

# Biodiversity Monitoring in China

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# Sino-BON

- 1201 Keping Ma  
**Biodiversity monitoring relies on the integration of human observation and automatic collection of data with advanced equipment and facilities**  
 2016 Vol. 24 (11): 1201-1202 [Abstract] ( 223 ) RICH HTML <sup>NEW</sup> [PDF 3199KB] ( 377 )

## Special Feature: Chinese Biodiversity Monitoring and Research Network (Sino BON)

- 1203 Xiangcheng Mi, Jing Guo, Zhanqing Hao, Zongqiang Xie, Ke Guo, Keping Ma  
**Chinese forest biodiversity monitoring: scientific foundations and strategic planning**  
 2016 Vol. 24 (11): 1203-1219 [Abstract] ( 187 ) RICH HTML <sup>NEW</sup> [PDF 1127KB] ( 306 )

- 1220 Ke Guo, Changcheng Liu, Qingmin Pan  
**Methods of observing typical plant communities in the Steppe and Desert Biodiversity Observation Network, Sino BON**  
 2016 Vol. 24 (11): 1220-1226 [Abstract] ( 104 ) RICH HTML <sup>NEW</sup> [PDF 353KB] ( 210 )

- 1227 Huanzhang Liu, Junxing Yang, Shuwei Liu, Xin Gao, Yushun Chen, Chunguang Zhang, Kai Zhao, Xinhui Li, Wei Liu  
**Theory and methods on fish diversity monitoring with an introduction to the inland water fish diversity observation in China**  
 2016 Vol. 24 (11): 1227-1233 [Abstract] ( 140 ) RICH HTML <sup>NEW</sup> [PDF 270KB] ( 249 )

- 1234 Kaiwen Pan, Lin Zhang, Yuanhu Shao, Shenglei Fu  
**Thematic monitoring network of soil fauna diversity in China: exploring the mystery of soils**  
 2016 Vol. 24 (11): 1234-1239 [Abstract] ( 286 ) RICH HTML <sup>NEW</sup> [PDF 690KB] ( 403 )

- 1240 Xiangzhen Li, Liangdong Guo, Jiabao Li, Minjie Yao  
**Soil microbial diversity observation in China: current situation and future consideration**  
 2016 Vol. 24 (11): 1240-1248 [Abstract] ( 373 ) RICH HTML <sup>NEW</sup> [PDF 4323KB] ( 362 )

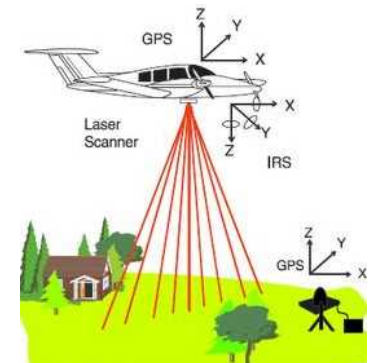
- 1249 Qinghua Guo, Jin Liu, Yumei Li, Qiuping Zhai, Yongcai Wang, Fangfang Wu, Tianyu Hu, Huawei Wan, Huiming Liu, Wenming Shen  
**A near-surface remote sensing platform for biodiversity monitoring: perspectives and prospects**  
 2016 Vol. 24 (11): 1249-1266 [Abstract] ( 124 ) RICH HTML <sup>NEW</sup> [PDF 1050KB] ( 269 )

- 1267 Qinghua Guo, Fangfang Wu, Tianyu Hu, Linhai Chen, Jin Liu, Xiaoqian Zhao, Shang Gao, Shuxin Pang  
**Perspectives and prospects of unmanned aerial vehicle in remote sensing monitoring of biodiversity**

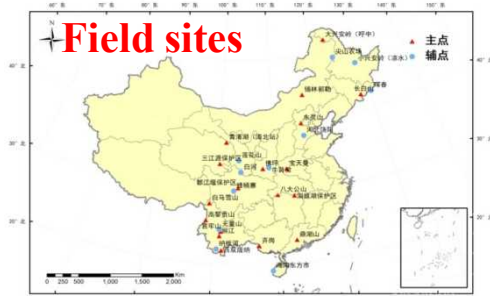
Standard & Criteria

Data Management & Sharing

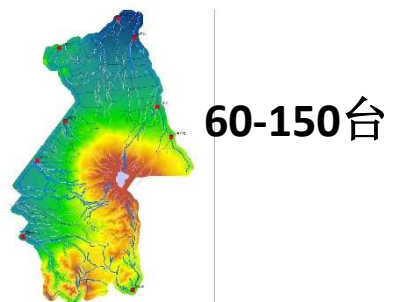
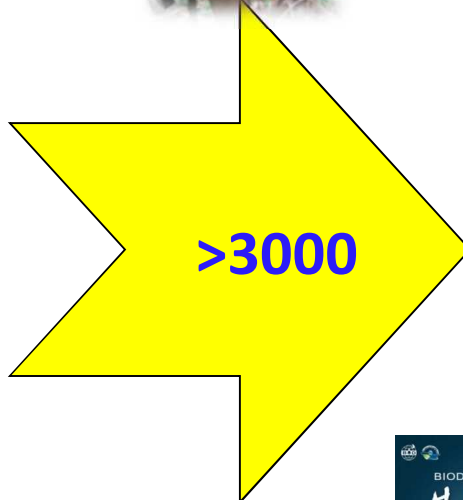
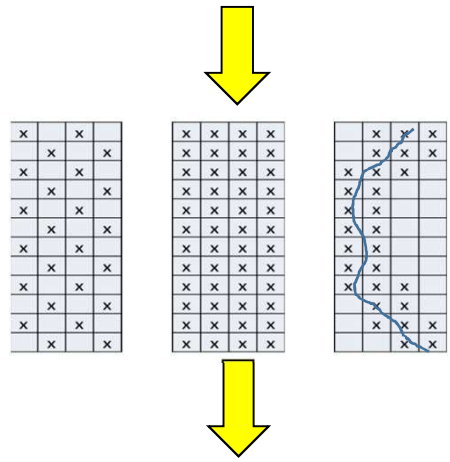
Remote Sensing



# Camera-Trapping Network of Mammal Diversity (2011—)

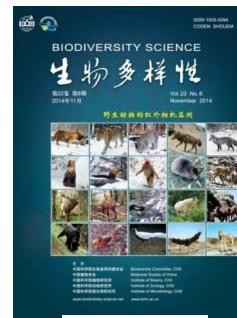


## CameraData Base (2013—)



3.0 M photos  
Mammals: 120 sp.  
Birds: 270 sp.

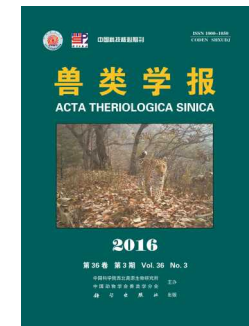
<http://cameradata.ioz.ac.cn/>



2014



2015



2016



## Collaboration with ISZS and CBRN



### CBRN: 169 members of Nature Reserve



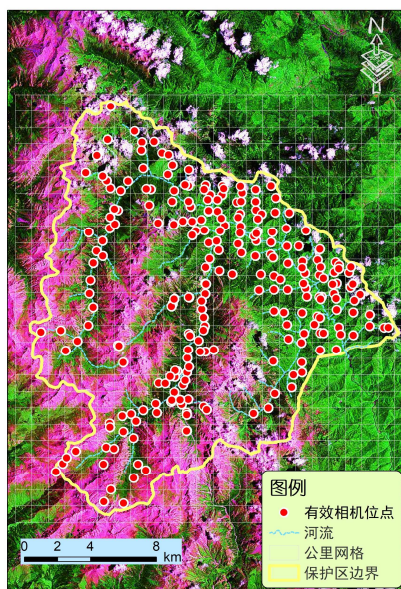


# PKU's camera-trapping network in SW China

- 40+ protected areas across 7 mountain ranges (20 directly surveyed by PKU with comprehensive reserve-wide data)
- 3000+ survey stations, 250,000+ camera-days
- ~2.5 million images/videos (56 mammal, 20 pheasant, 140+ other bird species)

## General Protocol

- ✓ 1km x1km grids
- ✓ 1-2 camera station at each cell
- ✓ Survey duration: 4-6 month



Survey stations at Wanglang Nature Reserve (2014-2018)



# Camera Trapping Network of Shanshui, Peking University

In the field: 401 camera trap stations

Covering 7000 km<sup>2</sup>

Cameras working 9-10

Months/year

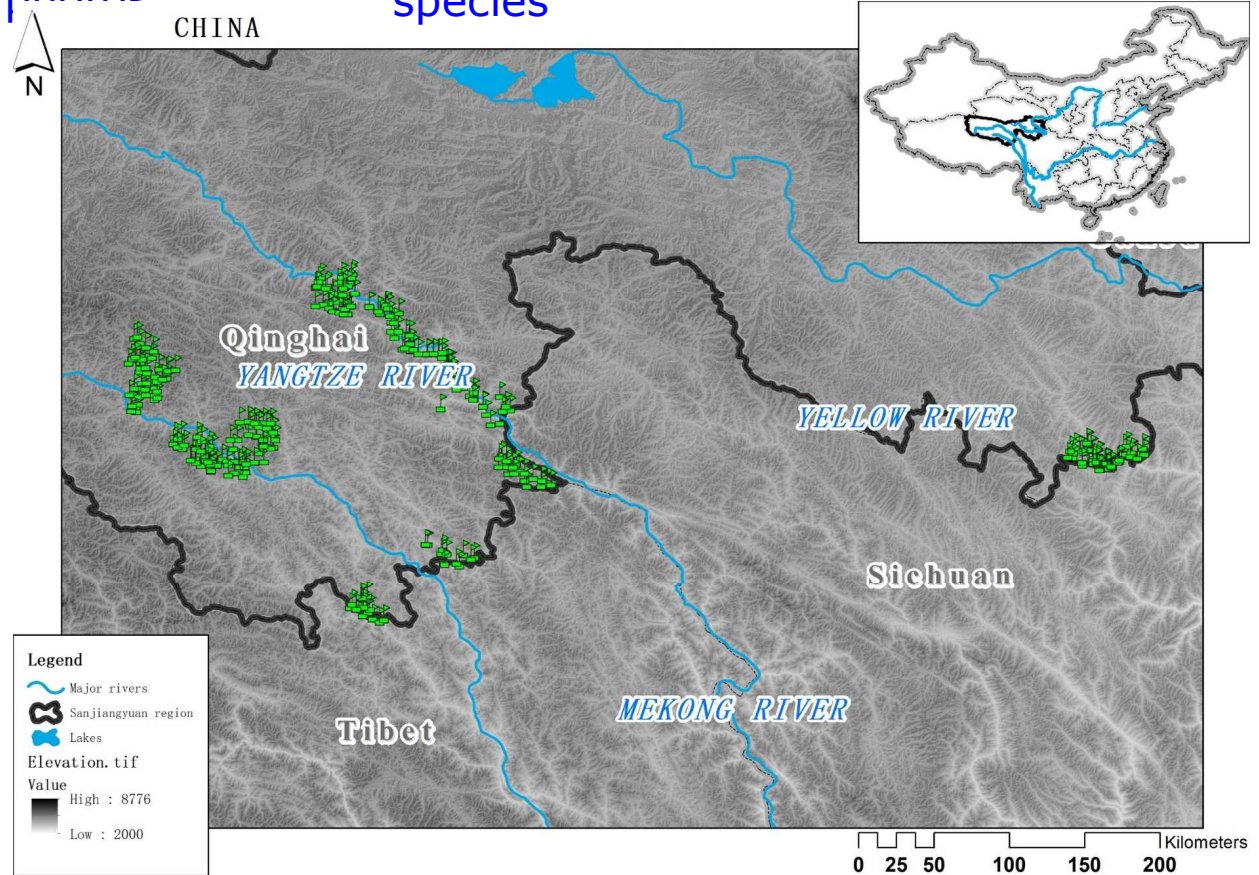
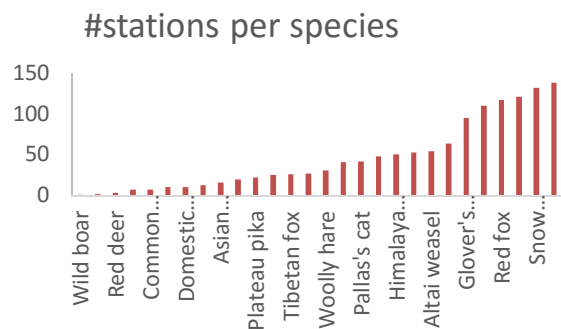
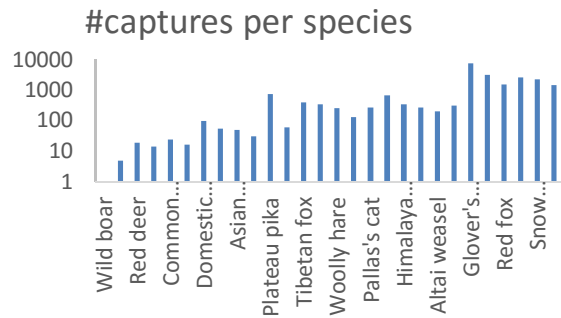
4.5 million photos

Data input: 29805 independent captures

97715 camera days

23 wild mammal species

species

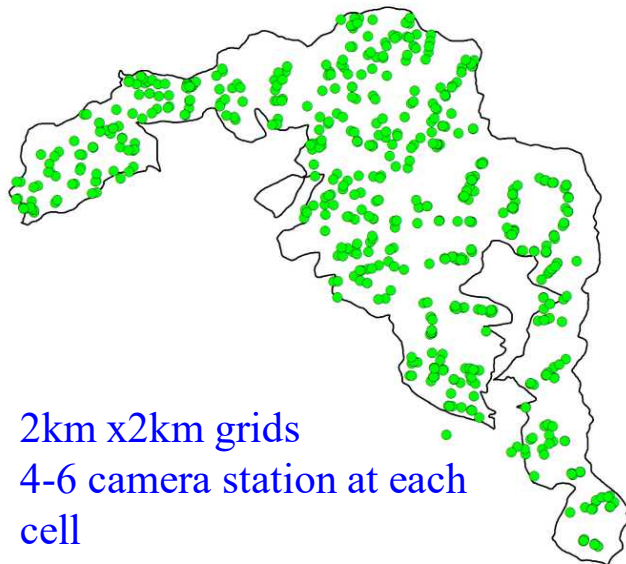


# Chinese Academy of Forestry, <http://www.papc.cn>

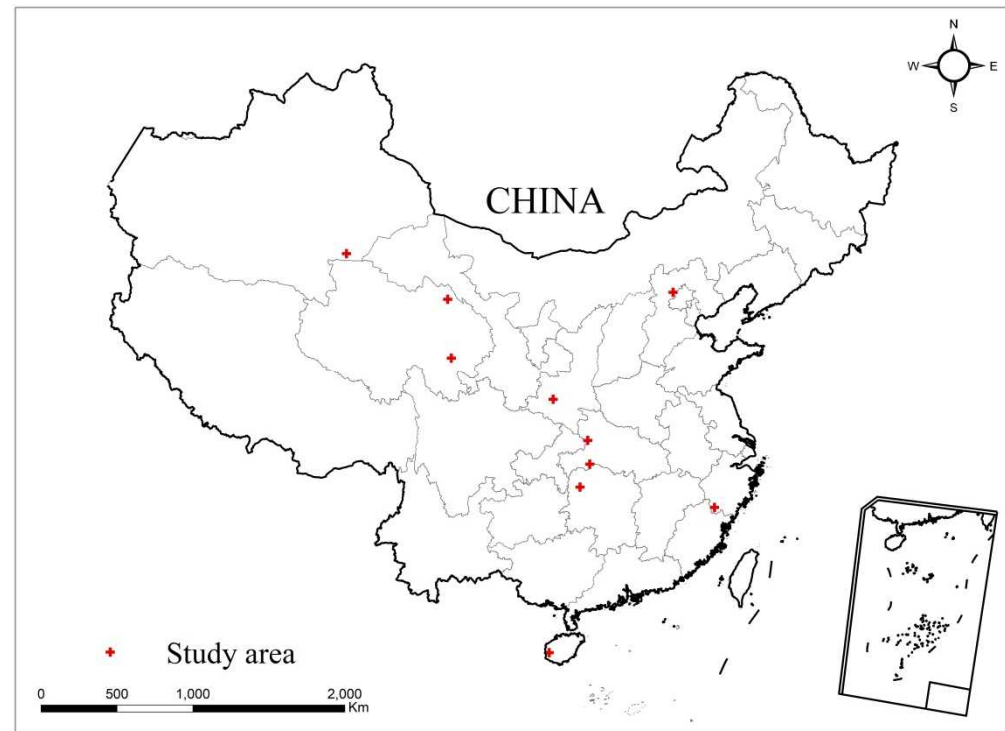


- 10+protected areas, 2000+ survey stations
- ~200, 000 images/videos (50+mammal,100+birds)

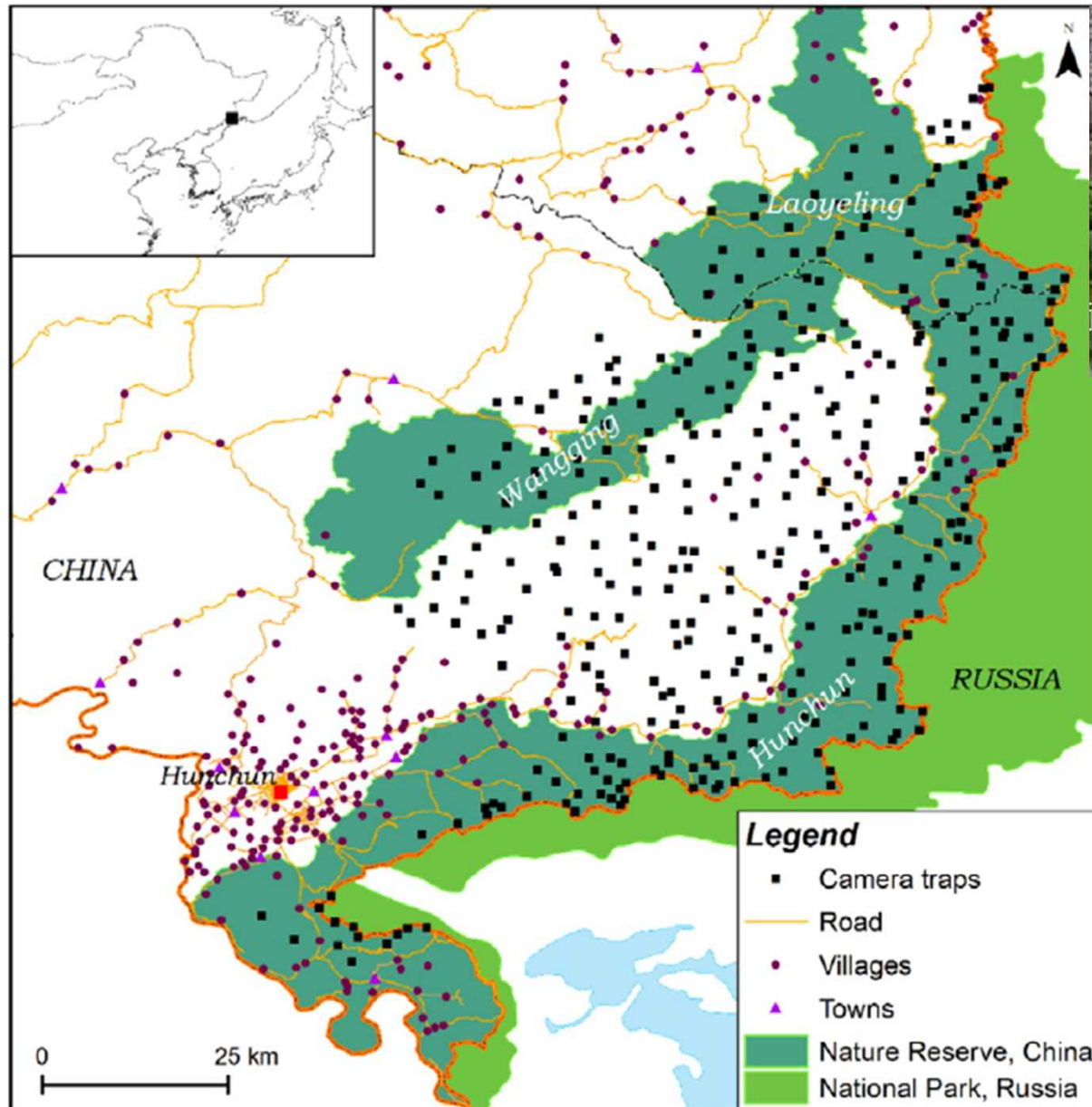
## Survey stations at Changqing



- ✓ 2km x2km grids
- ✓ 4-6 camera station at each cell
- ✓ Survey duration: 4-6 months



