Mammalian geographic characteristic in the arid region of Northwest China
西北干旱区哺乳动物分布现状

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研究背景

方法

结果

讨论

研究背景

- 干旱地区的物种保护
- 物种种类少
- 密度低

保护的重要性?

研究背景

➡ 干旱地区的物种保护
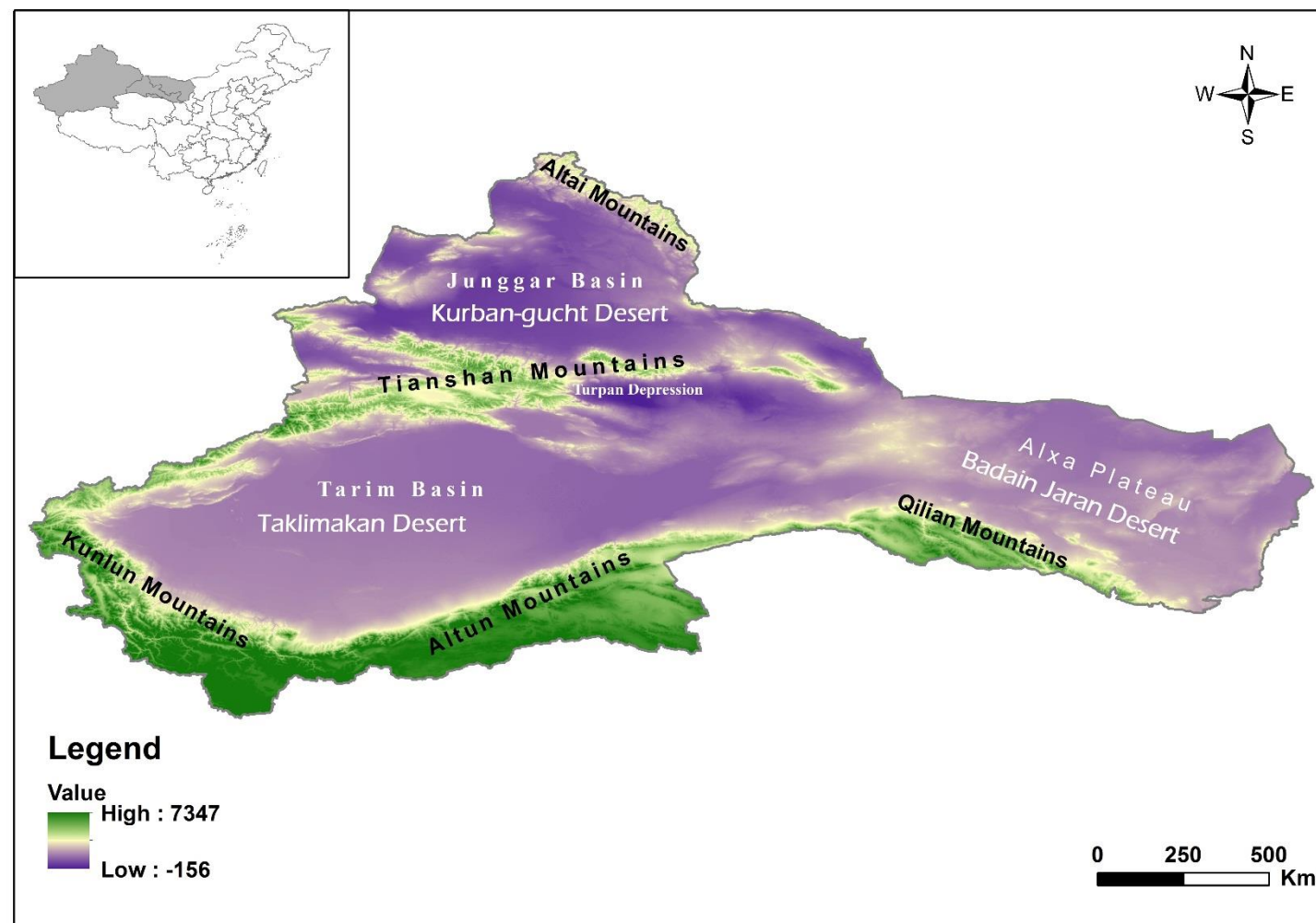
➡ A. 濒危物种

➡ B. 生态环境脆弱

研究背景

- 已有研究倾向于
- A. 热点地区
- B. 濒危物种
- 仅有部分研究关注干旱地区

撒哈拉

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研究背景

面积为3,281,200 km², 海拔变化-156–7,347 m. 平均降雨量小于 250 mm.

