基于“大数据”的鸟类多样性研究

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概要

- “大数据+生物多样性”背景
- 我们所谓的“大数据”
- 具体研究案例

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•综述•

大数据时代的生物多样性科学与宏生态学

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(华东师范大学生态与环境科学学院, 上海 200241)

摘要: 高质量的生物多样性数据是认知生物多样性的起源和维持机制及应对其丧失风险的科学基础。当前, 在新物种发现、已知物种的地理分布、种群数量与时空动态、物种进化史、功能性状、物种与环境之间以及物种与物种之间的相互作用等7个方面都存在着知识上的空缺。大数据时代的到来为弥补这些知识空缺提供了可能。大数据的挖掘及其应用最近已成为国际生物多样性与宏生态学研究的前沿内容。如何有效地利用和分析不断增长的生物多样性大数据是生物多样性研究面临的一个极大挑战。本文通过全球、大陆和区域尺度上的研究案例展示了大数据在生物多样性研究中应用的新进展, 内容涉及森林覆盖变化、保护生态学、生物多样性与生态系统功能、气候变化对生物多样性的影响等。最后, 对大数据在生物多样性研究中存在的数据采集、处理和分析等方面的问题进行了总结, 并对其潜在应用前景进行了探讨。

关键词: 大数据科学; 保护生物学; 生物多样性信息学; 宏系统生态学; 公众科学

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REVIEW

Opportunities and challenges for big data ornithology

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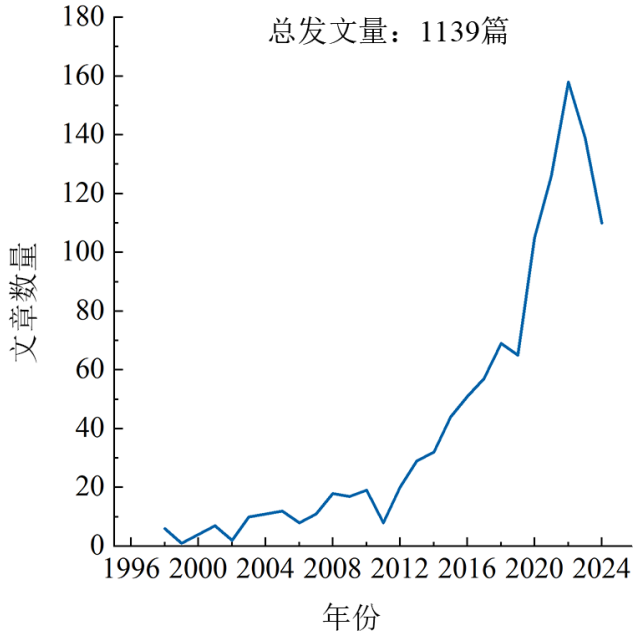
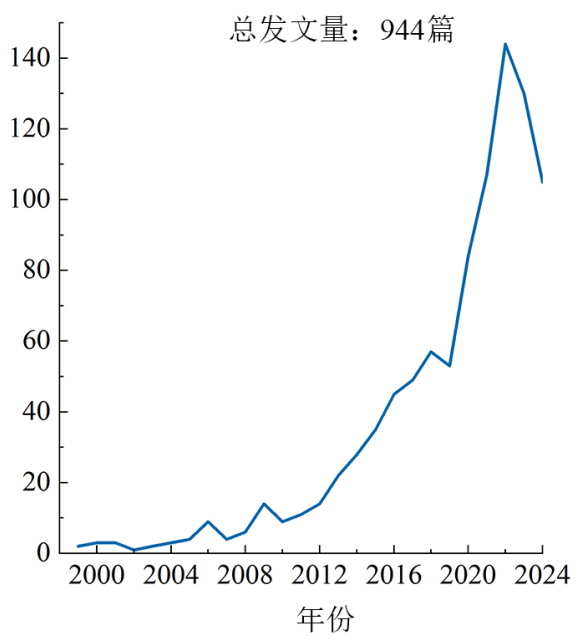
ABSTRACT

