968	-0.912	-0.976	-0.913	-0.368	-0.448	-0.352	0.135	-0.435	-0.350	-0.314	-0.350	1.000					
Dis_road	-0.525	0.221	0.189	0.060	-0.521	-0.506	0.131	-0.511	-0.520	-0.518	-0.208	-0.134	-0.200	-0.098	0.002	-0.188	-0.107	-0.133	-0.107	0.498	1.000				
Dis_settle	-0.654	0.297	0.221	0.115	-0.635	-0.638	0.233	-0.626	-0.652	-0.639	-0.521	-0.127	-0.235	-0.086	-0.028	-0.212	-0.090	-0.147	-0.090	0.611	0.586	1.000			
Dis_river	-0.196	-0.040	-0.072	0.124	-0.196	-0.190	0.051	-0.179	-0.207	-0.180	-0.653	0.034	-0.024	0.061	-0.063	-0.009	0.060	0.007	0.060	0.159	0.258	0.200	1.000		
Den_forest	-0.094	0.124	0.163	-0.157	-0.121	-0.101	-0.029	-0.142	-0.094	-0.122	-0.093	-0.184	-0.285	-0.071	-0.201	-0.289	-0.083	-0.267	-0.083	0.124	0.074	0.034	-0.030	1.000	
Human_pop	0.185	-0.146	-0.150	0.066	0.188	0.181	-0.035	0.196	0.178	0.196	0.178	0.108	0.189	0.051	0.106	0.183	0.061	0.158	0.061	-0.188	-0.131	-0.146	-0.037	-0.151	1.000

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