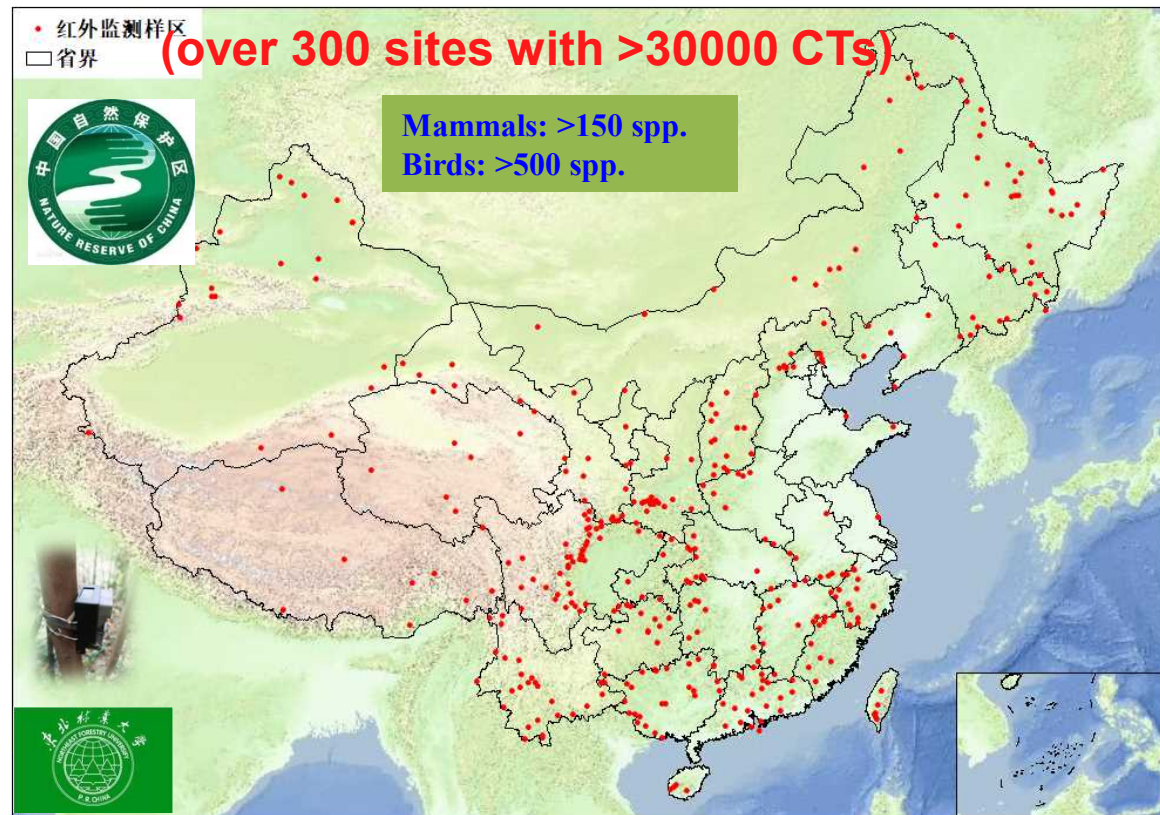
# Beijing Normal University



Monitoring areas of the long-term Tiger-Leopard Observation Network (TLON) in NE China showing the camera placement relative to settlements, major roads and nature reserves or national parks.

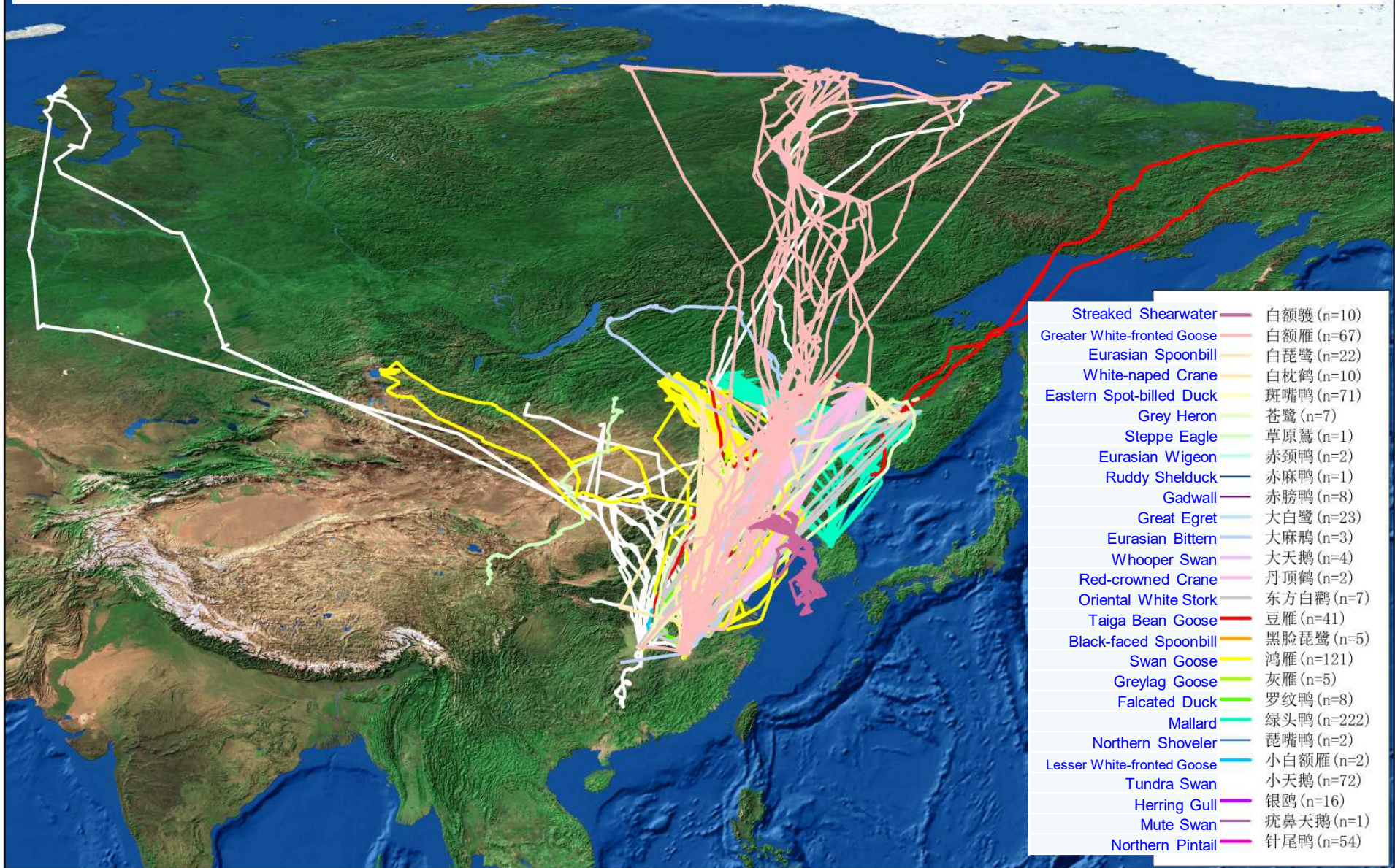


# Current camera-trapping projects in China

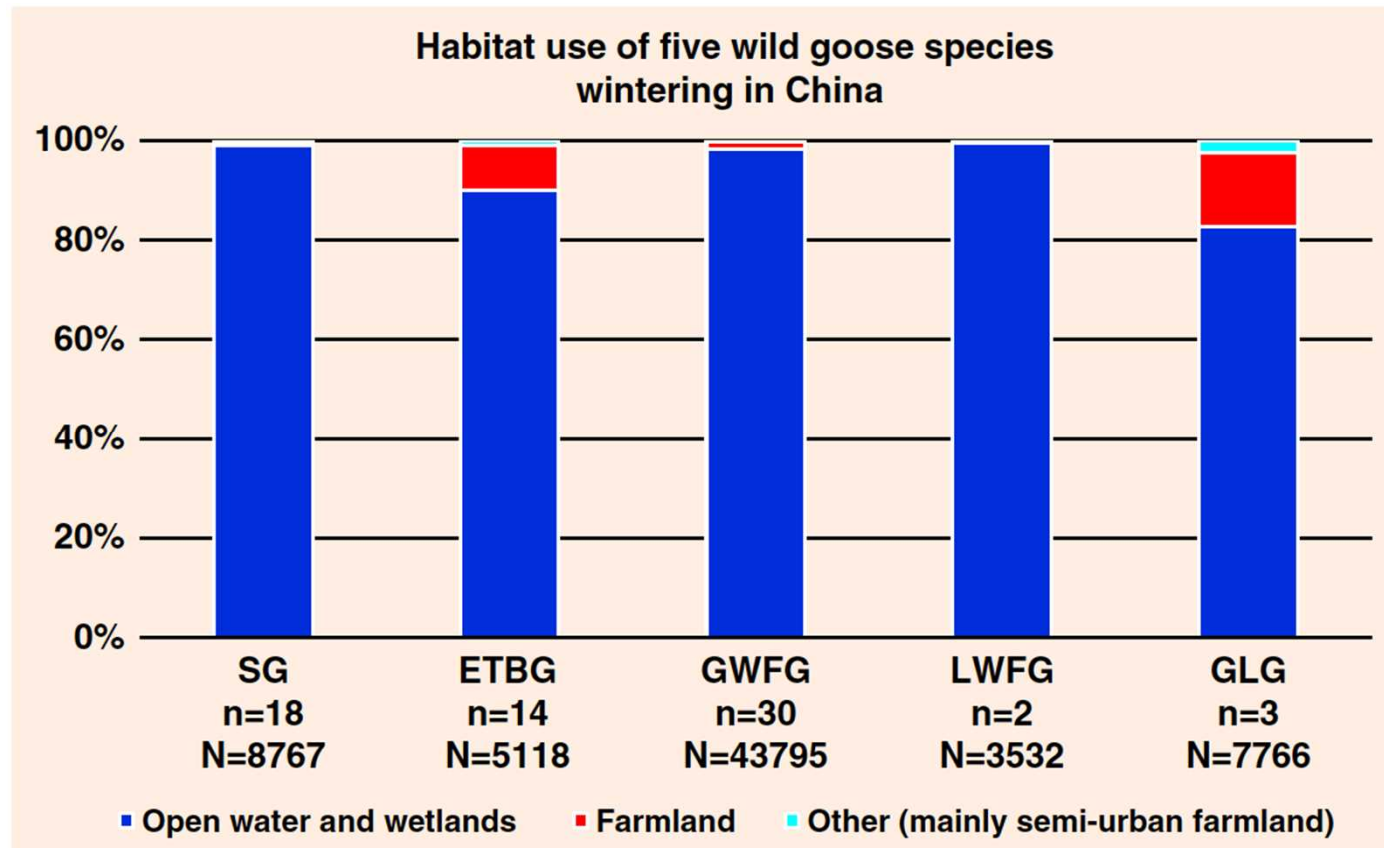


## Sino Bon-Bird

Established the biggest Bird Satellite Tracking Database in Aisa through Sino-BON and QIA collaboration, containing 787 birds of 37 species.

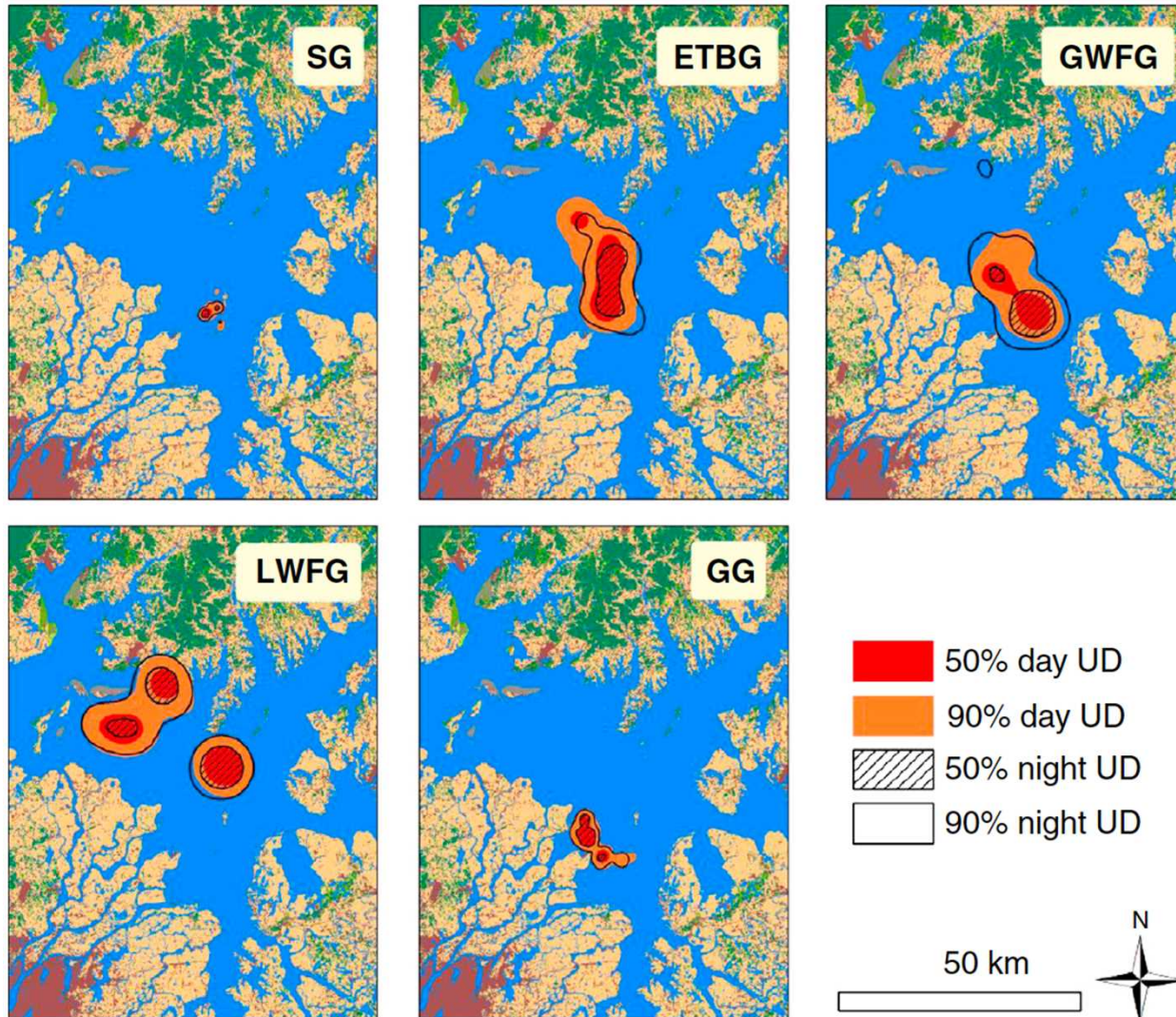


# Are declining populations of wild geese in China 'prisoners' of their natural habitats?

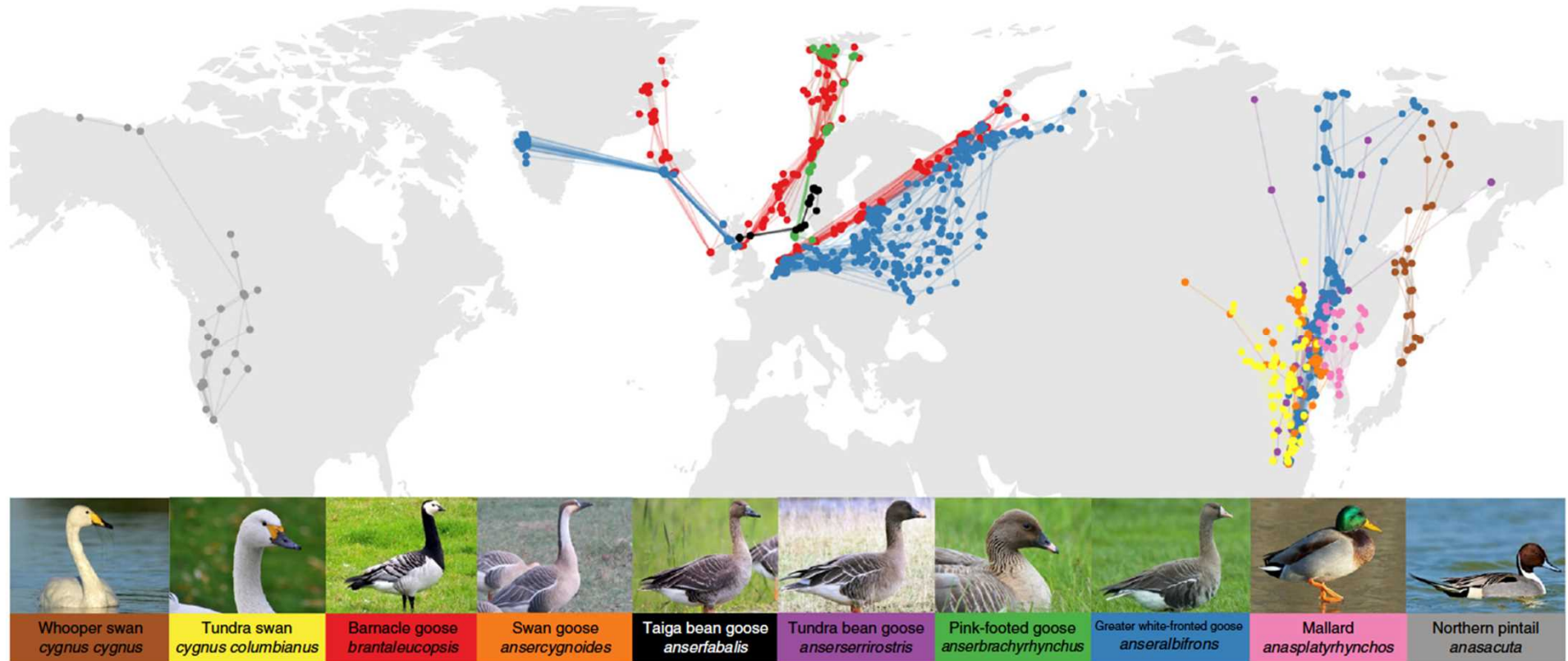


Percentage of habitat use of Swan Geese *Anser cygnoides* (SG at 2 wintering sites), Eastern Tundra Bean Geese *A. serrirostris* (ETBG at 2 sites), Greater White-fronted Geese *A. albifrons* (GWFG at 2 sites), Lesser White-fronted Geese *A. erythropus* (LWFG at 2 sites) and Greylag Geese *A. anser* (GG at 1 site) based on positional fixes from deployed GPS loggers overlaid on official land use maps of China. Axis label gives number of birds (n) contributing total number of positional fixes (N). **Habitat use and home ranges of five wintering goose species in China**

# Are declining populations of wild geese in China 'prisoners' of their natural habitats?



Map showing cumulative 50% and 90% home ranges (see Supplemental Information: experimental procedures for methods) of individuals of the same five goose species in the central part of Poyang Lake, Jiangxi Province. Ranges are generated based on positional fixes from deployed GPS loggers overlaid on the 2010 national China Ecosystem Assessment (CEA) land-use map with 30x30m resolution, blue representing open water and natural wetlands combined.