Recent advancements in information technology and data acquisition have created both new research opportunities and new challenges for using big data in ornithology. We provide an overview of the past, present, and future of big data in ornithology, and explore the rewards and risks associated with their application. Structured data resources (e.g., North American Breeding Bird Survey) continue to play an important role in advancing our understanding of bird population ecology, and the recent advent of semistructured (e.g., eBird) and unstructured (e.g., weather surveillance radar) big data resources has promoted the development of new empirical perspectives that are generating novel insights. For example, big data have been used to study and model bird diversity and distributions across space and time, explore the patterns and determinants of broad-scale migration strategies, and examine the dynamics and mechanisms associated with geographic and phenological responses to global change. The application of big data also holds a number of challenges wherein high data volume and dimensionality can result in noise accumulation, spurious correlations, and incidental endogeneity. In total, big data resources continue to add empirical breadth and detail to ornithology, often at very broad spatial extents, but how the challenges underlying this approach can best be mitigated to maximize inferential quality and rigor needs to be carefully considered.

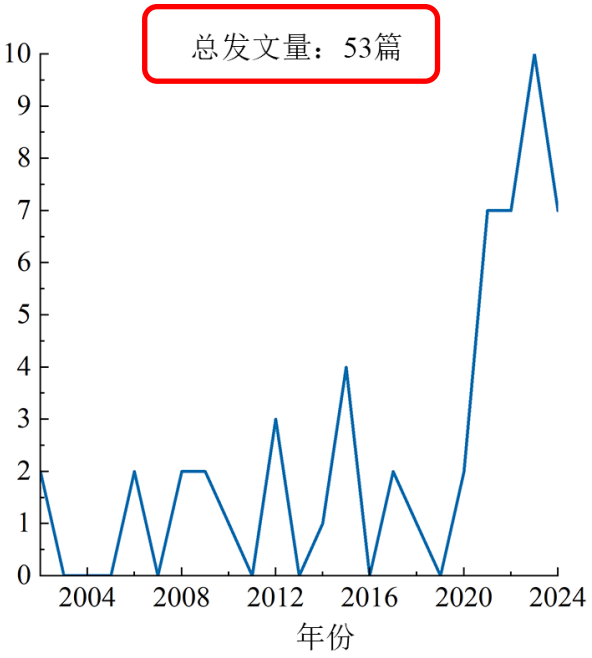
WOS相关文章分析



大数据和**生态学**文章的年发文量



大数据和**生物多样性**文章的年发文量



大数据和**鸟类多样性**文章的年发文量

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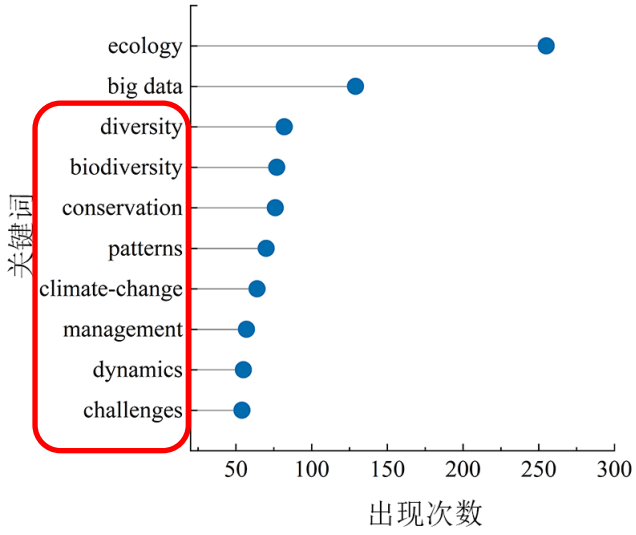
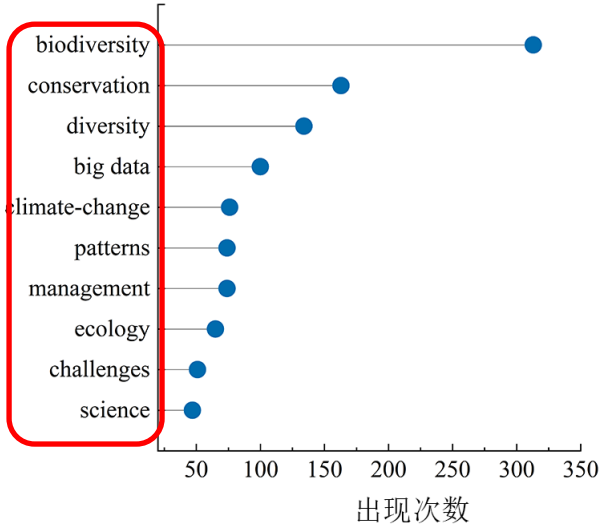