研究背景

为何选择西北地区？

- 研究空缺
- 144 哺乳动物分布于西北地区
- 珍稀濒危物种

  雪豹 (*Uncia uncia*), 野骆驼(*Camelus ferus*), and 兔狲(*Felis manul*)

- 人为影响剧烈

研究意义

- 我们运用物种分布模型，结合物种分布数据，分析西北干旱区哺乳动物潜在分布

- 主要集中在以下方面

- (1) 选择濒危物种、搜集分布数据;

- (2) 利用MaxEnt分析物种潜在分布;
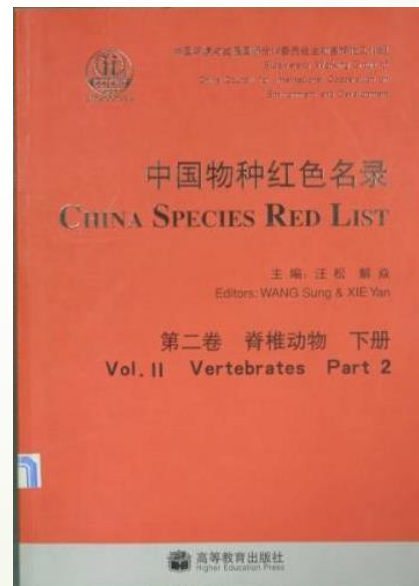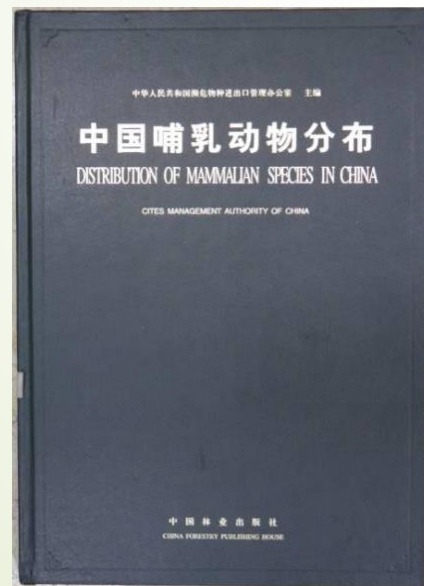
- (3) 识别分布热点地区.

方法

数据搜集
- 物种分布数据
- 环境因子

模型
- 潜在分布

优先区
- 分布热点

方法

➡ 数据搜集

➡ 我们从动物志、发表文献、地方记录、保护区科考报告等方面搜集物种分布数据

方法

Common name	Scientific name	IUCN Red List	Records
Bactrian Camel	*Camelus ferus*	CR	46
Alpine Musk Deer	*Moschus chrysogaster*	EN	45
Chiru	*Pantholops hodgsonii*	EN	92
Dhole	*Cuon alpinus*	EN	25
Ili Pika[E]	*Ochotona iliensis*	EN	19
Kozlov's Pika[E]	*Ochotona koslowi*	EN	27
Snow Leopard	*Panthera uncia*	EN	36
Goitered Gazelle	*Gazella subgutturosa*	VU	90
Marbled Polecat	*Vormela peregusna*	VU	64
Siberian Musk Deer	*Moschus moschiferus*	VU	44
White-lipped Deer	*Cervus albirostris*	VU	94
Yak	*Bos mutus*	VU	43
Altai Weasel	*Mustela altaica*	NT	28
Argali	*Ovis ammon*	NT	54
Asiatic Wild Ass	*Equus hemionus*	NT	66
Pallas's Cat	*Otocolobus manul*	NT	37
Tibetan Gazelle	*Procapra picticaudata*	NT	40
Yarkand Hare[E]	*Lepus yarkandensis*	NT	61
Alpine Ibex	*Capra ibex*	LC	27
Asian Badger	*Meles leucurus*	LC	27
Beech Marten	*Martes foina*	LC	60
Blue Sheep	*Pseudois nayaur*	LC	31
Brown Bear	*Ursus arctos*	LC	38
Corsac Fox	*Vulpes corsac*	LC	24
Eurasian Lynx	*Lynx lynx*	LC	56
Gray Wolf	*Canis lupus*	LC	41
Kiang	*Equus kiang*	LC	40
Least Weasel	*Mustela nivalis*	LC	34
Moose	*Alces alces*	LC	22
Red Deer	*Cervus elaphus*	LC	42
Red Fox	*Vulpes vulpes*	LC	32
Sable	*Martes zibellina*	LC	34
Steppe Polecat	*Mustela eversmanii*	LC	25
Stoat	*Mustela erminea*	LC	22
Tibetan Fox	*Vulpes ferrilata*	LC	64
Wolverine	*Gulo gulo*	LC	29
Total			1559