Overview of spring migration and stopover site dataset for Anatidae. The dataset includes 222 spring migrations from 193 individuals belonging to 14 populations (five grazers, seven facultative herbivores and two omnivores) of 10 species covering Europe, East Asia and North America, from 1995 to 2016. Points are stopover site locations; point colour corresponds to background colour of species names; consecutive stopover sites during the individual migrations are connected by a line, as an indication of migration route. (Photo credits in order of appearance: J. Frade, M. Langthim, P. Ertl, Y. Muzika, O. Samwald, D. Cooper, B. Keen, S. Harvančík, S. Harvančík and M. Panchal).

**Comparison of three different methods for assessing the level of support for the green wave hypothesis**

Species	Population	Feeding guild	Simple Conventional Correlation <sup>a</sup>	Correlation method evaluated by Stochastic Migrations <sup>a,b</sup>	MSSM <sup>c</sup>
Barnacle Goose <i>Branta leucopsis</i>	Greenland	Grazer	○	○	○
Barnacle Goose <i>Branta leucopsis</i>	Svalbard	Grazer	◐	●	●
Barnacle Goose <i>Branta leucopsis</i>	Barents Sea	Grazer	◐	●	●
Greater White-fronted Goose <i>Anser albifrons</i>	Barents Sea	Grazer	◐	●	●
Greater White-fronted Goose <i>Anser albifrons</i>	East Asia	Grazer	○	○	○
Whooper Swan <i>Cygnus cygnus</i>	East Asia	Facultative herbivore	●	● <sup>d</sup>	○
Tundra Swan <i>Cygnus columbianus</i>	East Asia	Facultative herbivore	○	○	○
Swan Goose <i>Anser cygnoides</i>	East Asia	Facultative herbivore	○	○	○
Taiga Bean Goose <i>Anser fabalis</i>	Scandinavia	Facultative herbivore	○	○	○
Tundra Bean Goose <i>Anser serrirostris</i>	East Asia	Facultative herbivore	○	○	○
Pink-footed Goose <i>Anser brachyrhynchus</i>	Svalbard	Facultative herbivore	◐	●	○
Greater White-fronted Goose <i>Anser albifrons</i>	Greenland	Facultative herbivore	○	○	○
Mallard <i>Anas platyrhynchos</i>	East Asia	Omnivore	○	○	○
Northern Pintail <i>Anas acuta</i>	North America	Omnivore	◐	○	○
Criteria to evaluate the level of support <sup>e</sup>					
Differences among feeding guilds			X	X	✓
Effect of bill morphology			X	X	✓

Scientific names of species were shown in italics. The three methods are Simple Conventional Correlation of arrival time, Correlations based on Stochastic Migrations, and Metric Selection approach based on Stochastic Migrations (MSSMs). Level of support (from high to low) is marked as ● for a surfer, ◐ for a weak surfer in Simple Conventional Correlation, and ○ for a non-surfer. ✓/X denotes that the results met/failed to meet the evaluation criteria. See Supplementary Table 1 for definitions of surfer, weak surfer and non-surfer

<sup>a</sup>Statistical results are shown in Supplementary Table 5




<sup>b</sup>Results only applicable for green wave surfers or weak surfers identified by Simple Conventional Correlations

<sup>c</sup>Based on results using the instantaneous rate of green-up (IRG) metric; statistical results are shown in Figs. 2-4 and Supplementary Figs. 4-6

<sup>d</sup>Supported by stochastic timing migrations, the only stochastic migration because of the lack of migration tracks for simulation of the other two types of stochastic migrations

<sup>e</sup>Statistical results are shown in Supplementary Table 4

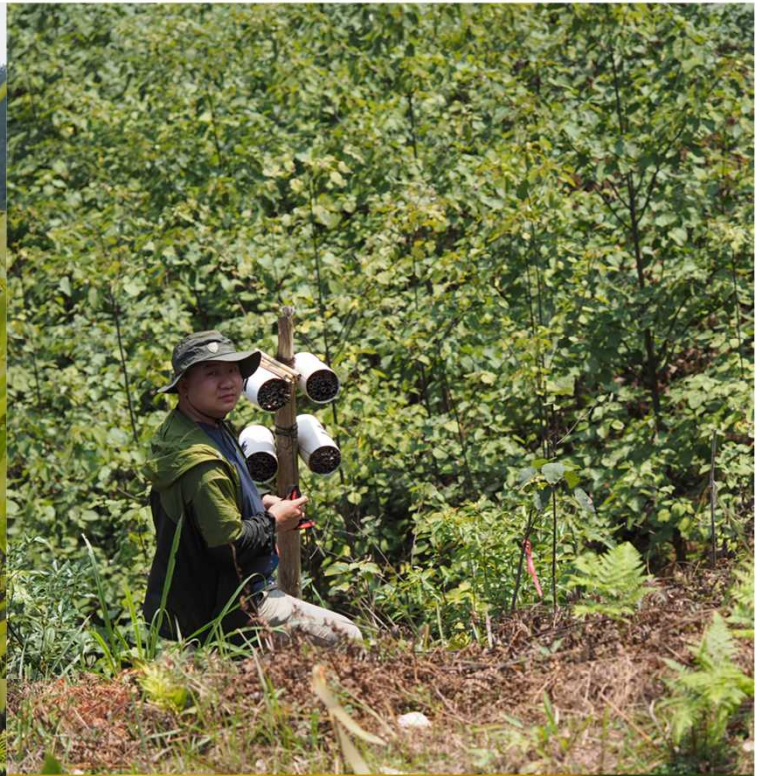
# Stochastic simulations reveal few green wave surfing populations among spring migrating herbivorous waterfowl

Xin Wang <sup>1,2</sup>, Lei Cao<sup>1,3</sup>, Anthony D. Fox<sup>4</sup>, Richard Fuller <sup>5</sup>, Larry Griffin<sup>6</sup>, Carl Mitchell<sup>6</sup>, Yunlin Zhao<sup>7</sup>, Oun-Kyong Moon<sup>8</sup>, David Cabot<sup>9</sup>, Zhenggang Xu<sup>6</sup>, Nyambayar Batbayar<sup>10</sup>, Andrea Kölzsch <sup>11,12,13</sup>, Henk P. van der Jeugd<sup>14,15</sup>, Jesper Madsen<sup>4</sup>, Liding Chen<sup>1,3</sup> & Ran Nathan<sup>2</sup>

Tracking seasonally changing resources is regarded as a widespread proximate mechanism underpinning animal migration. Migrating herbivores, for example, are hypothesized to track seasonal foliage dynamics over large spatial scales. Previous investigations of this green wave hypothesis involved few species and limited geographical extent, and used conventional correlation that cannot disentangle alternative correlated effects. Here, we introduce stochastic simulations to test this hypothesis using 222 individual spring migration episodes of 14 populations of ten species of geese, swans and dabbling ducks throughout Europe, East Asia, and North America. We find that the green wave cannot be considered a ubiquitous driver of herbivorous waterfowl spring migration, as it explains observed migration patterns of only a few grazing populations in specific regions. We suggest that ecological barriers and particularly human disturbance likely constrain the capacity of herbivorous waterfowl to track the green wave in some regions, highlighting key challenges in conserving migratory birds.

Xingangshan, Jiangxi

Sino BON-Insect





# North East China



Apr., 2016



July, 2016

# Songshan, Beijing



May., 2015

# Taishan, Shandong



June., 2016

# Manas, Xinjiang



Aug., 2016

Africa

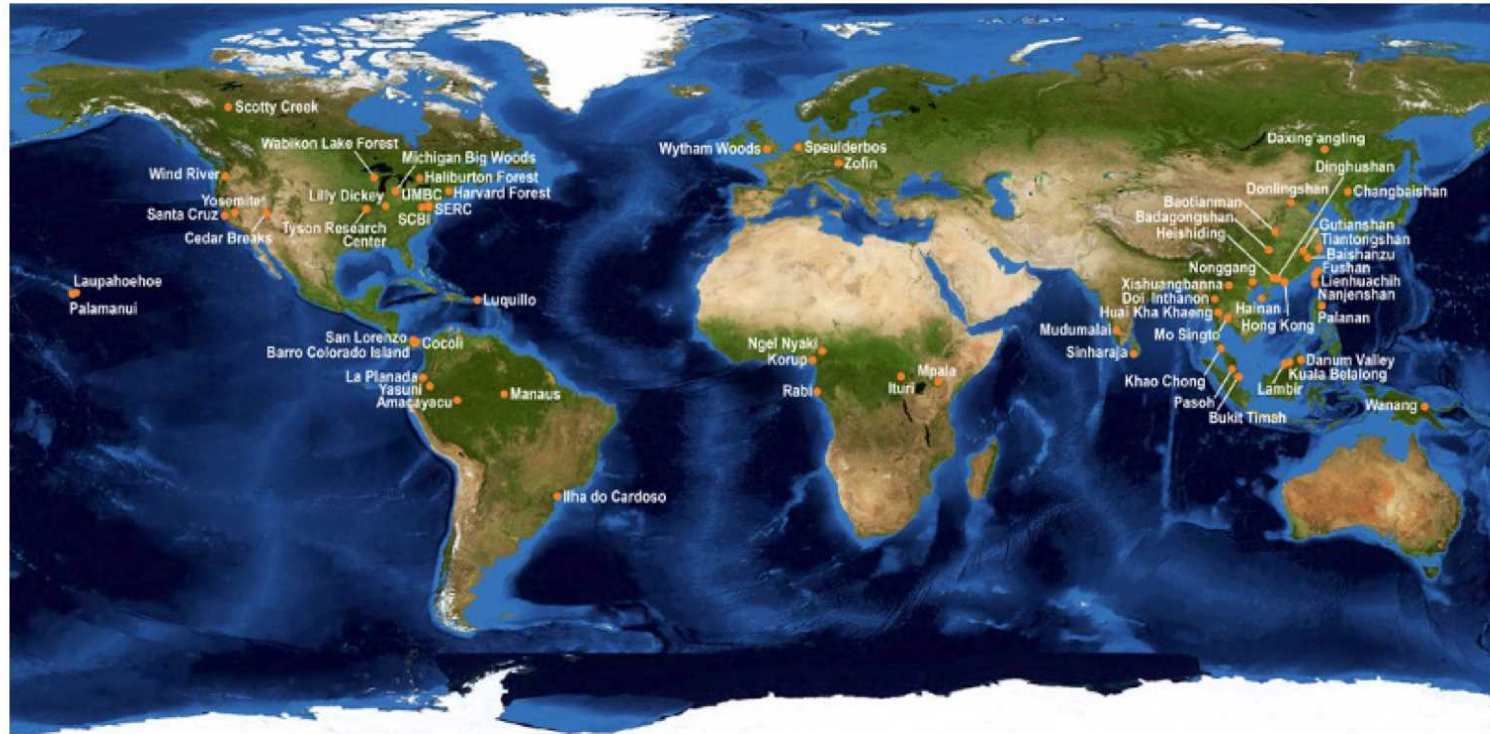
Asia

Europe

Latin America

North America

Oceania



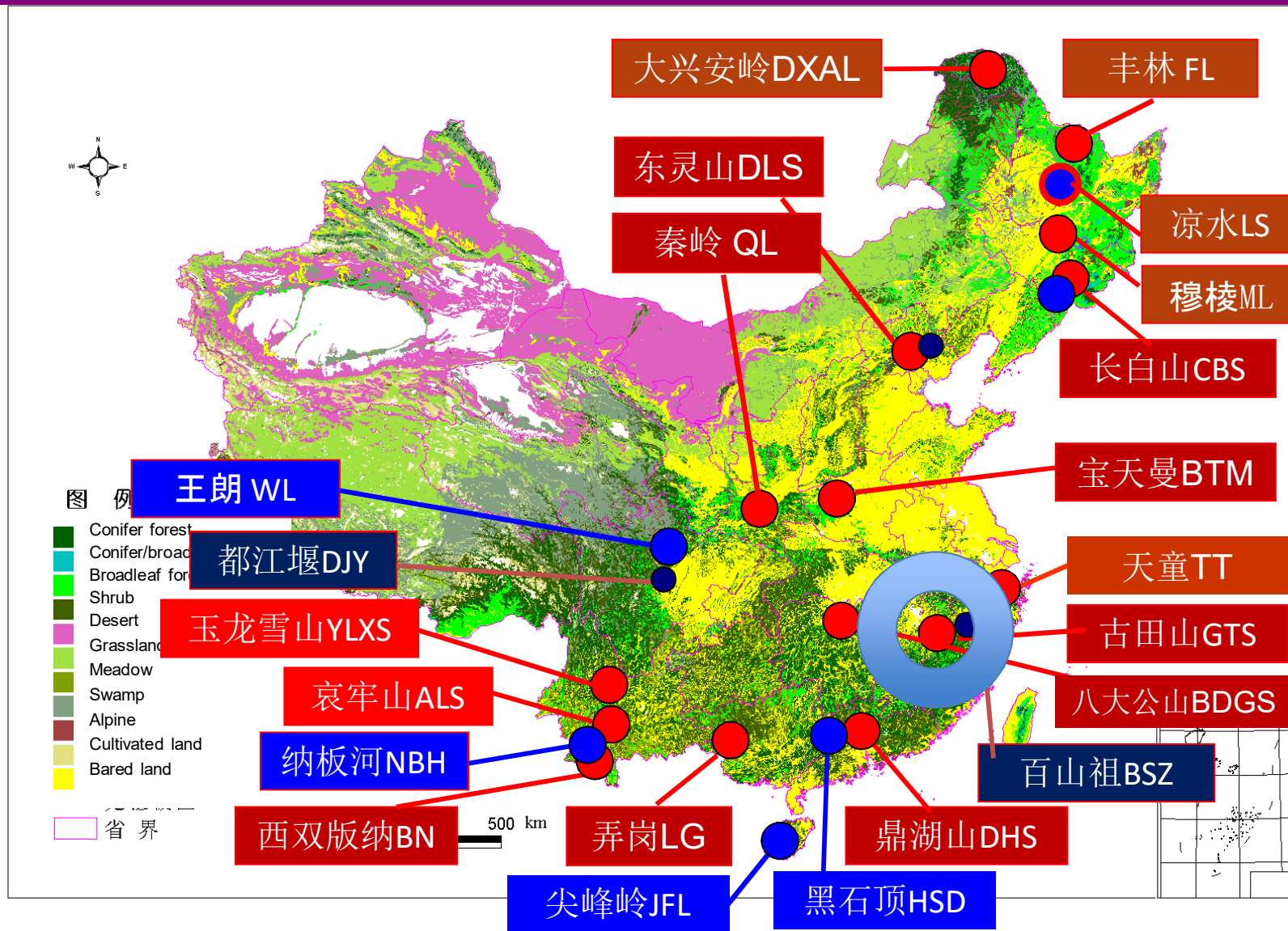
[View Larger](#)

BCI Webcam Wind River Webcam Wind River Canopy Webcam

[Announcements](#)

*Forest Global Earth Observatory* is a global network of forest research plots and scientists dedicated to the study of tropical and temperate forest function and diversity. Forest GEO conducts long-term, large-scale research on forests around the world.