大数据和**生态学**文章中10个关键词



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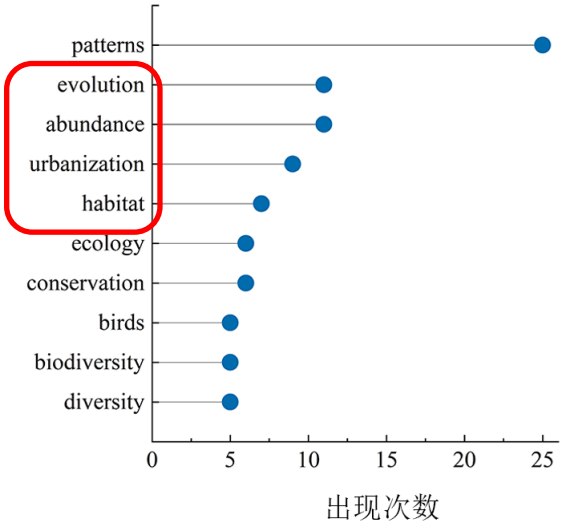

大数据和**鸟类多样性**文章中10个关键词

REVIEW

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ENVIRONMENT/ECOLOGY

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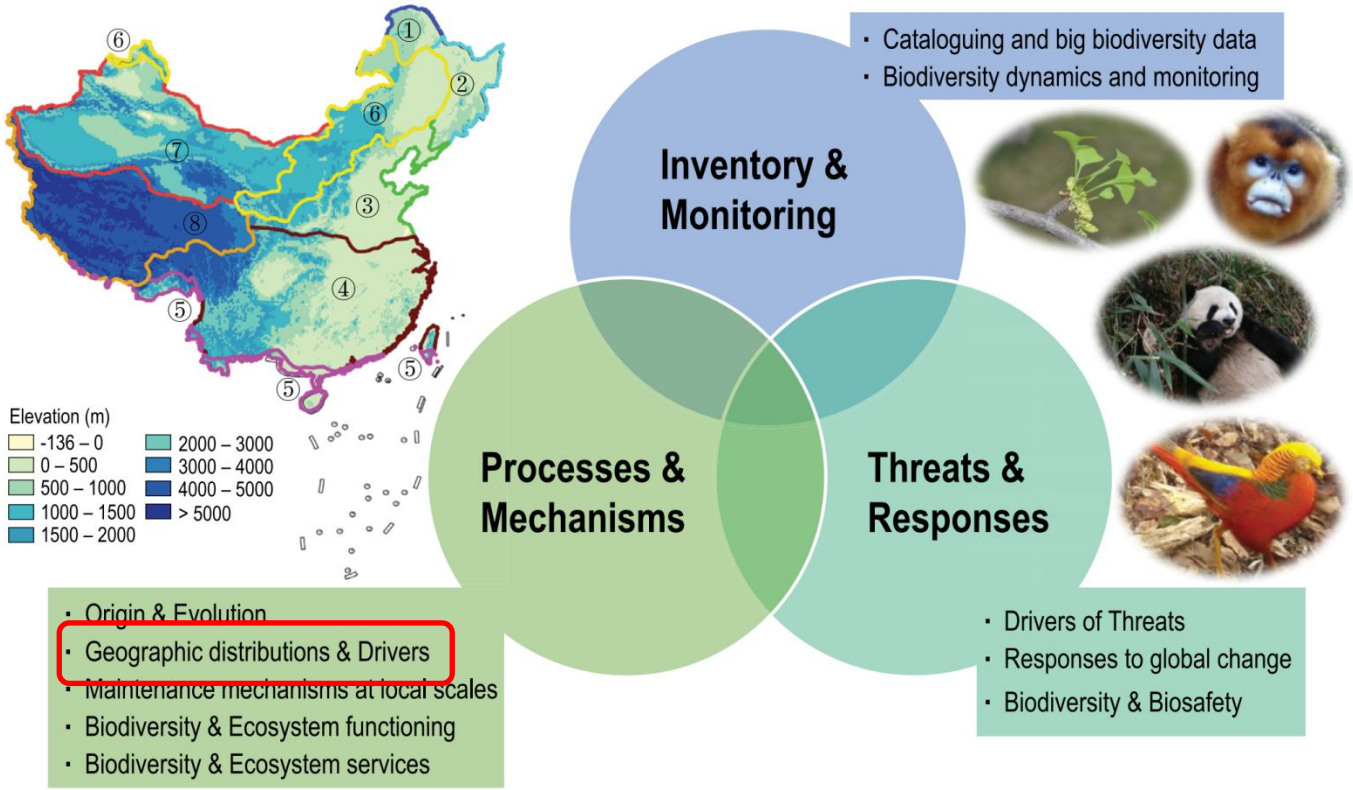
Special Topic: Ecological Civilization—Insights into Humans and Nature