- 选择36个物种
- 利用物种生境信息，校正物种分布数据
- 去除同一栅格的重复点
- 共获得分布点1559个

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方法

- **环境因子:**

- 生物气候因子和月气候数据 -- http://www.ccafs-climate.org/

- 地表覆盖类型 -- ISCGM dataset (http://www.iscgm.org/)

- 地形 **--** SRTM 90m Digital Elevation Data v4.1--International Scientific & Technical Data Mirror Site, Computer Network Information Center, Chinese Academy of Sciences. (http://www.gscloud.cn)

- 人类影响 -- the SEDAC database, Last of the Wild Data

- 自然保护区 -- nature reserve investigation

- 行政区划图 -- Geographic Information Center of the National Foundation(http://ngcc.sbsm.gov.cn/)
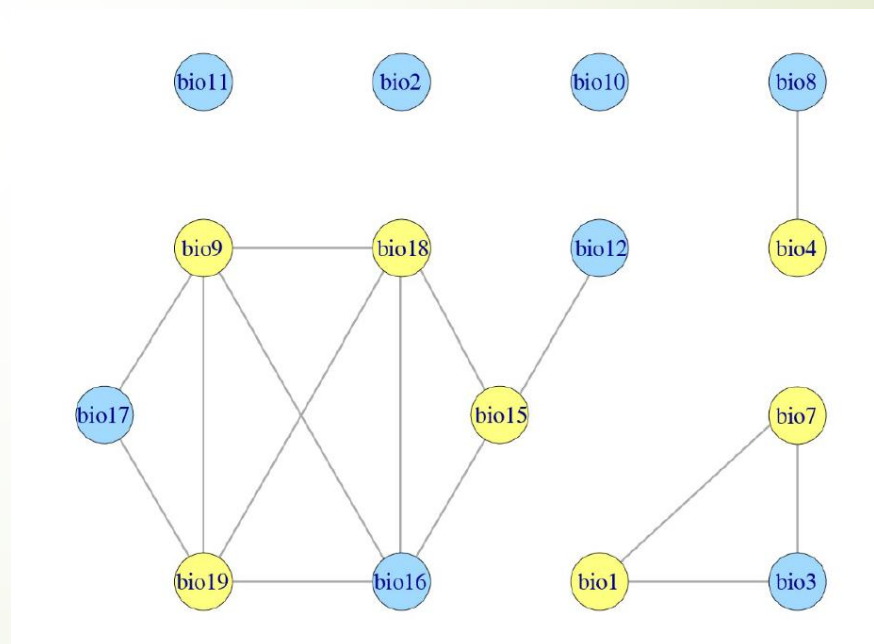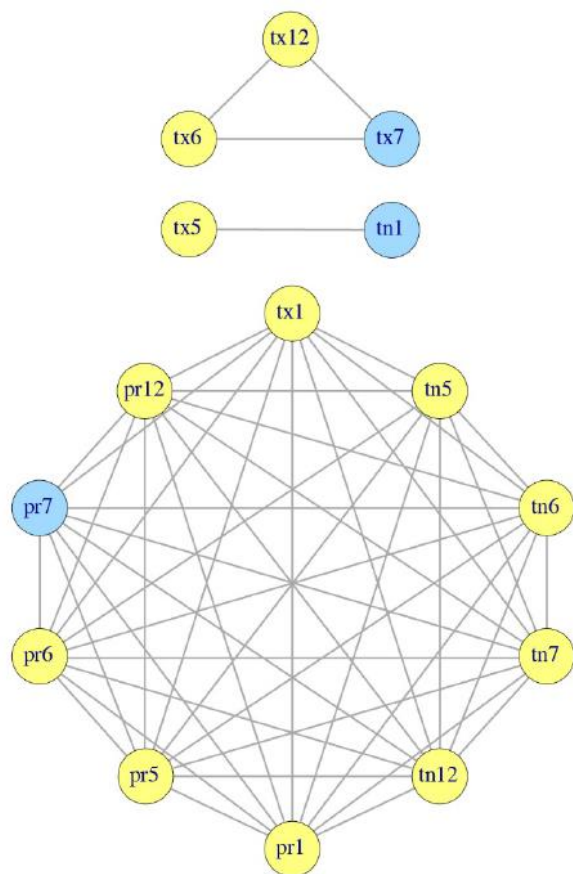
Method