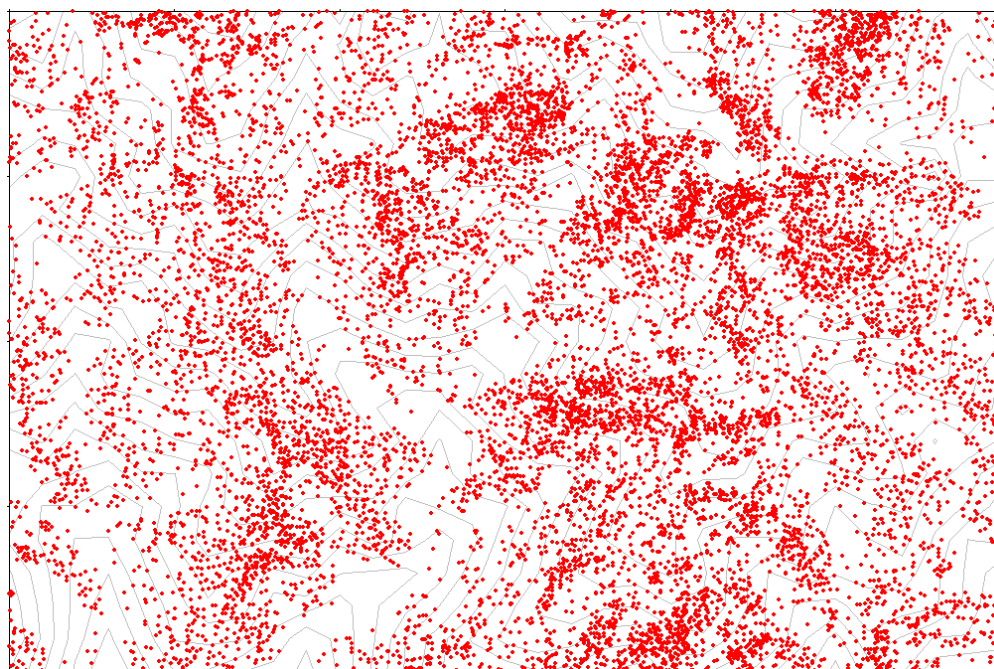
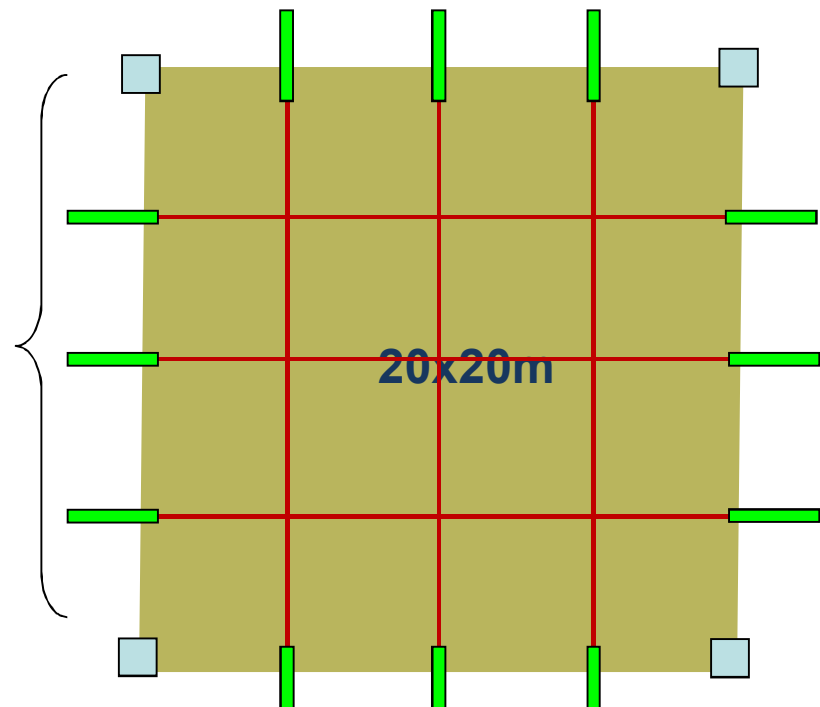
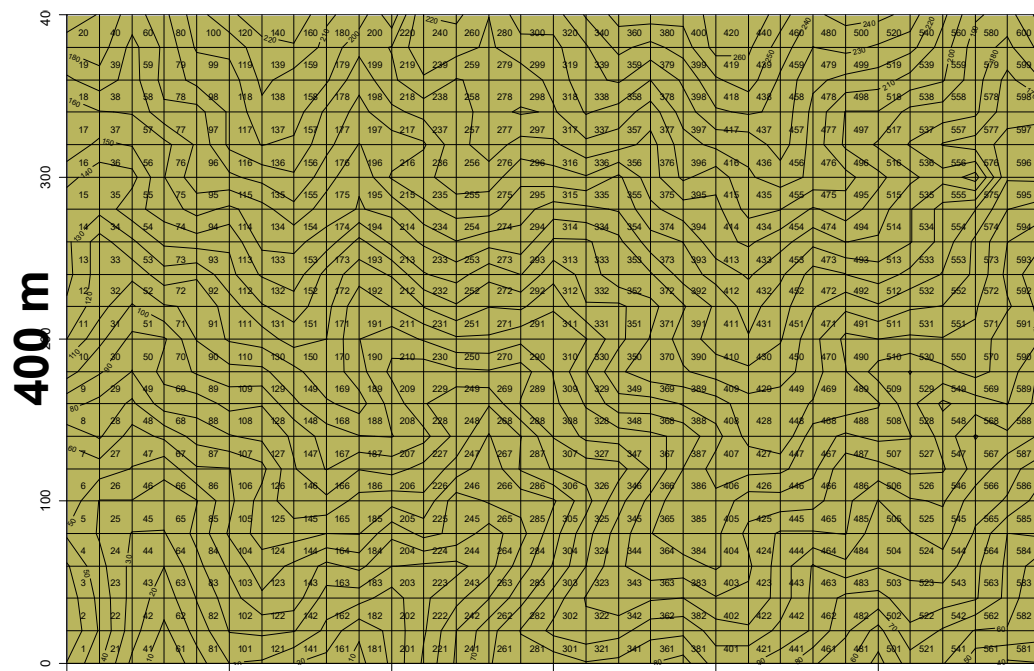
# Chinese Forest Biodiversity Monitoring Network (CForBio)



**24-ha subtropical evergreen broad-leaved forest plot  
(Gutianshan NNR-2005)**

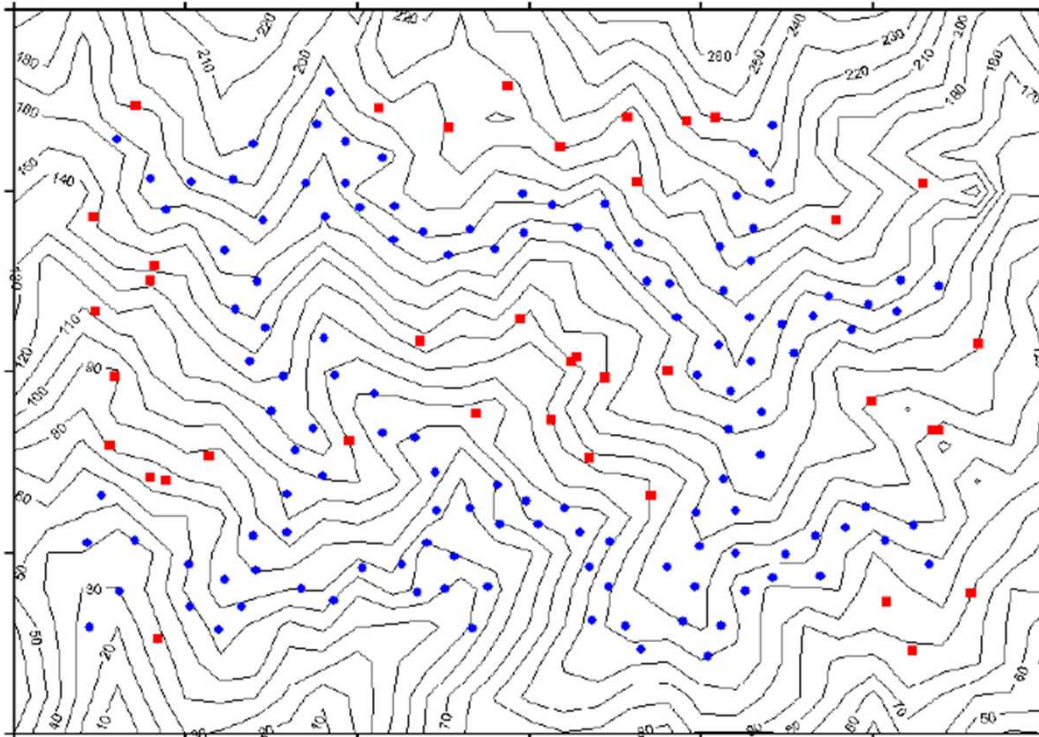


600 m

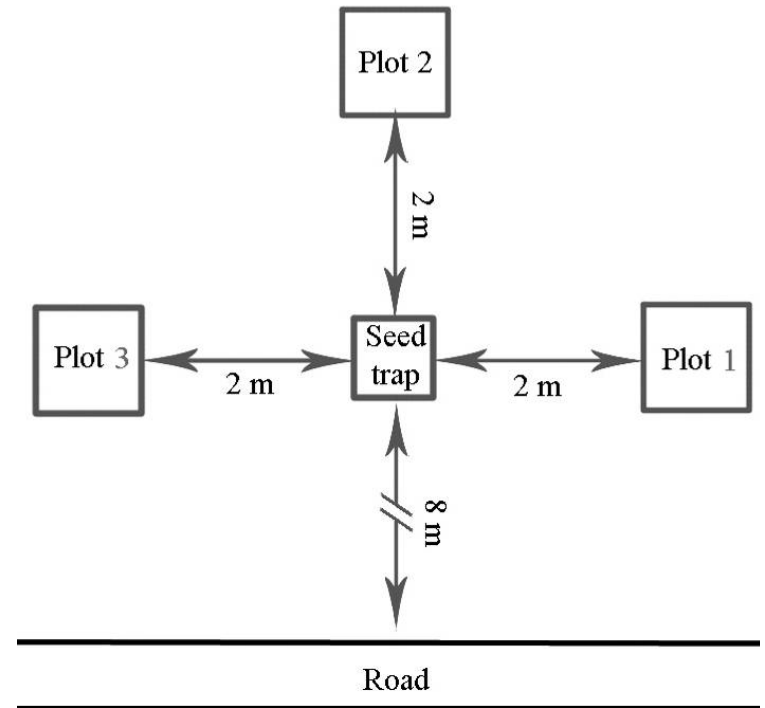


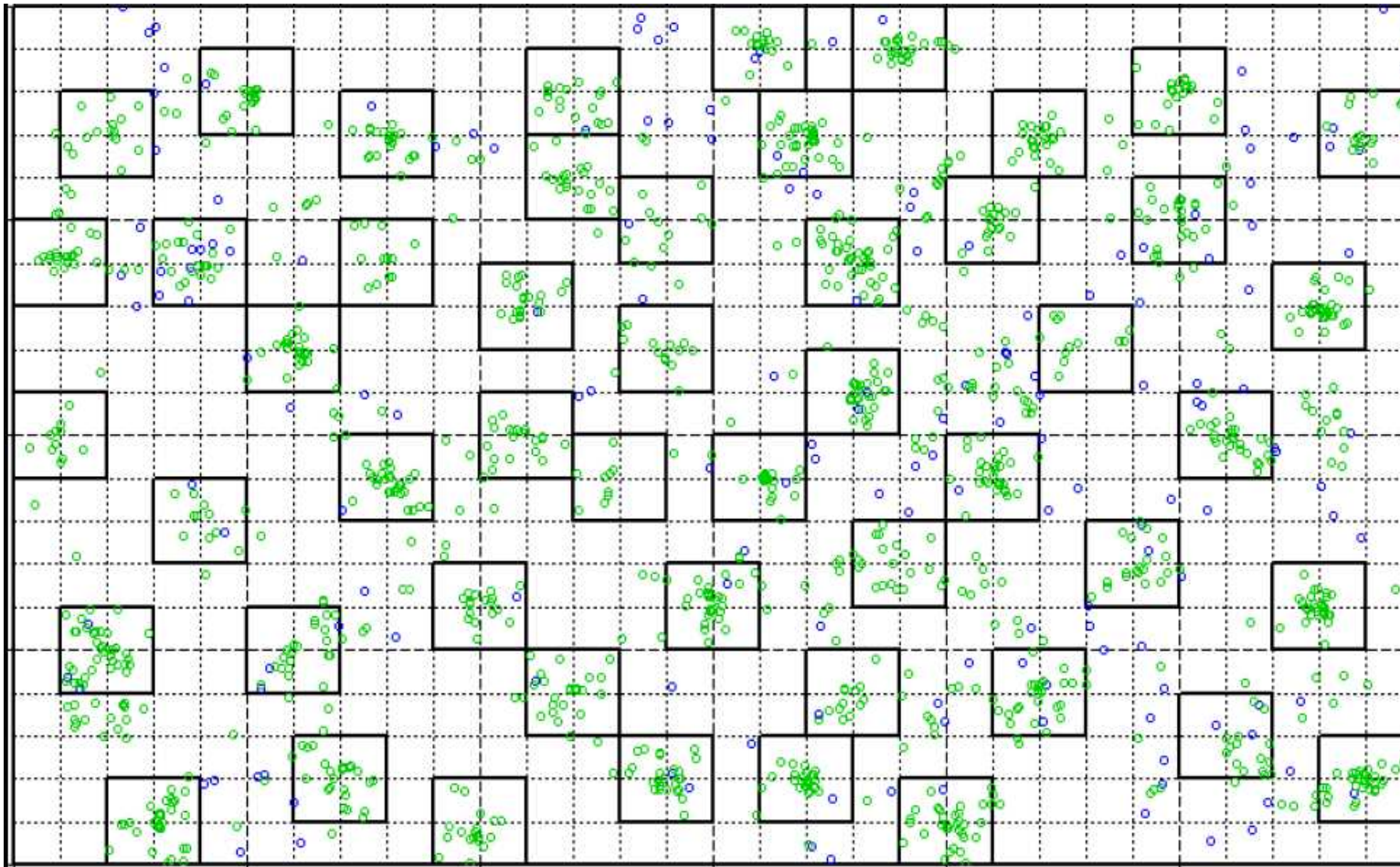


## Seed traps



## Seedling plots





>3000 trees monitored with dendrometer  
in the plot



Seeds



Seedlings



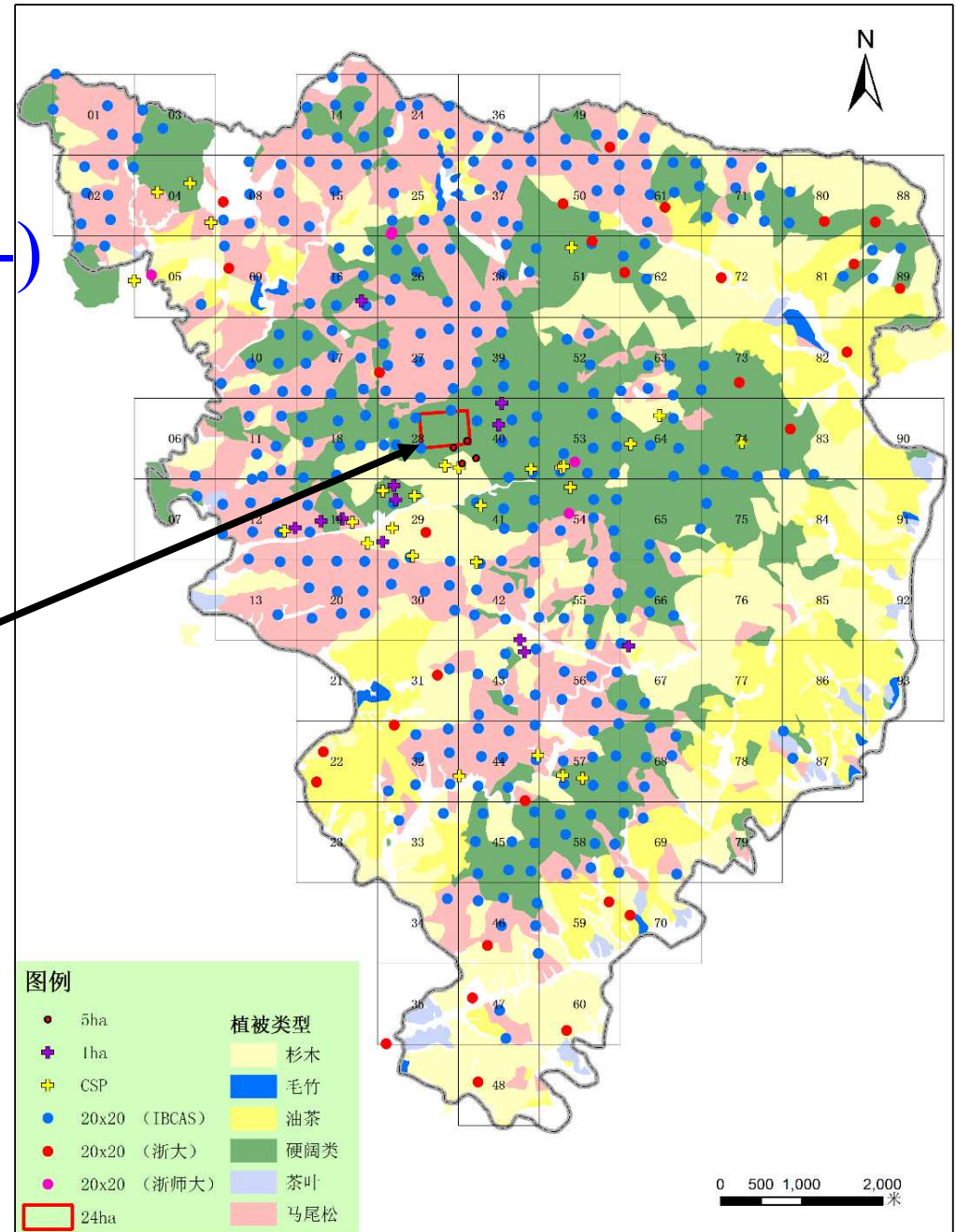
Adult trees



Saplings

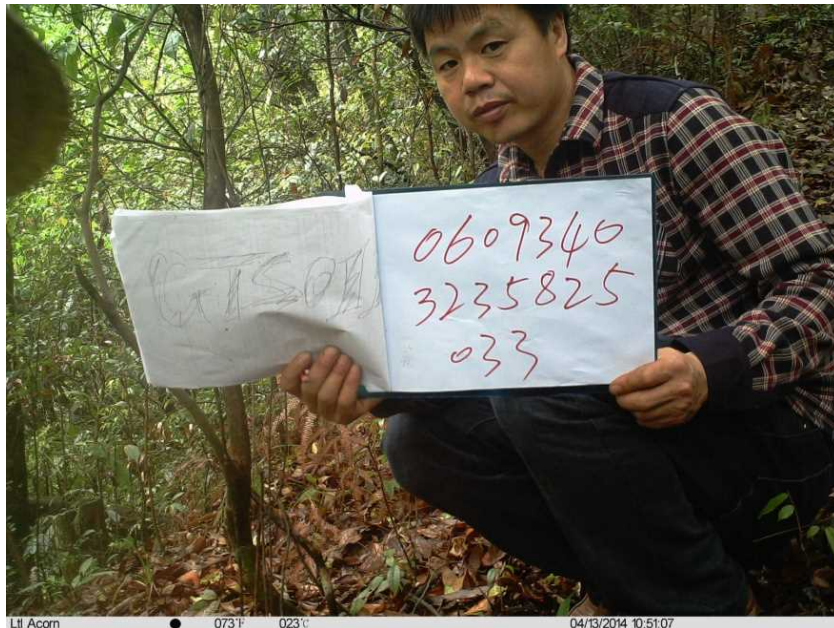


➤ 300 small plots across the reserve (2015-)