The global significance of biodiversity science in China: an overview

Xiangcheng Mi[1,†], Gang Feng[2,†], Yibo Hu[3], Jian Zhang[4], Lei Chen[1], Richard T. Corlett[5,6], Alice C. Hughes[5,6], Stuart Pimm[7], Bernhard Schmid[8], Suhua Shi[9], Jens-Christian Svenning[10] and Keping Ma[1,11,*]



概要

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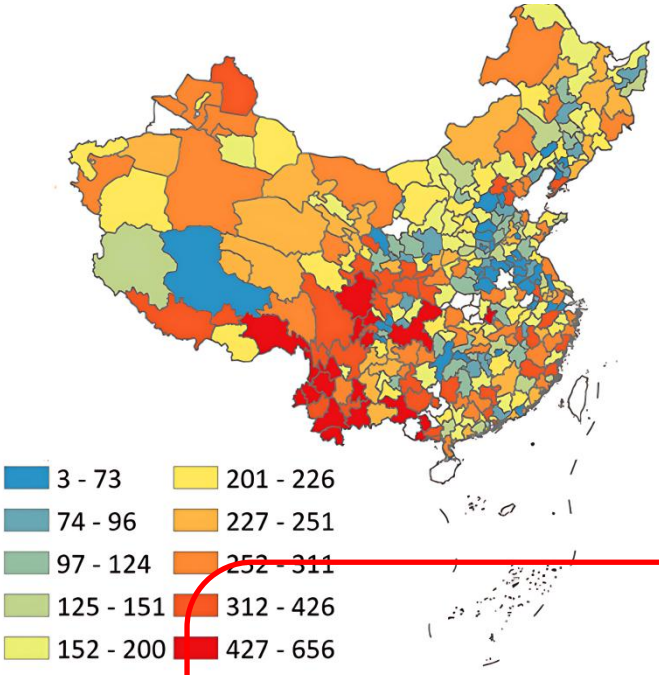
- 具体研究案例

中国鸟类地级市分布数据库

鸟类物种丰富度



BirdReport 中国观鸟记录中心

NSII 国家标本平台 National Specimen Information Infrastructure

GBIF Global Biodiversity Information Facility

基于文献的全球鸟类样线数据库

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ORIGINAL RESEARCH

WILEY Ecology and Evolution Open Access

The database of the PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) project