Table S1. Eco-geographic variables used in species distribution models of mammals in the arid region of Northwest China.

Group	Eco-geographic variable	Code	Unit
Bioclimatic variables	Annual Mean Temperature	bio1	° C
	Mean Diurnal Range (Mean of monthly (max temp - min temp))	bio2	° C
	Isothermality (BIO2/BIO7) (* 100)	bio3	
	Temperature Seasonality (SD * 100)	bio4	
	Max Temperature of Warmest Month	bio5	° C
	Min Temperature of Coldest Month	bio6	° C
	Temperature Annual Range (BIO5-BIO6)	bio7	° C
	Mean Temperature of Wettest Quarter	bio8	° C
	Mean Temperature of Driest Quarter	bio9	° C
	Mean Temperature of Warmest Quarter	bio10	° C
	Mean Temperature of Coldest Quarter	bio11	° C
	Annual Precipitation	bio12	mm
	Precipitation of Wettest Month	bio13	mm
	Precipitation of Driest Month	bio14	mm
	Precipitation Seasonality (Coefficient of Variation)	bio15	
	Precipitation of Wettest Quarter	bio16	mm
	Precipitation of Driest Quarter	bio17	mm
	Precipitation of Warmest Quarter	bio18	mm
	Precipitation of Coldest Quarter	bio19	mm
Monthly climate variables	Max Temperature in January	tx1	° C
	Max Temperature in May	tx5	° C
	Max Temperature in June	tx6	° C
	Max Temperature in July	tx7	° C
	Max Temperature in December	tx12	° C
	Min Temperature in January	tn1	° C
	Min Temperature in May	tn5	° C
	Min Temperature in June	tn6	° C
	Min Temperature in July	tn7	° C
	Min Temperature in December	tn12	° C
	Precipitation of January	pr1	mm
	Precipitation in December	pr12	mm
	Precipitation in May	pr5	mm
	Precipitation in June	pr6	mm
	Precipitation in July	pr7	mm
Topography	Elevation	elev	m
	Aspect	asp	(°)
	Slope	slo	(°)
Human impact	Human Footprint Index	hfoo	
	Human Influence Index	hinf	
Habitat	Land Cover	land	
	Tree Cover	tree	

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Method

- 我们计算生物气候因子以及相关月气候数据的皮尔森相关性

- 建立相关性图-- the "igraph" package in R

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方法

- MaxEnt 3.3.3k设置

- number of random selected background points = 10,000;

- replicated run type = subsample; replicates = 20;

- auto feature;

- convergence threshold = 0.00001;