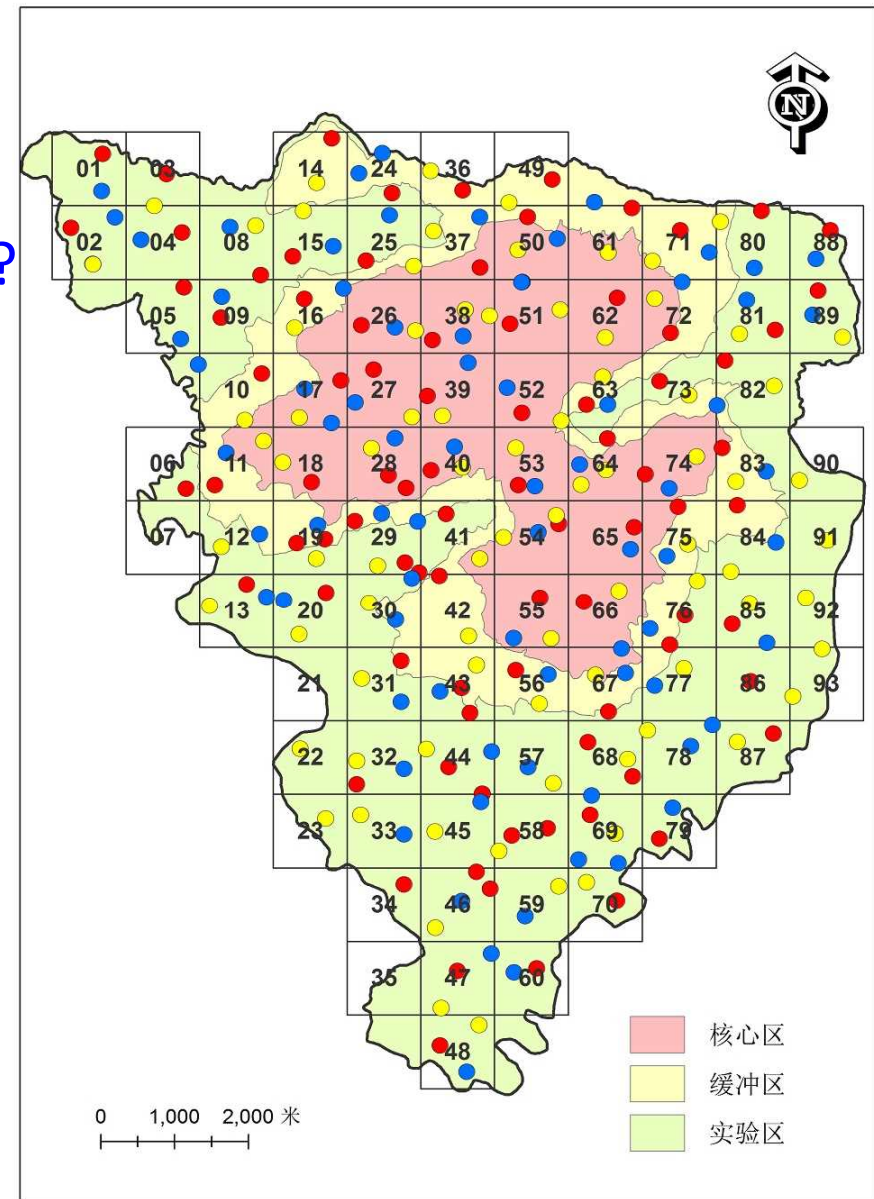


# Camera-trapping (2014-)

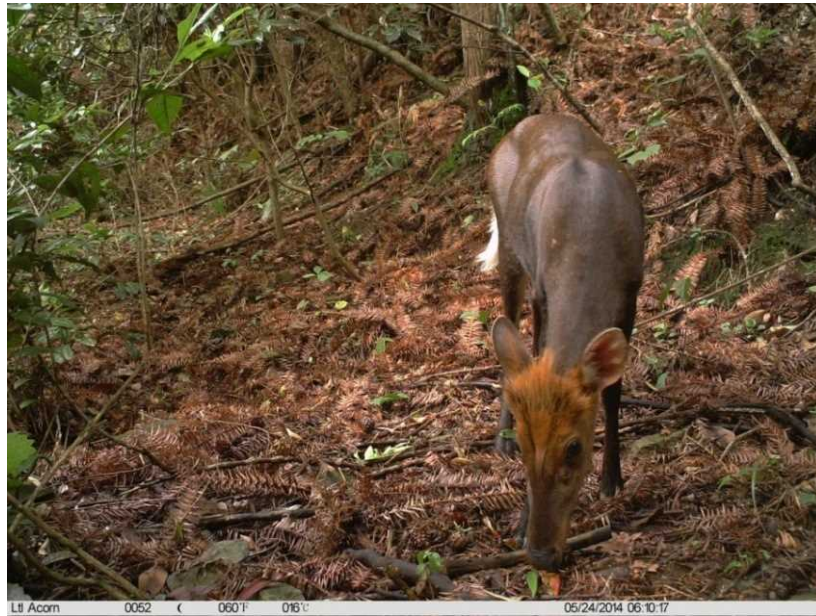
- What animals are there?
- Their distribution and abundance?
- How do they change?