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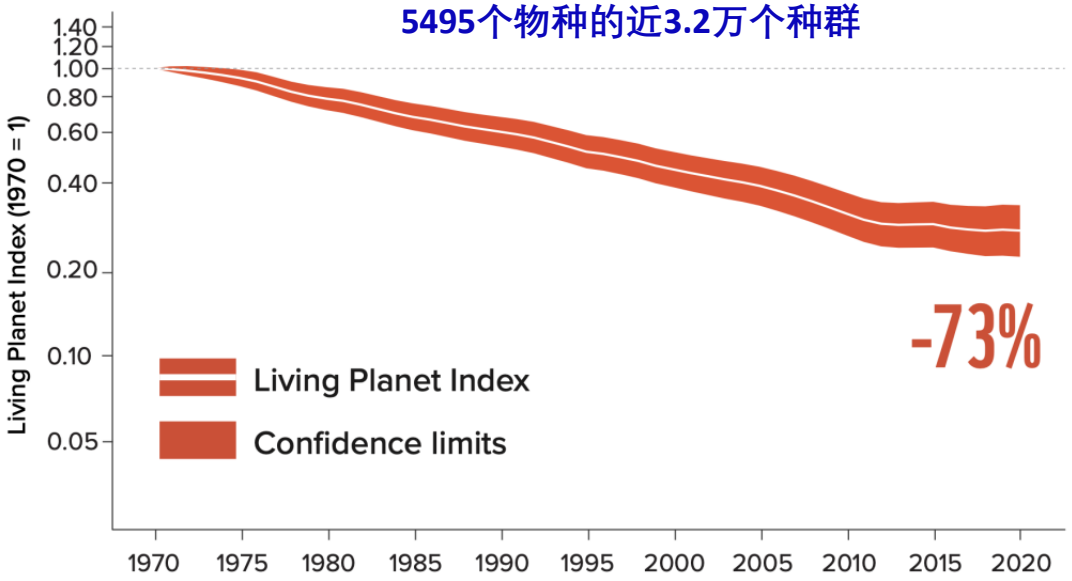
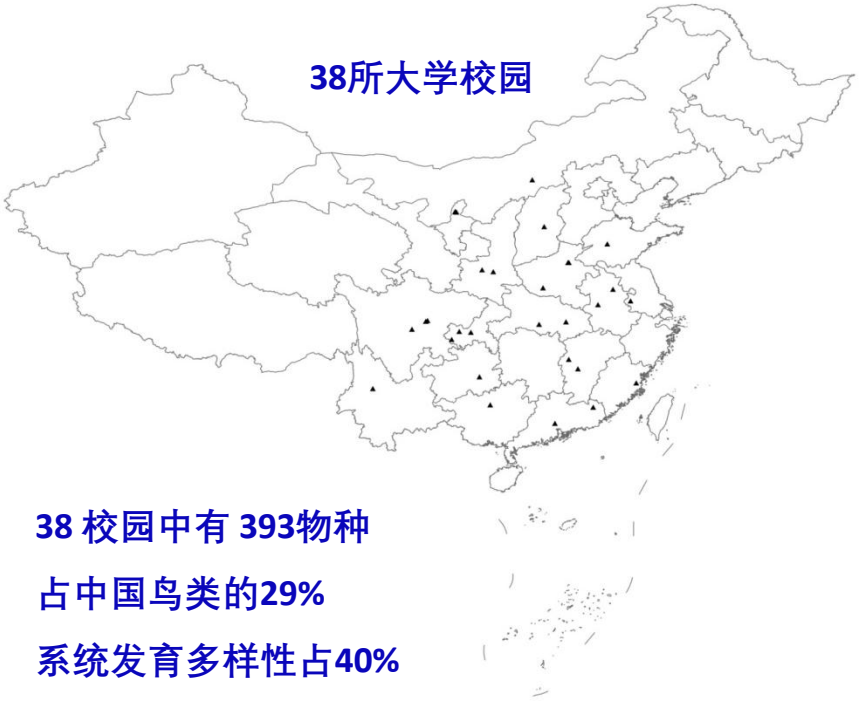
基于报告的全球鸟类种群动态数据库