- output format = logistic

方法

▶ 运行Maxent
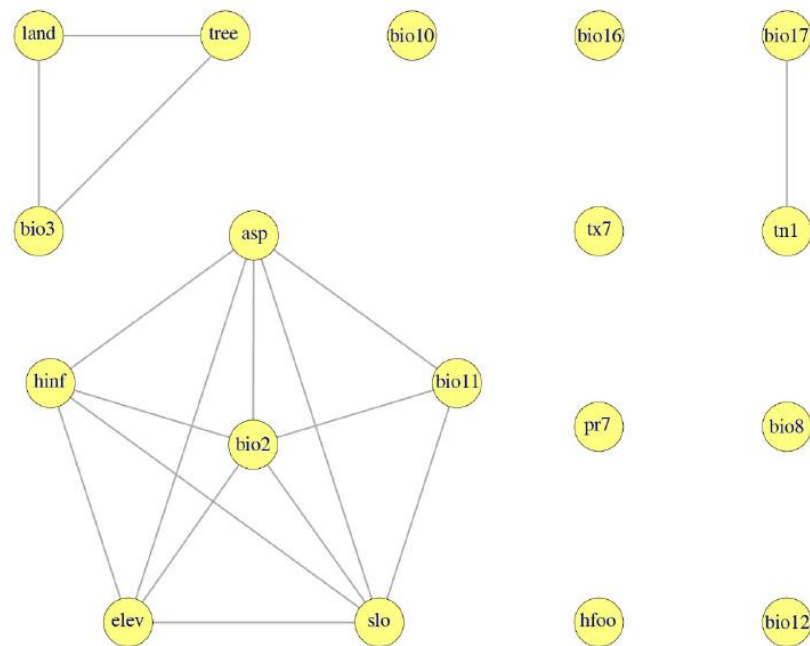
▶ 对相关性≥ 0.8的成对环境因子, 我们去除贡献率低的因子

Fig S2. Network diagram of 18 environmental variables. Two circles are linked if the two represented variables are highly correlated ($|r| \geq 0.8$).

方法

- 不同物种具有不同的因子组合

Table S2. Selected variables used in species distribution models for mammals in the arid region of Northwest China.