Lit Acorn ● 073°F 023°C 04/13/2014 10:51:07



# 偶蹄目 Artiodactyla (Ungulates)



黑麂 *Muntiacus crinifrons*



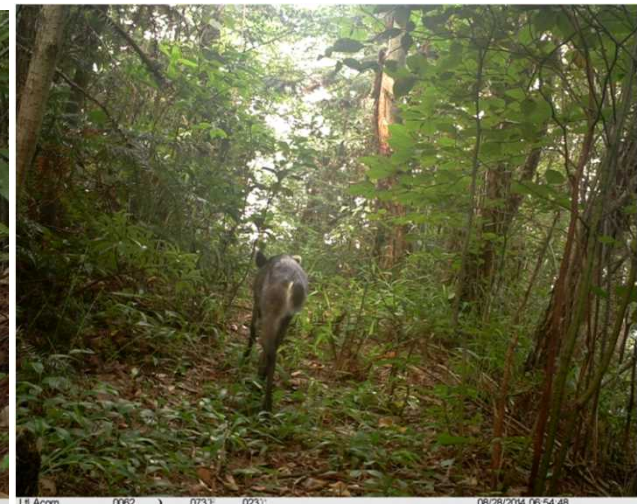
黄麂 *Muntiacus reevesi*



野猪 *Sus scrofa*



麝 *Capricornis milneedwardsii*

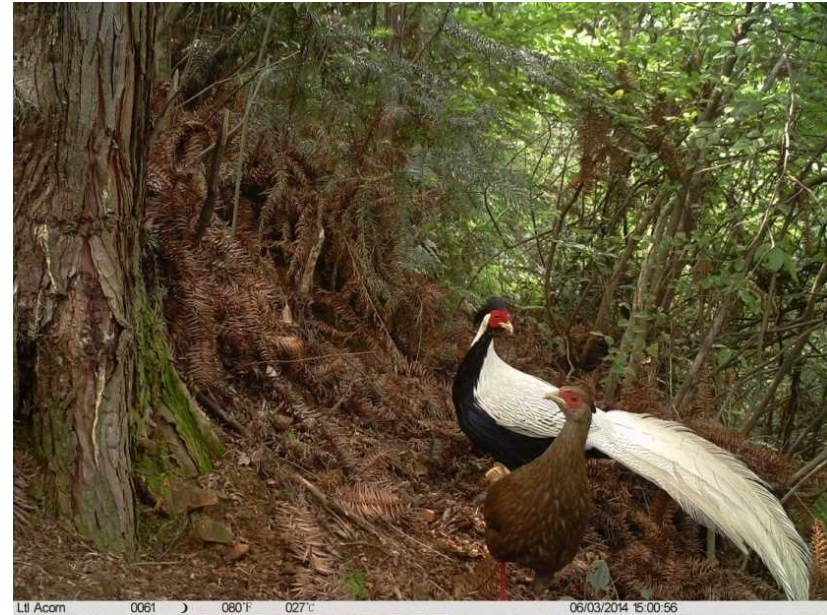


毛冠鹿 *Elaphodus cephalophus*

# 鸡形目 Galliformes (Pheasants)



白颈长尾雉 *Syrmaticus ellioti*



白鹇 *Lophura nycthemera*



灰胸竹鸡 *Bambusicola thoracicus*

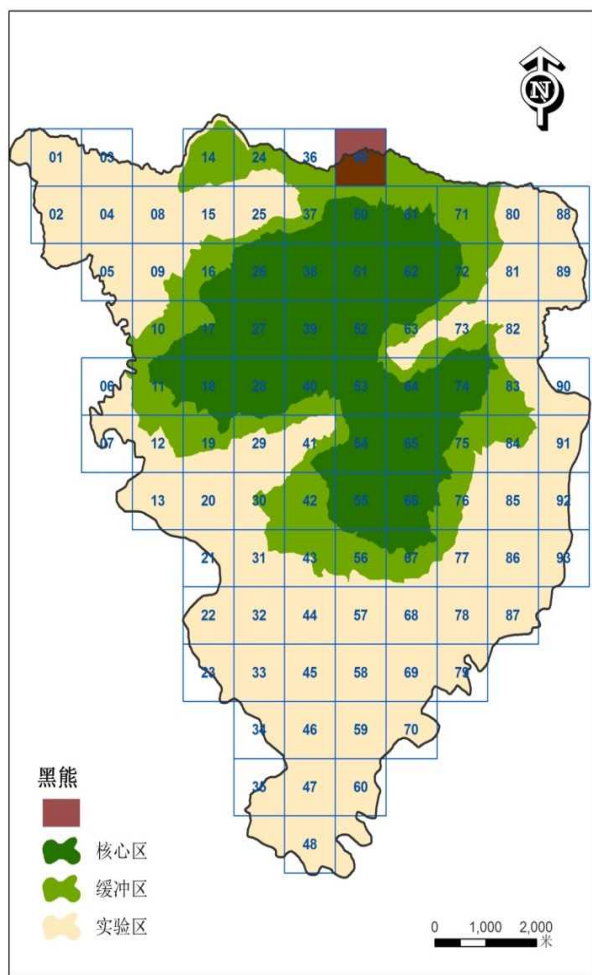


勺鸡 *Pucrasia macrolopha*

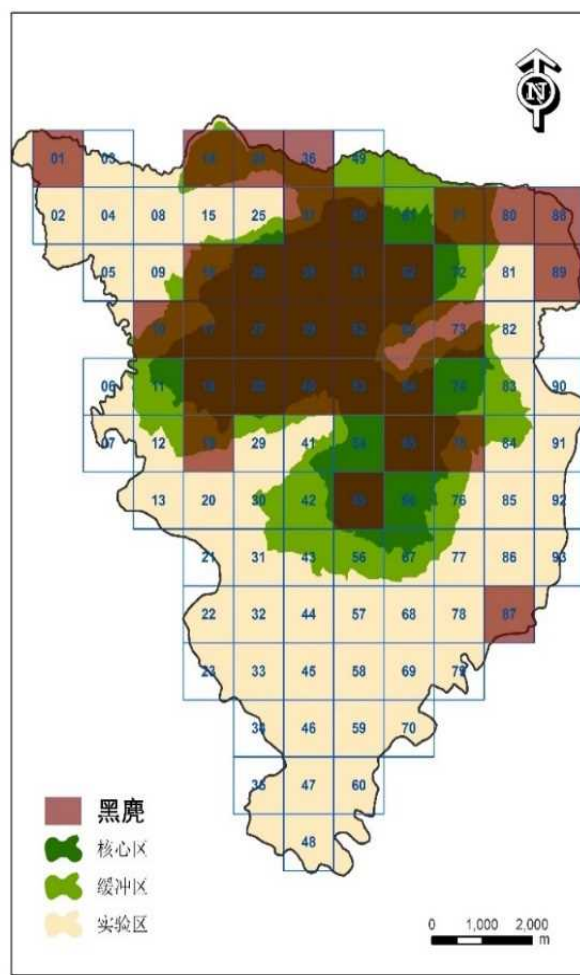


雉鸡 *Phasianus colchicus*

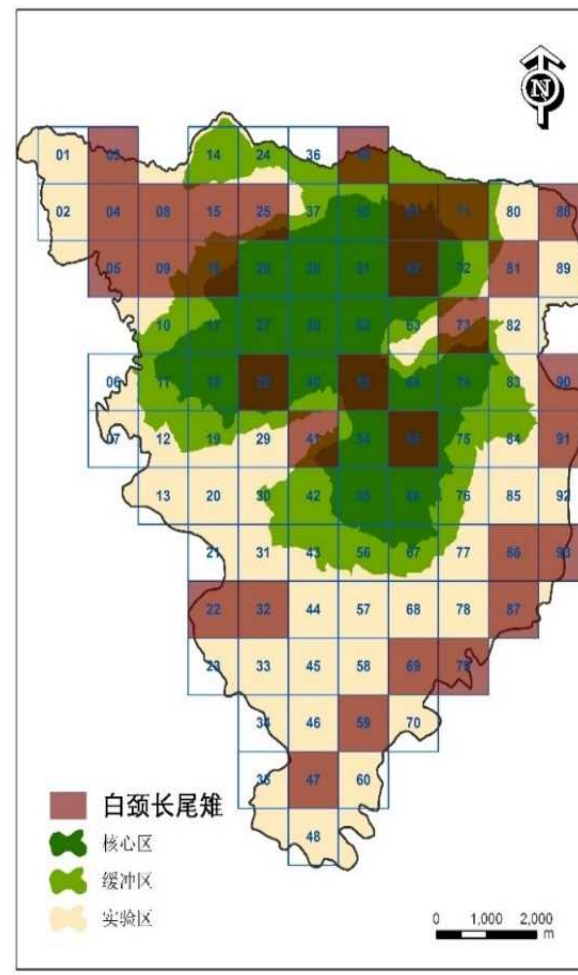
# 黑熊



# 黑鹿



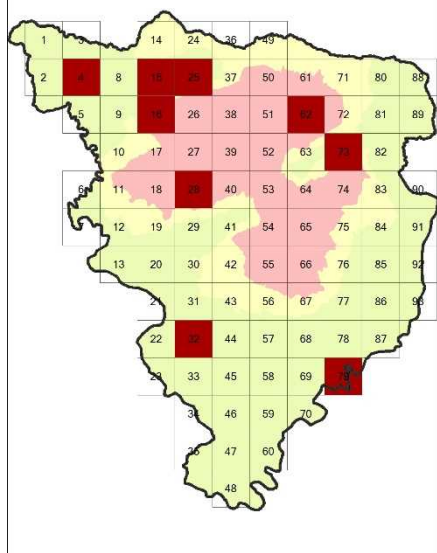
# 白颈长尾雉



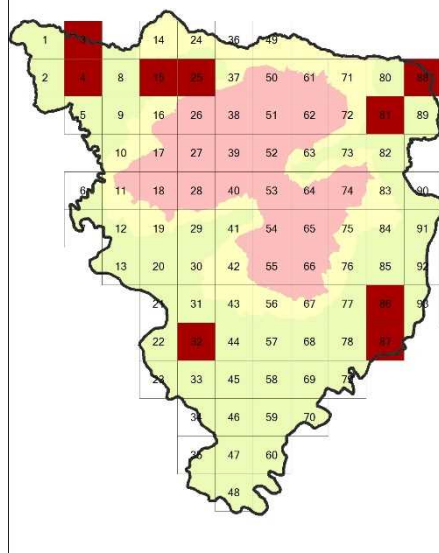




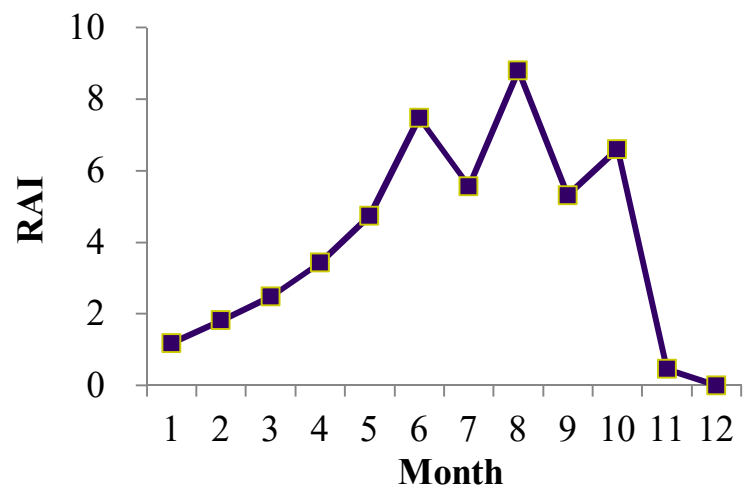
5-6, 2014



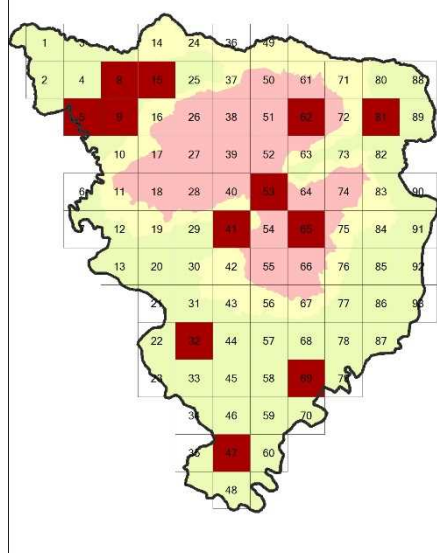
7-8, 2014



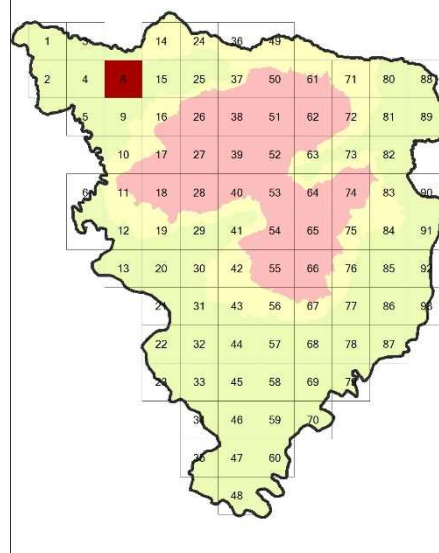
Elliot's pheasant



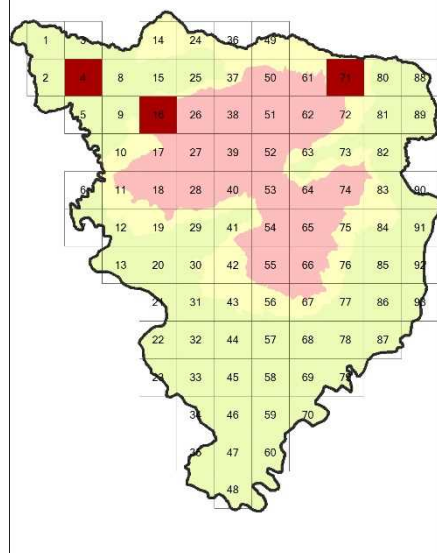
9-10, 2014



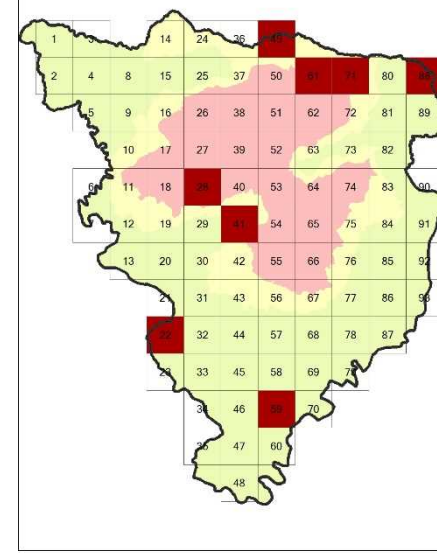
11-12, 2014



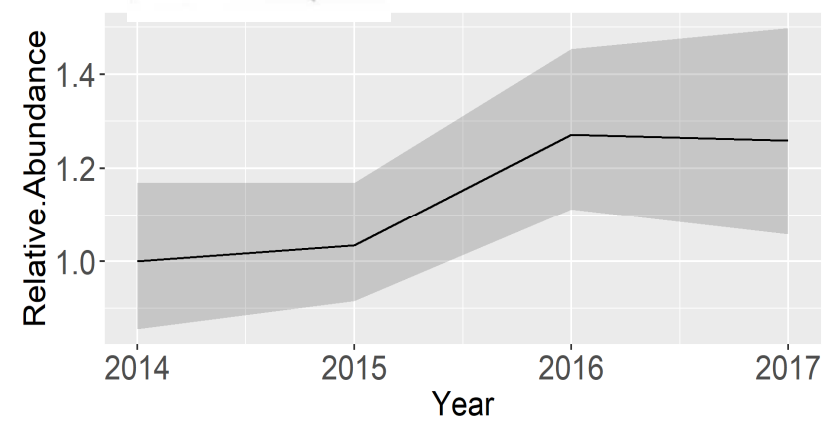
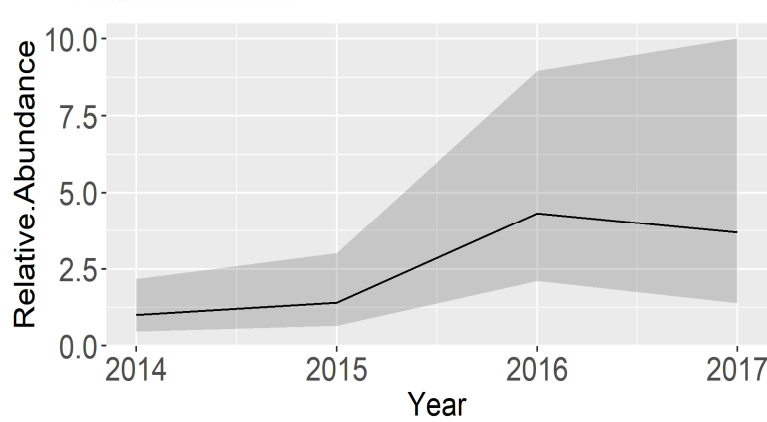
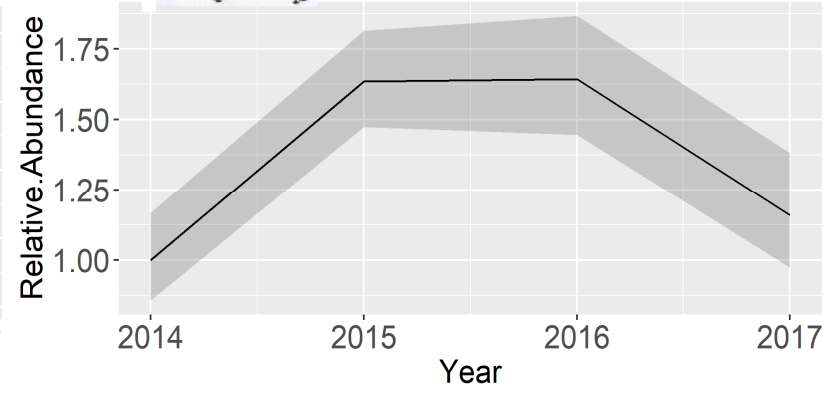
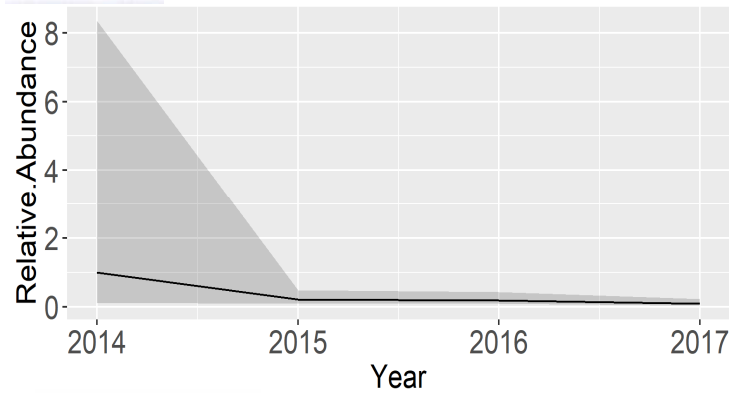
1-2, 2015

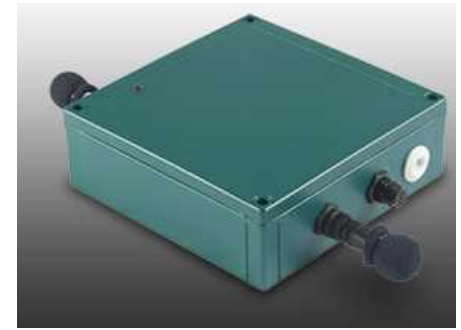


3-4, 2015

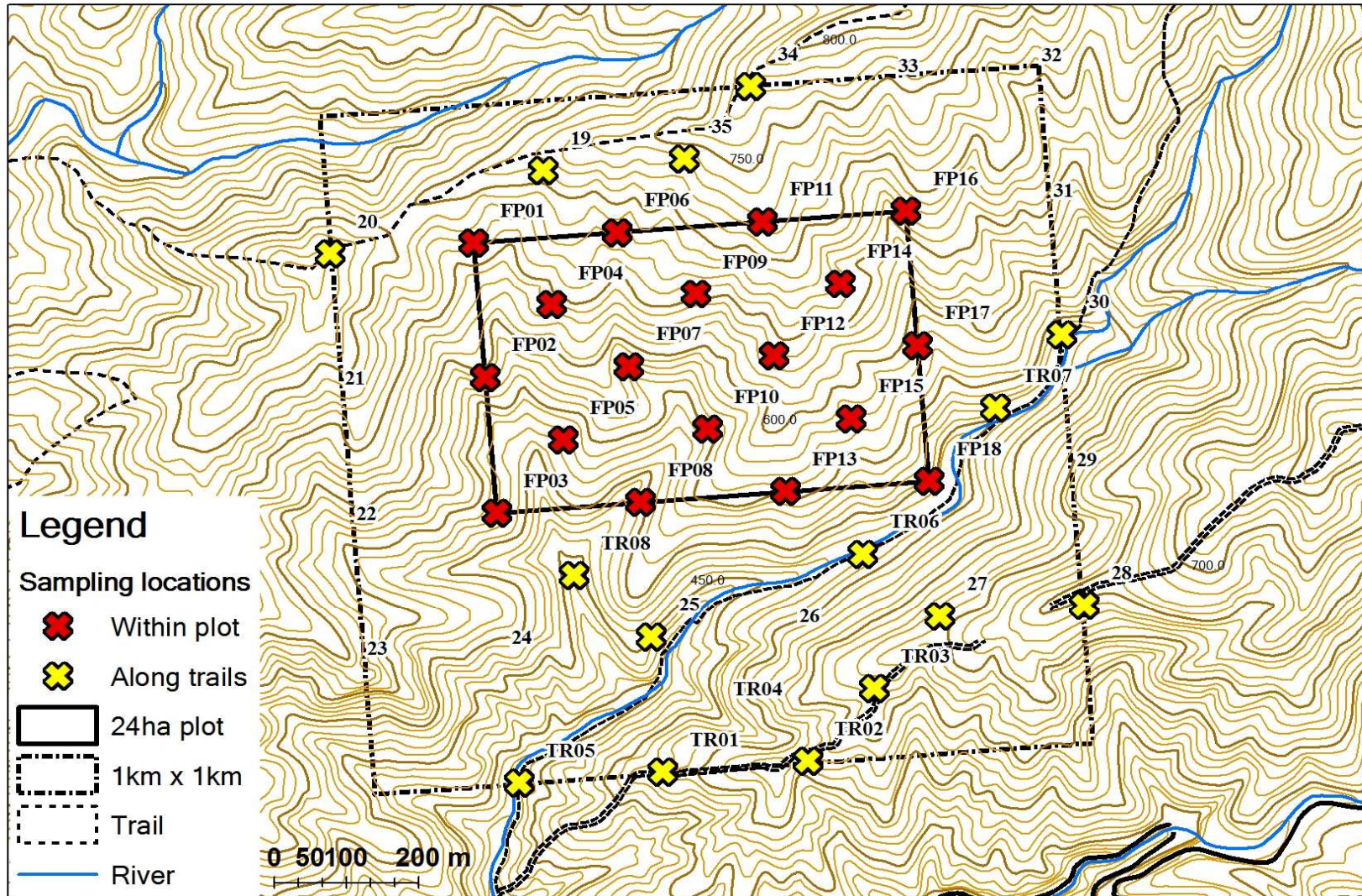


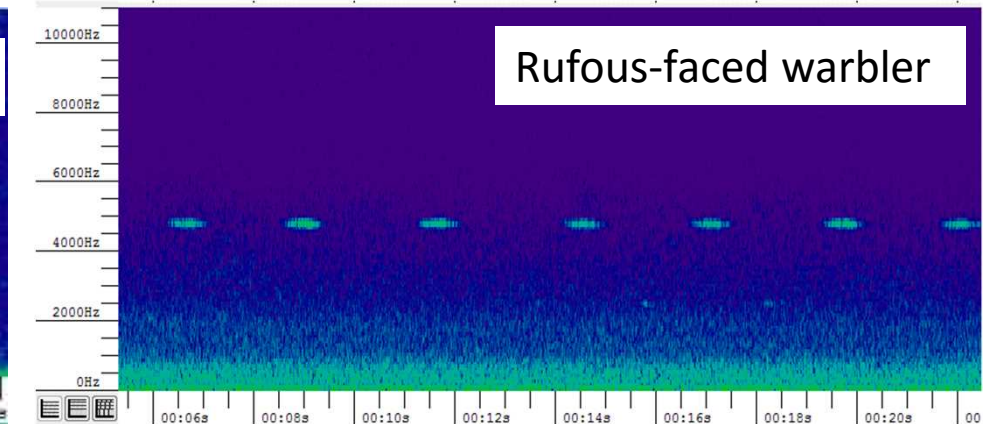
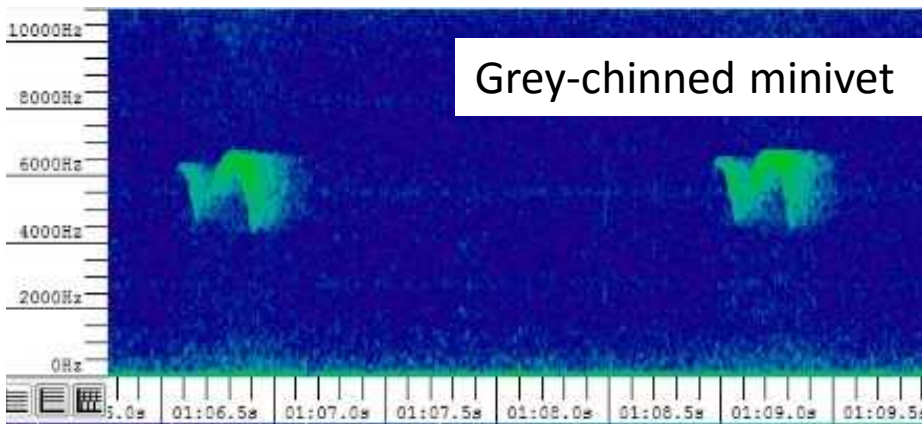
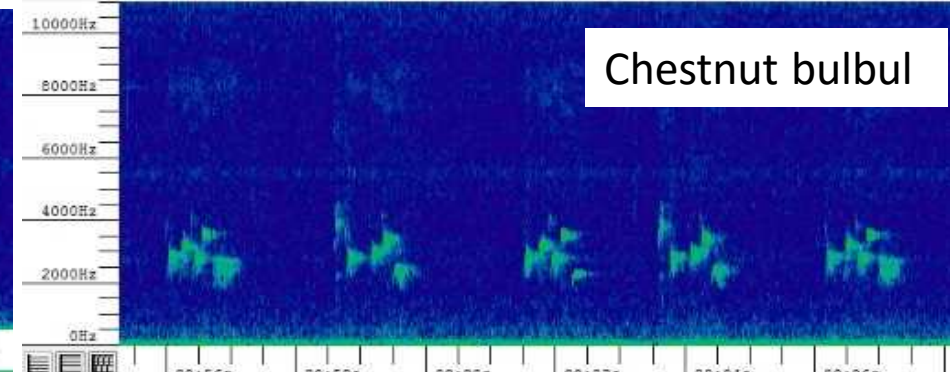
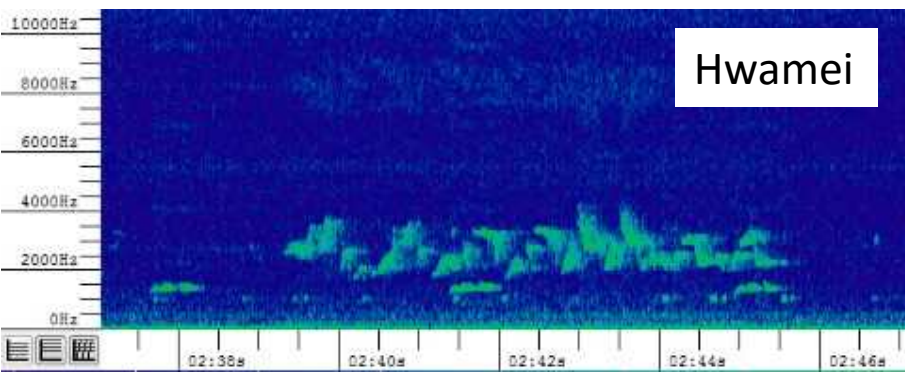
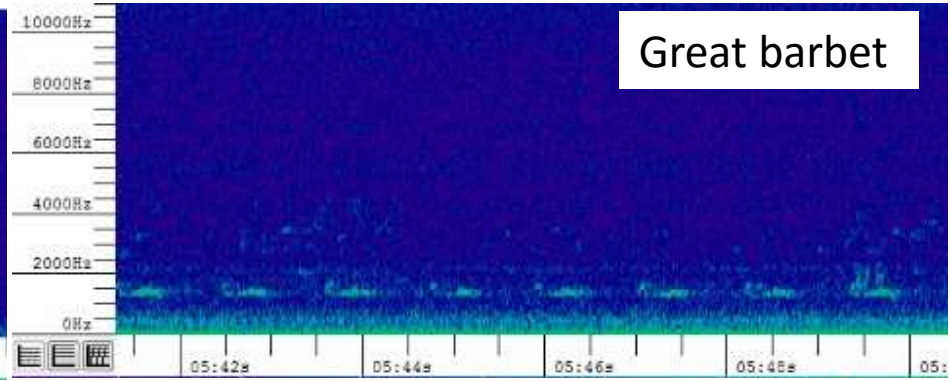
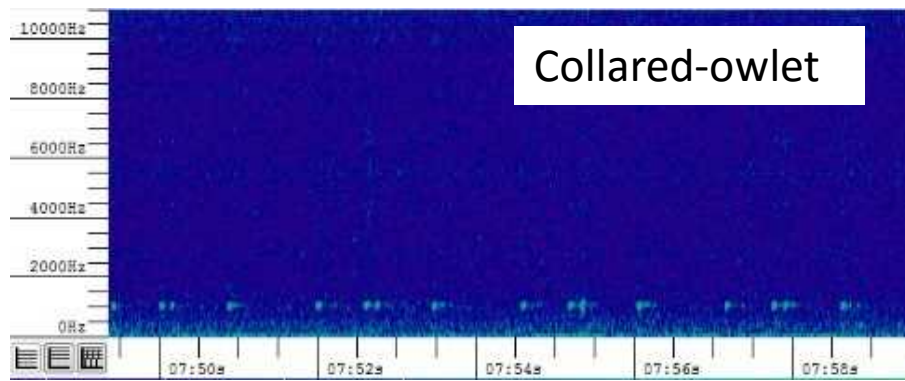
# Change of animal abundance





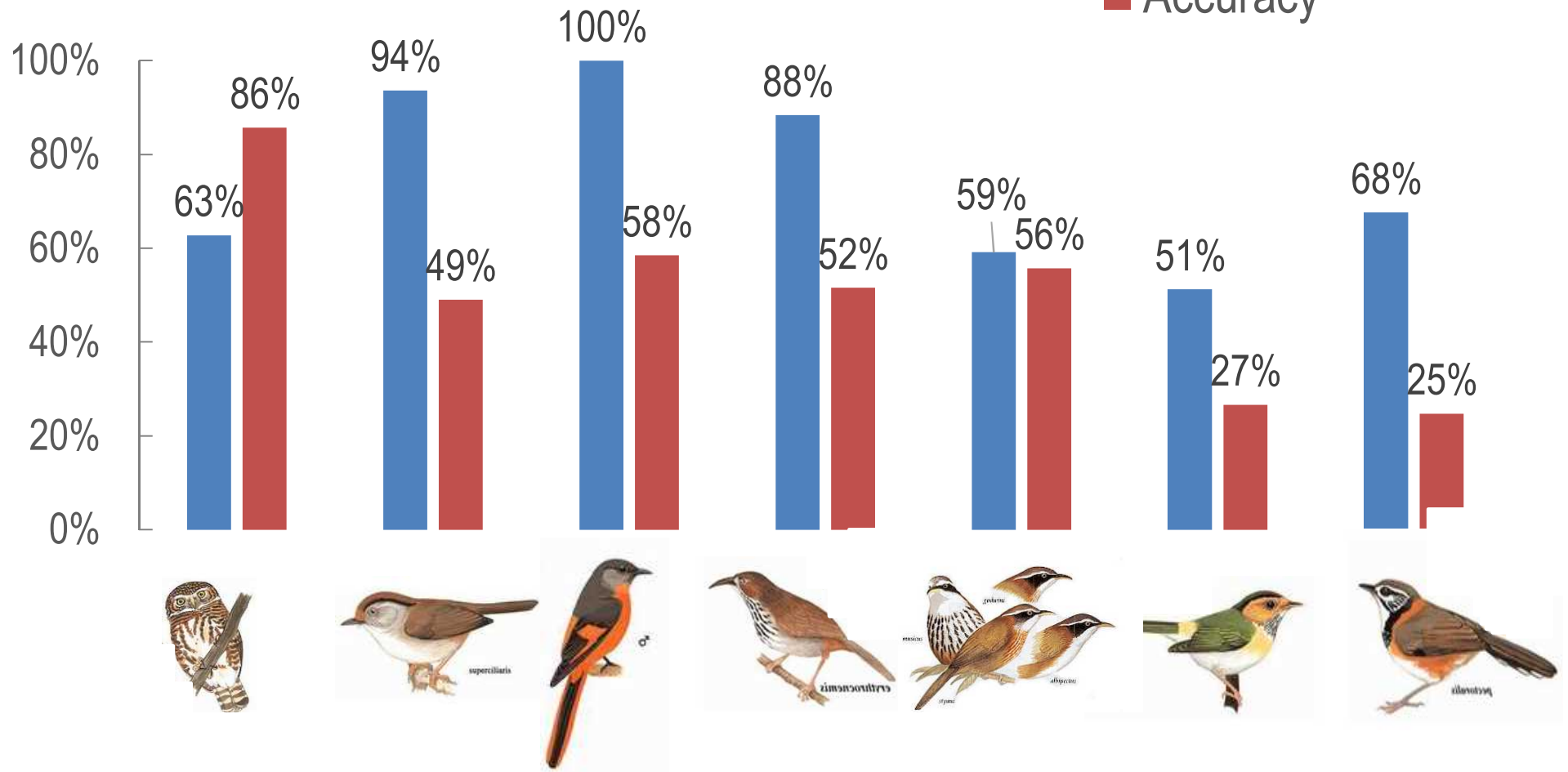
## ➤ Automated Acoustic Recording (2014-)