5495个物种的近3.2万个种群



基于文献的中国城市绿地鸟类数据库

38所大学校园



38 校园中有 393物种

占中国鸟类的29%

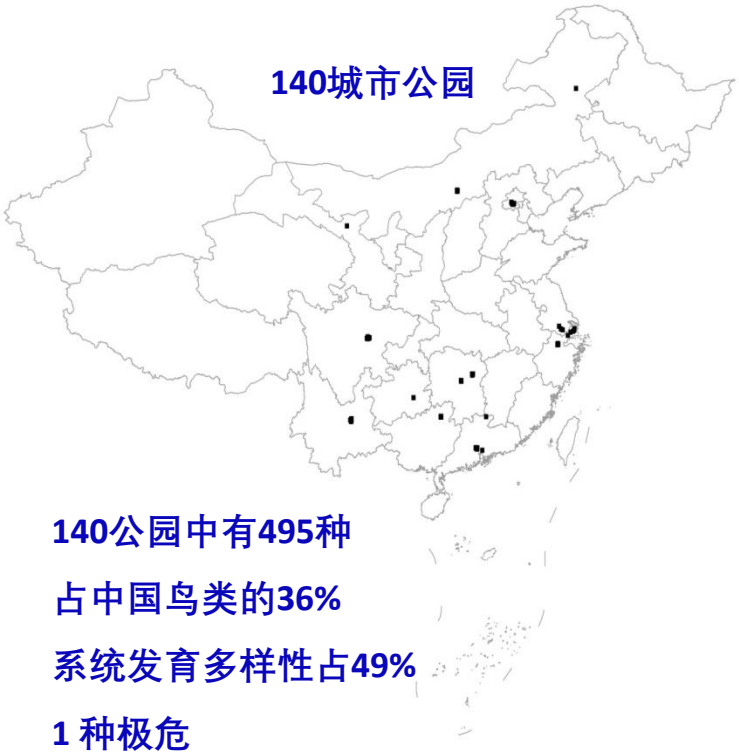
系统发育多样性占40%

2 濒危种

4 易危种

33 近危种

140城市公园



140公园中有495种

占中国鸟类的36%

系统发育多样性占49%

1 种极危

8种濒危

11种易危

53种近危

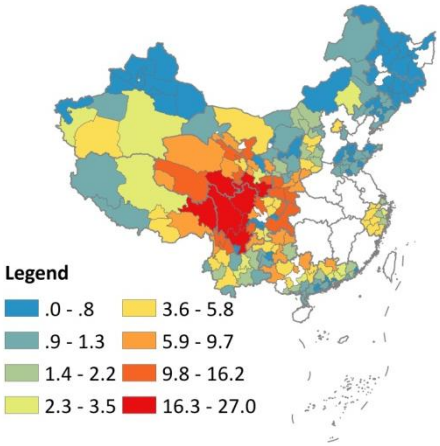
(Zhang et al., 2018, Urban Ecosystem;
Liu et al., 2019, Urban Forestry and Urban Greening)
*(**Wang et al., 2021, Ecological Research**)*

概要

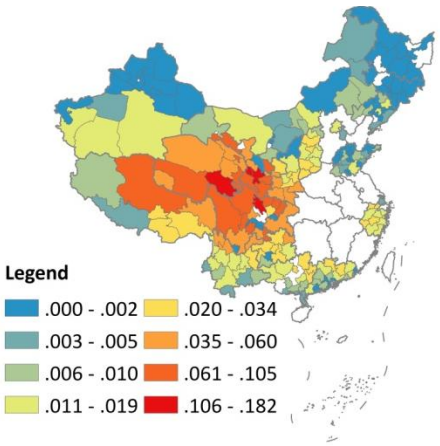
- “大数据+生物多样性”背景
- 我们所谓的“大数据”
- **具体研究案例**