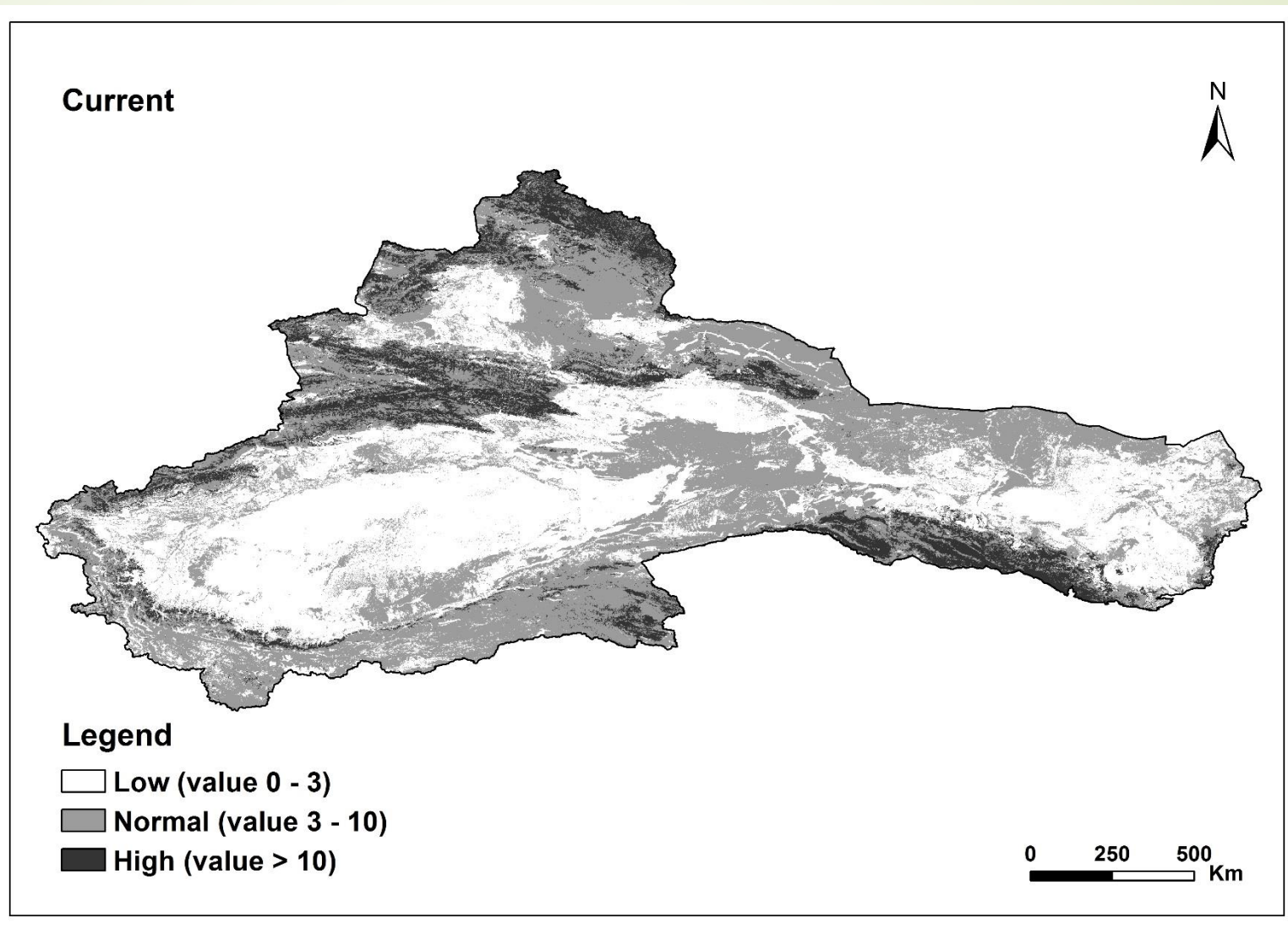| Common name	Scientific name	Selected variables
Bactrian Camel	*Camelus ferus*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio2 , land, bio17
Alpine Musk Deer	*Moschus chrysogaster*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem, bio3, bio17
Chiru	*Pantholops hodgsonii*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem, bio3, tn1
Dhole	*Cuon alpinus*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem, land, bio17
Ili Pika[E]	*Ochotona iliensis*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio2, tree, bio17
Kozlov's Pika[E]	*Ochotona koslowi*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem, bio3, bio17
Snow Leopard	*Panthera uncia*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,bio17
Goitered Gazelle	*Gazella subgutturosa*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,tn1
Marbled Polecat	*Vormela peregusna*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,bio17
Siberian Musk Deer	*Moschus moschiferus*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,bio17
White-lipped Deer	*Cervus albirostris*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem, bio3, bio17
Yak	*Bos mutus*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,tn1
Altai Weasel	*Mustela altaica*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,bio17
Argali	*Ovis ammon*	Bio8, Bio10, Bio12, Bio16, tx7, pr7, hfoo,bio11,dem,land,bio17

方法

- 选取the sensitivity-specificity sum maximisation approach的阈值，来确定潜在分布

- 因此，对于所有结果，高于阈值的定义为"有分布"，低于阈值的定义为"无分布"。

结果

- 平均AUC 为0.942 ± 0.017 (Table 1).
- 狼獾(*Gulo gulo*) 的AUC 值最高
- 马鹿(*Cervus elaphus*) 的AUC 值最低

结果

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Result

- 猞猁(*Lynx Lynx*) 分布面积最大，共883,615 km², 而狼獾最小，仅 9,651 km².

- 36个物种平均海拔分布为1,732 ± 1,380 m (305 ~ 4,911 m).

- 生物多样性低、中、高地区的面积，分别为1,417,095 km², 1,462,475 km²和 401,630 km².

- 生物多样性高的地区主要集中在祁连山、天山、吐鲁番盆地和阿勒泰地区 (Fig. 2).

Discussion

- 西部地区

- 威胁: 人为干扰和荒漠化

- 保护建议：建立生态走廊，限制城市和农田扩张，抑制荒漠化。这些措施建议集中在天山和阿勒泰山区。

- 东部地区

- 威胁：荒漠化

- 保育已有保护区植被、抑制荒漠化

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END
Thanks！

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