■ Detection rate  
■ Accuracy



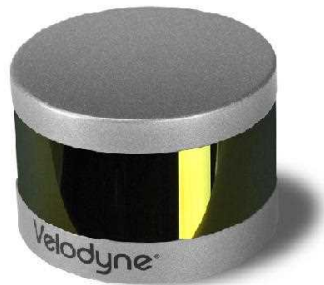
# 近地面遥感监测

## Near-surface Remote Sensing Platform



Li-Air UAV-RS  
platform  
Independent R&D

LIDAR



Hyperspectral

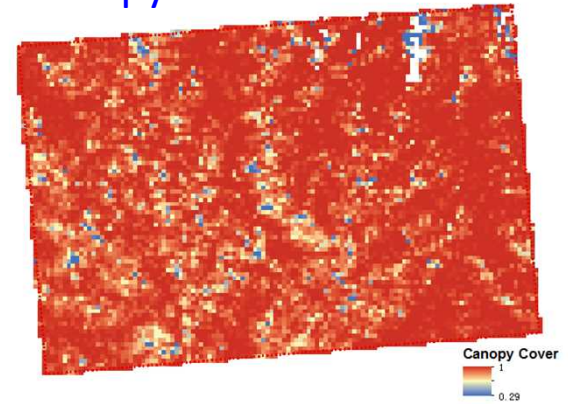


- High-resolution DEM  
3D structure information
- Canopy height model
  - LAI, Gap fraction
  - Aboveground biomass

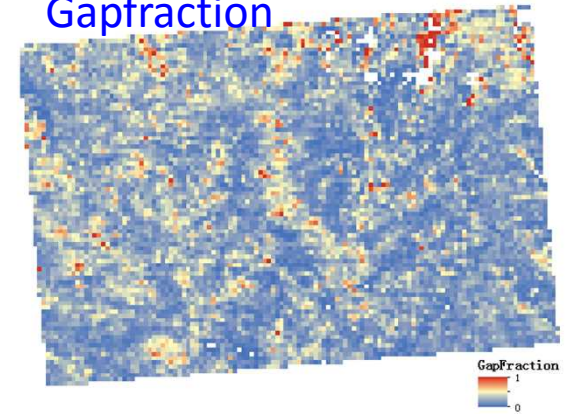
- High resolution in spectral
- Vegetation index
  - Leaf biochemical properties
  - Plant function traits

## Gutianshan 24-ha plot

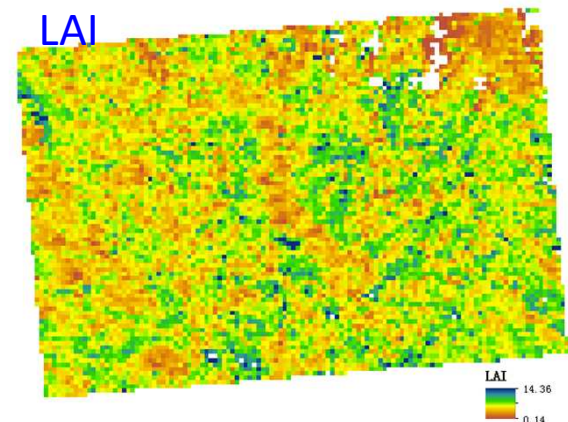
Canopy cover



Gapfraction

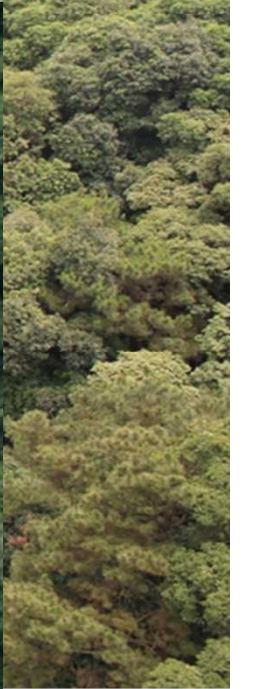


LAI



# Forest Crane





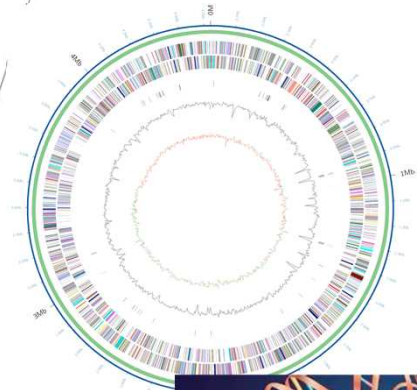
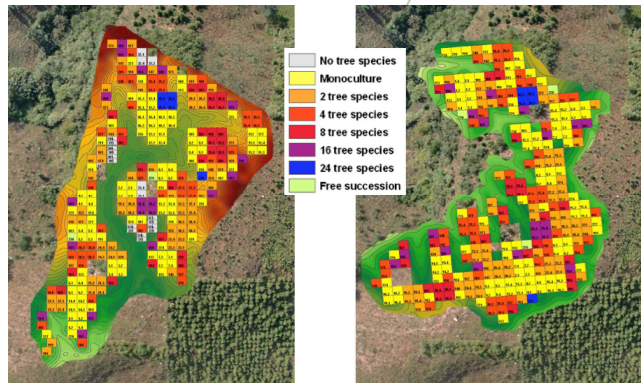
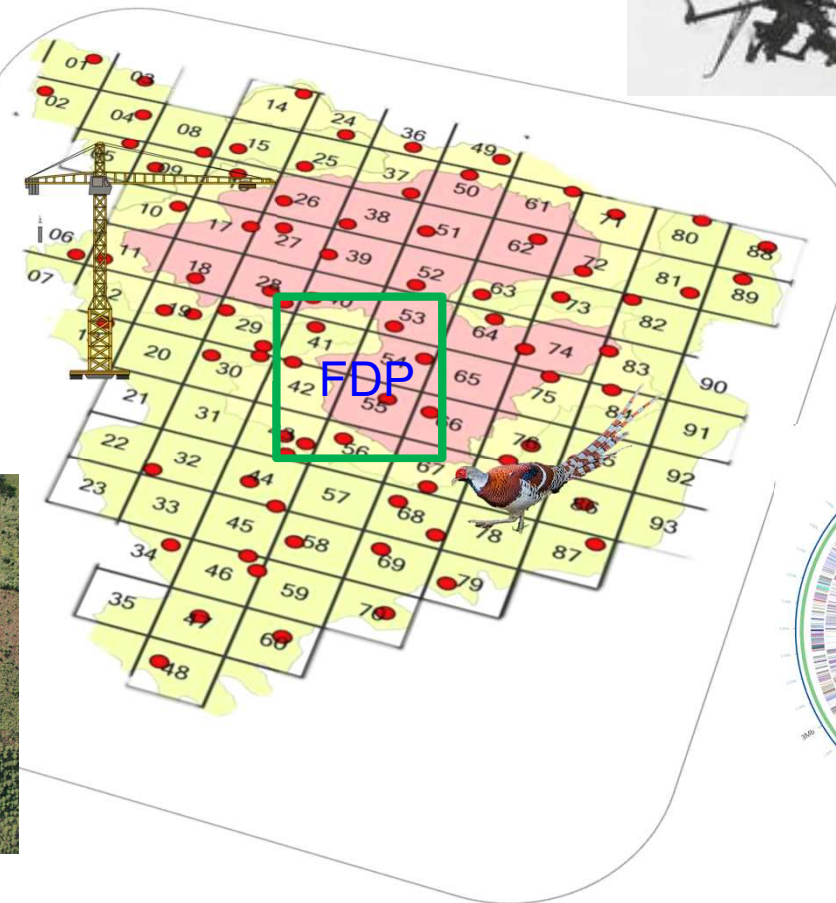
0° 北



# Ongoing monitoring program at Gutianshan

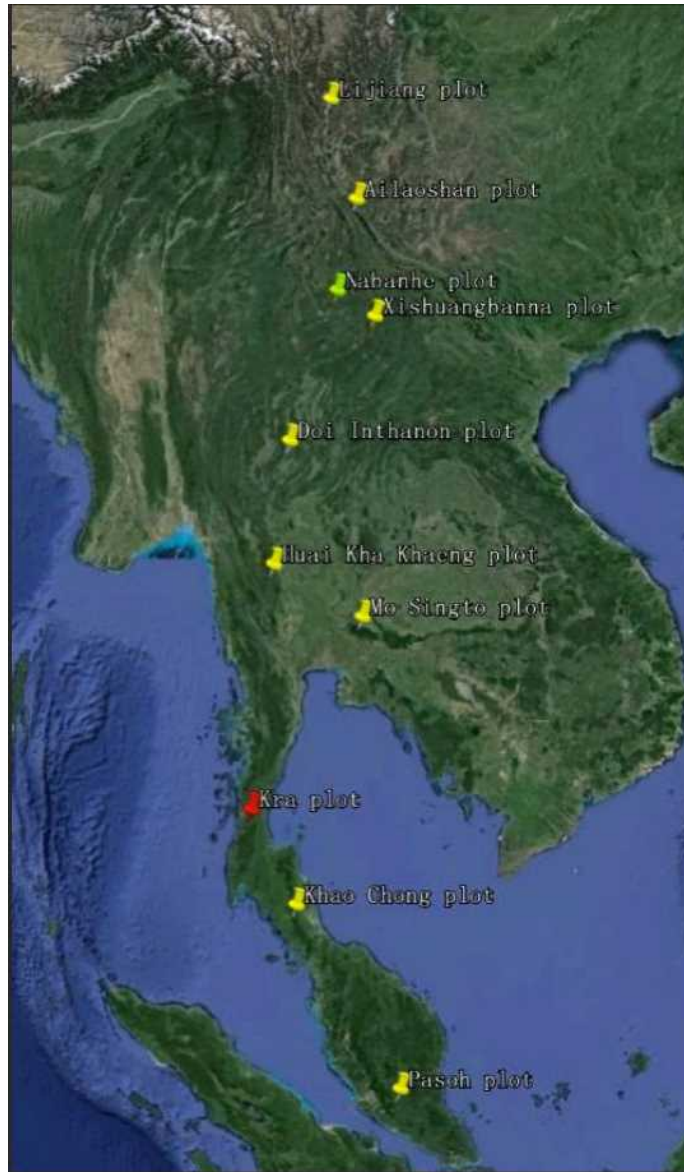
- 24-ha forest dynamics plot (2005-)
- > 300 small plots across the reserve (2015-)
- Camera-trapping for large terrestrial animals (2014-)
- Automated acoustic recording for song birds (2014-)
- Near-surface remote sensing (2016-)
- Forest crane (2018-)

# Gutianshan Integrated Monitoring System



# Regional network of FDPs

from Southwest China to Central South Peninsula of Southeast Asia



## 中国西南-中南半岛东经101度线黄金森林样带

- 全球热带雨林三大核心分布区之一
- 全球生物多样性热点地区之一
- 热带亚洲成分的分化中心
- 热带中心-热带北缘的连续完整区域（全球独一无二）
- 温度和降水自南向北连续递减区域
- 10个大型（15-50 ha）森林动态样地
- >3000 树种
- >1,000,000 个体（ $dbh \geq 1cm$ ）

From LIN Luxiang

# Academic Papers

Sci. Bull.  
DOI 10.1007/s11434-016-1132-9



Review

Life & Medical Sciences

## CForBio: a network monitoring Chinese forest biodiversity

Gang Feng · Xiangcheng Mi · Hui Yan ·  
Frank Yonghong Li · Jens-Christian Svenning ·  
Keqing Ma

Received: 25 March 2016 / Revised: 29 April 2016 / Accepted: 13 May 2016  
© Science China Press and Springer-Verlag Berlin Heidelberg 2016

**Abstract** China harbors a rich variety of forest types and forest-associated biodiversity, linked to both historical and contemporary environmental factors. However, being a country with a large population and rapid economic development, its diverse forest is facing unprecedented challenges. The Chinese Forest Biodiversity Network (CForBio) was initiated 12 years ago to study the maintenance of biodiversity in China's forest ecosystems. In this review, we first summarize research progress in CForBio, and then give suggestions for future research. In the past 12 years, the research based on CForBio mainly focused on local ecological factors, such as environment filtering, biotic interactions and small-scale dispersal limitation. We

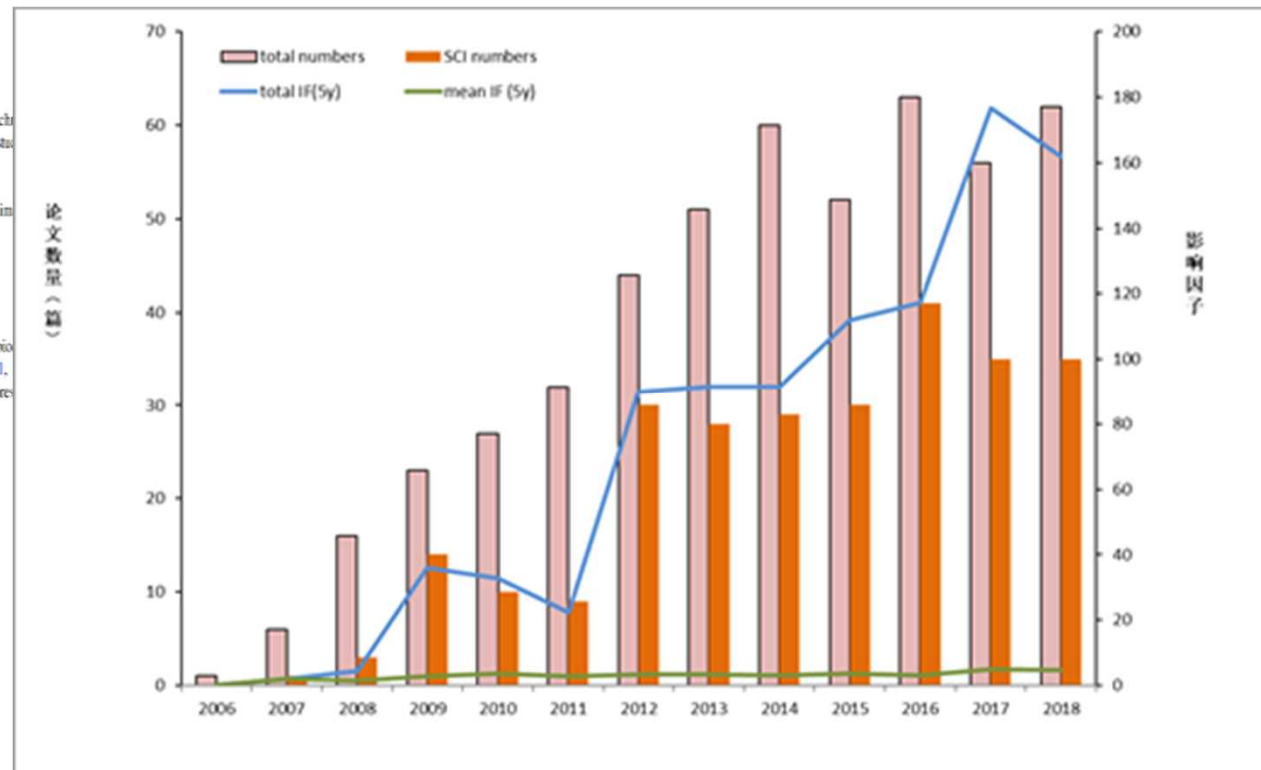
structure and functioning; (4) include new technologies such as remote sensing, to better monitor and study biodiversity change and maintenance.

**Keywords** Forest ecosystem · Defaunation · Climate change · Remote sensing

### 1 Introduction

Forests play important roles in maintaining biodiversity and for the functioning of the biosphere [1], majority of species described on Earth live in forests

	2007-2019.6	2019.6
All papers	515	22
SCI	283	17



# Academic Papers

生物多样性 2018, 26 (12): 1255–1267

*Biodiversity Science*



## Research trends and hotspots of Chinese Forest Biodiversity Monitoring Network (CForBio): A bibliometric analysis

Ruiyu Fu<sup>1,2,3</sup>, Hongxin Su<sup>1</sup>, Zhonghua Zhang<sup>1,2</sup>, Gang Hu<sup>1,2\*</sup>

1 Key Laboratory of Beibu Gulf Environment Change and Resources Utilization of Ministry of Education, Nanning Normal University, Nanning 530001

2 The Collaborative Innovation Center of the Ecological Environment and Integration Development in the Xijiang River Basin, Nanning Normal University, Nanning 530001

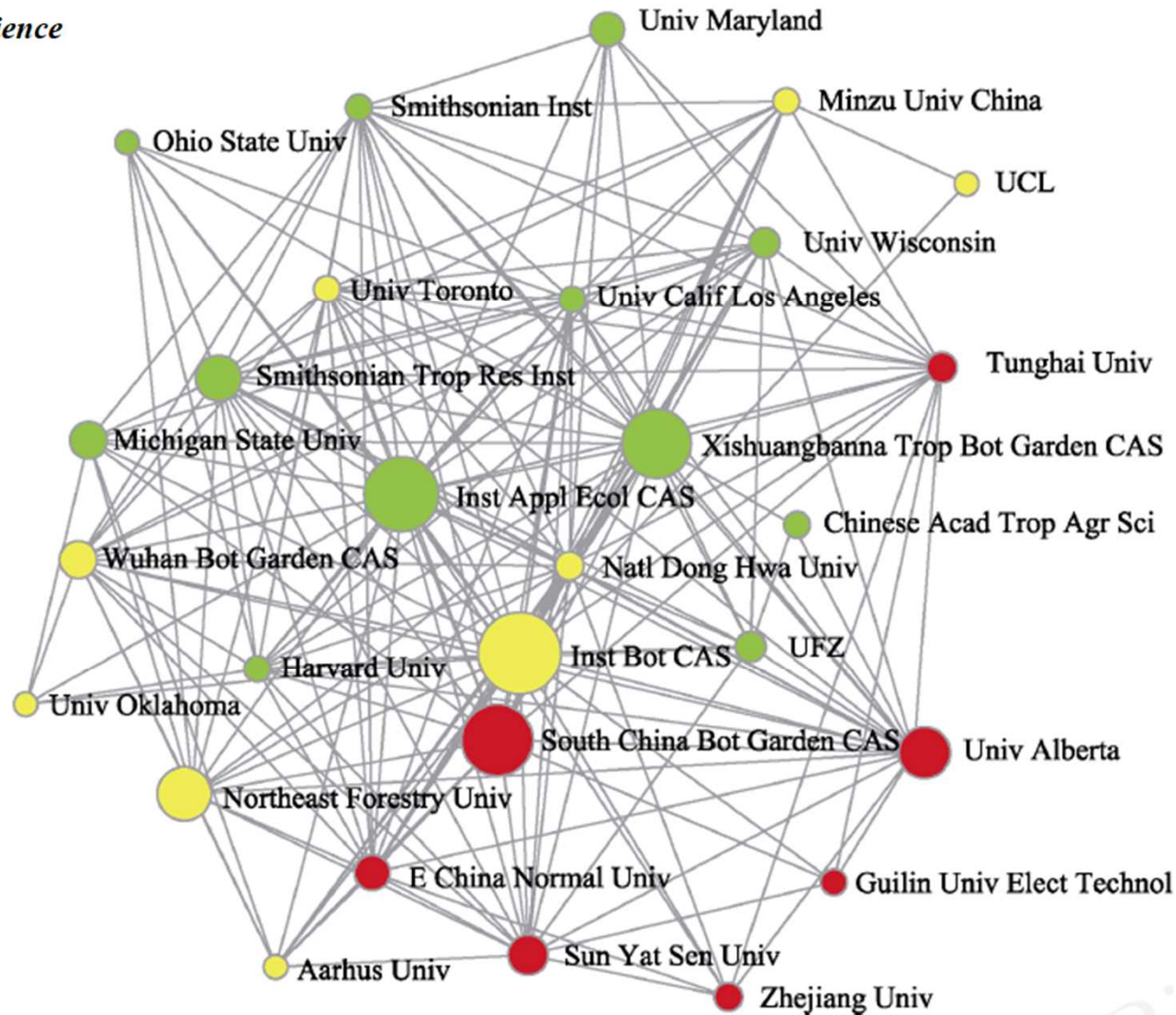
3 School of Geography and Planning, Nanning Normal University, Nanning 530001

**Abstract:** The research achievements of the Chinese Forest Biodiversity Monitoring Network (CForBio), a comprehensive research platform for biodiversity science, are highly influential for promoting biodiversity-related research in China. A detailed assessment of CForBio's publication growth, core research areas, and ability to foster cooperation will provide important information for the long-term development of CForBio and related ecological monitoring research. In order to understand CForBio's impact on science, this study made a comprehensive bibliometric analysis of research papers produced by CForBio-associated scientists, published between 2007 and 2017, using the China National Knowledge Infrastructure and Web of Science databases. Since 2007, the number of papers published by CForBio has grown rapidly, from 3 in 2007 to 55 in 2017, as has the number of papers published in journals included in the Science Citation Index (from 1 in 2007 to 34 in 2017). The top three most prolific authors are Guangze Jin (70 papers), Keping Ma

# Academic Papers

生物多样性 2018, 26 (12): 1255–1267

*Biodiversity Science*

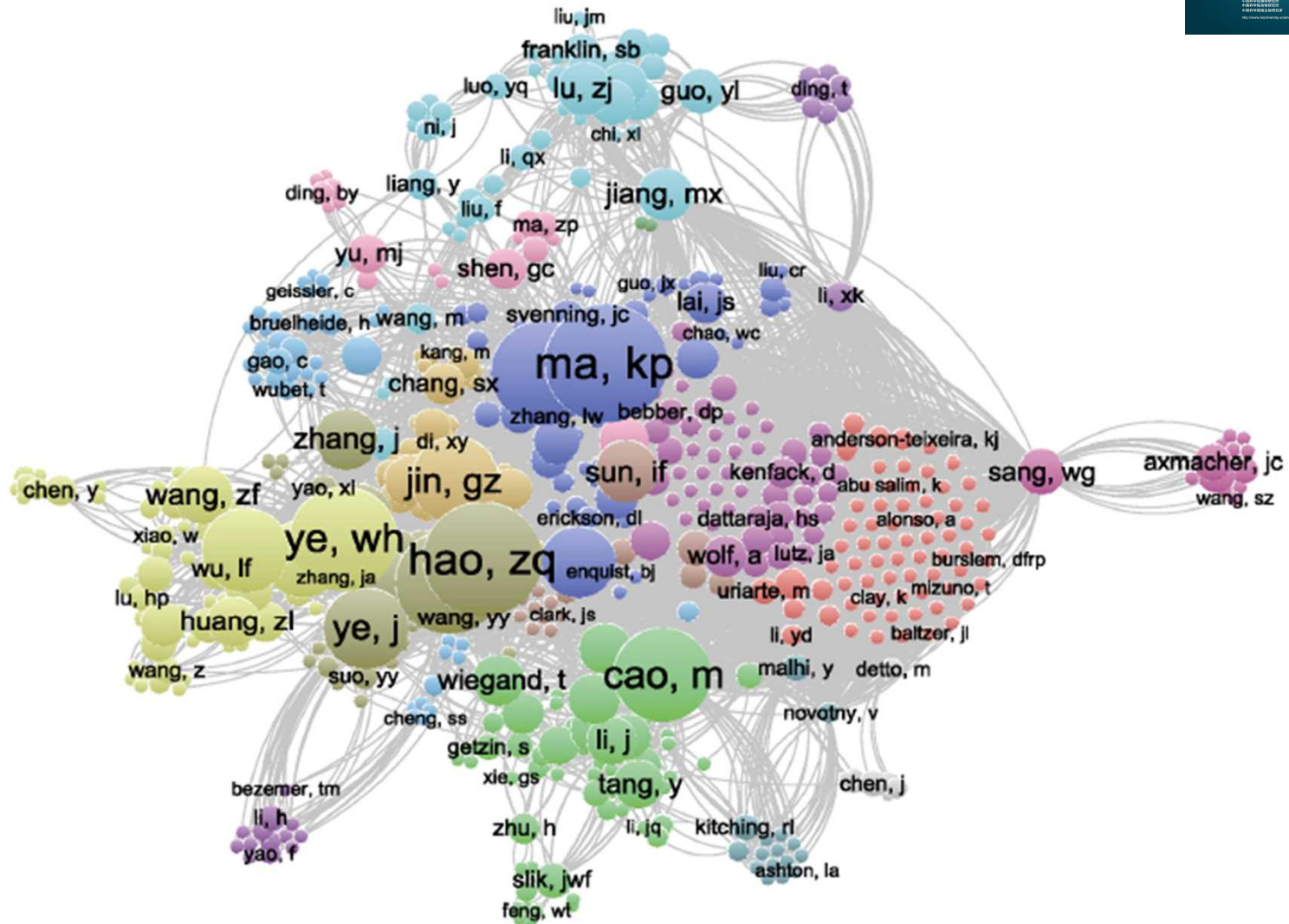
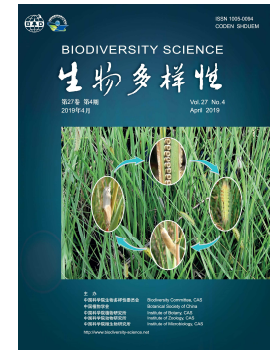


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# Academic Papers

生物多样性 2018, 26 (12): 1255–1267

*Biodiversity Science*

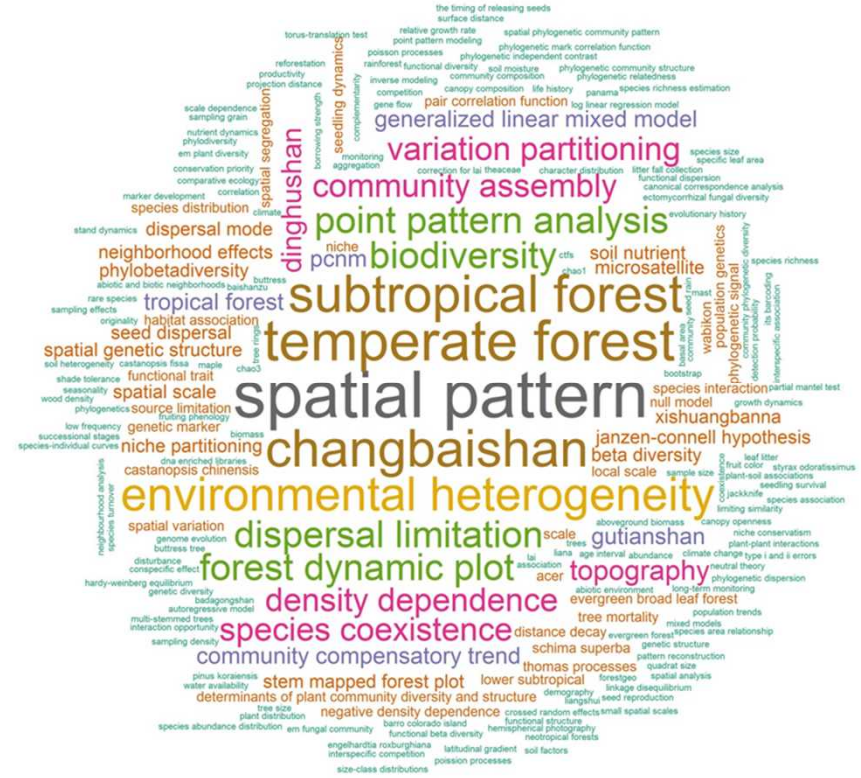
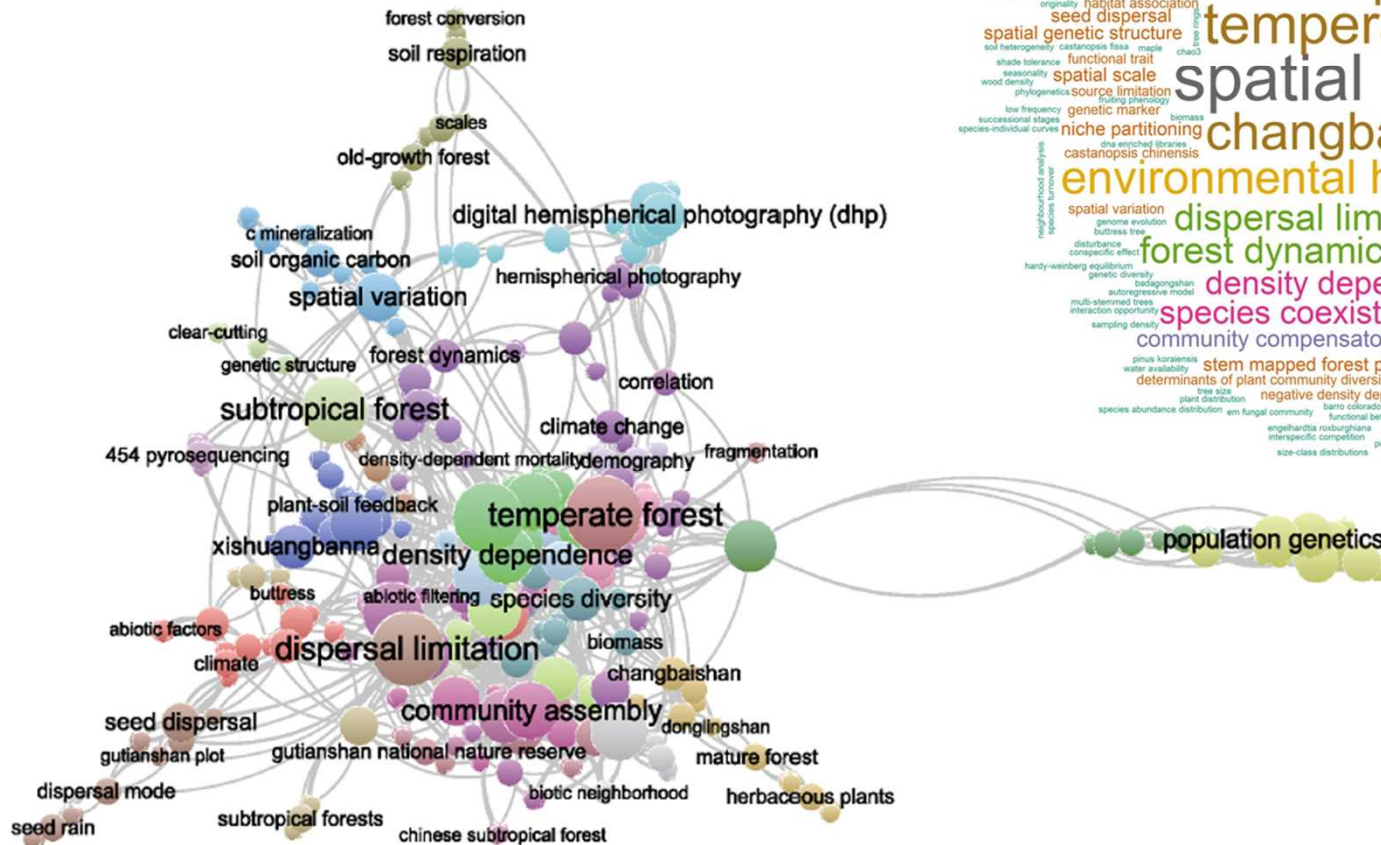




# Academic Papers

生物多样性 2018, 26 (12): 1255–1267

*Biodiversity Science*





# Stand Books



## 1. 马尾松

*Pinus massoniana* Lamb.  
松科 | Pinaceae

代码 (SpCode) = PINMAS  
个体数 (Individual number/24ha) = 2061  
最大胸径 (Max DBH) = 78.2 cm  
重要值排序 (Importance value rank) = 23

常绿乔木，高达45m，喜阳，是干扰后裸地植被演替的先物树种。针叶2针一束，罕3针一束。树干皮红褐色至灰褐色，呈不规则开裂并片状剥落。球果幼时绿色，成熟时褐色。卵形。子叶5~8。花期4月，球果次年10~12月成熟。

Evergreen conifer, up to 45 m tall; heliophilous, a pioneer species of the succession from denuded land after disturbance. Needles 2(or seldomly 3) per bundle. Bark gray or red-brown, irregularly scaly and flaking. Seed cones green when young, turning chestnut brown at maturity, ovoid in shape. Cytiledons 5-8. Pollination Apr-May, seed maturity Oct-Dec of 2nd year.

mǎwěisōng | Masson Pine

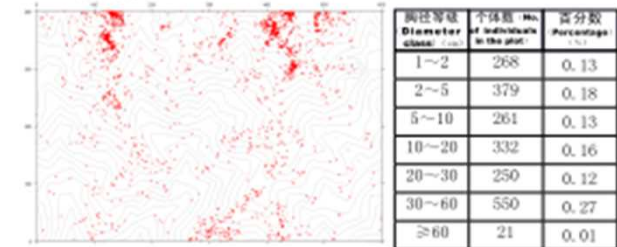


树干 Trunk  
摄影: 冯强 Photo by Feng Tang



雄球花 Male cones  
摄影: 何志军 Photo by He Zhijun

幼球果 Cone (immature)  
摄影: 何志军 Photo by He Zhijun

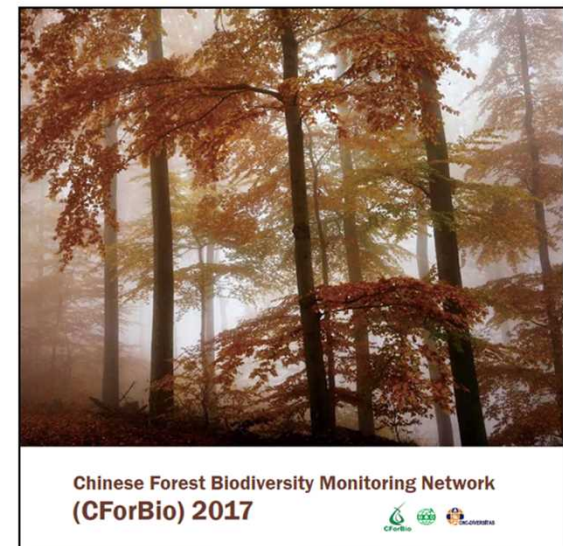
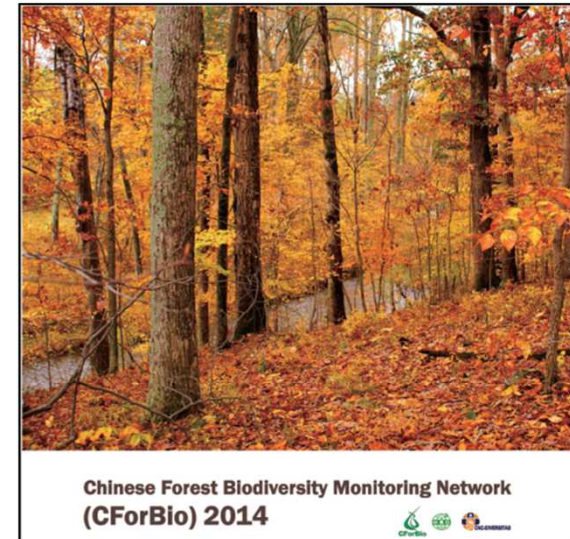
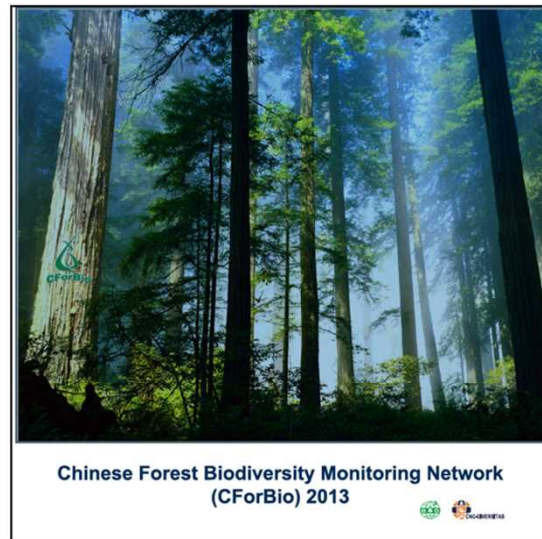
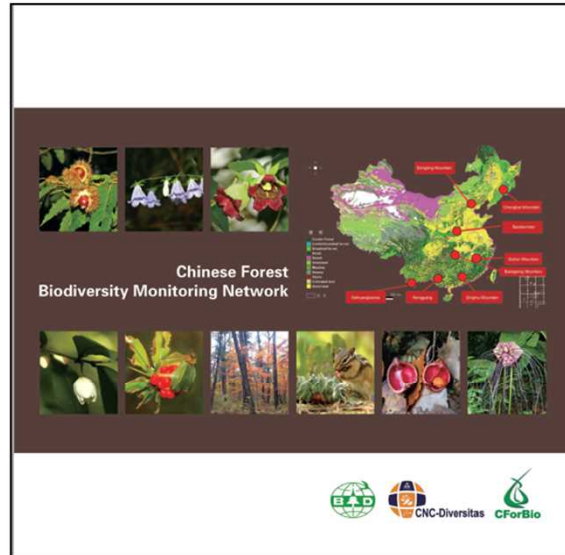


个体分布图 | Distribution of individuals

径级分布表 | DBH Class

# CForBio Annual Reports

<http://www.cncdiversitas.cn/>



# The 1<sup>st</sup> Workshop on Wildlife Monitoring with Camera Traps (July, 2014, Beijing)



# The 2<sup>nd</sup> and 3<sup>rd</sup> Workshop on Wildlife Monitoring with Camera Traps (August, 2016, April, 2018)





1<sup>st</sup>  
Workshop  
on  
Application  
of LiDAR in  
Forest  
Biodiversity  
Monitoring  
(June,  
2015)

# 2<sup>nd</sup> Workshop on Application of LiDAR in Forest Biodiversity Monitoring (June, 2016)



# 3<sup>rd</sup> Workshop on Application of LiDAR in Forest Biodiversity Monitoring (June, 2017)



第三期激光雷达森林生态应用培训班



4<sup>th</sup> Workshop on Application of LiDAR in Forest Biodiversity

Monitoring (June, 2018)

5<sup>th</sup> Workshop on Application of LiDAR in Forest Biodiversity

Monitoring (June, 2019)

“中国科学院植物科学继续教育基地”项目启动仪式  
暨第五期激光雷达森林生态应用培训班





# 2<sup>st</sup> National Symposium on Biodiversity Monitoring Oct. 2016



Thanks