稳定的古气候有更多的特有鸟

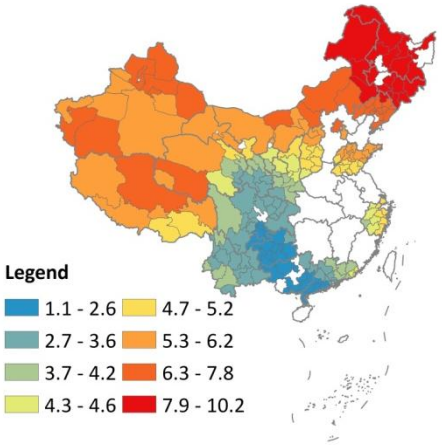
特有鸟丰富度

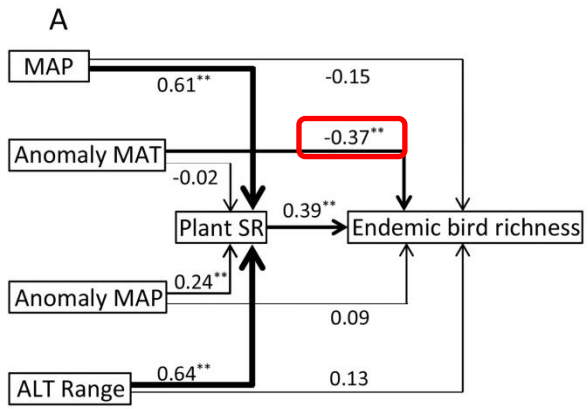


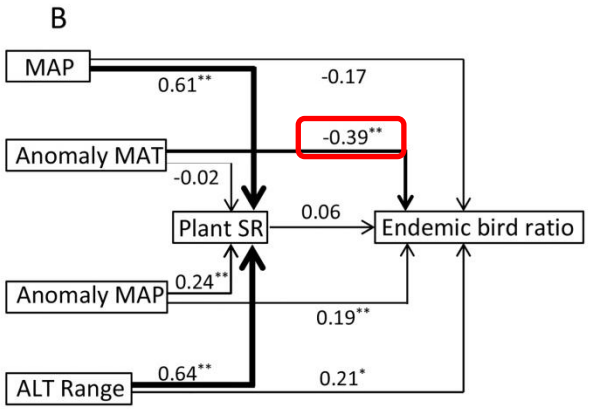
特有鸟比例



温度变化



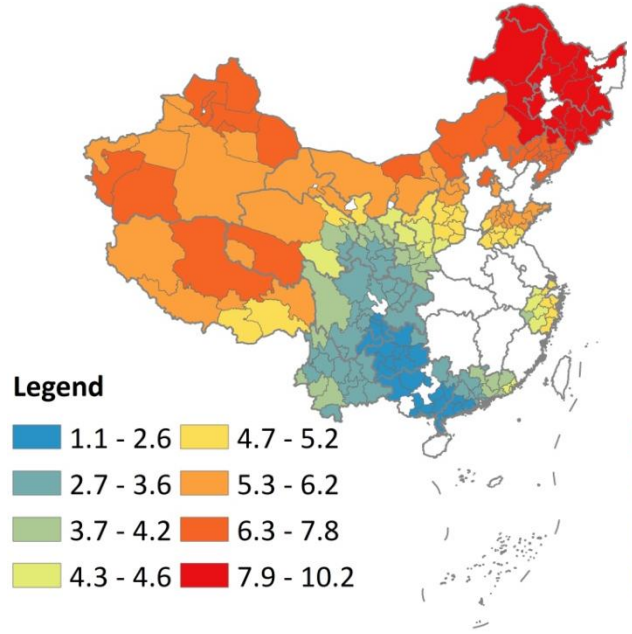




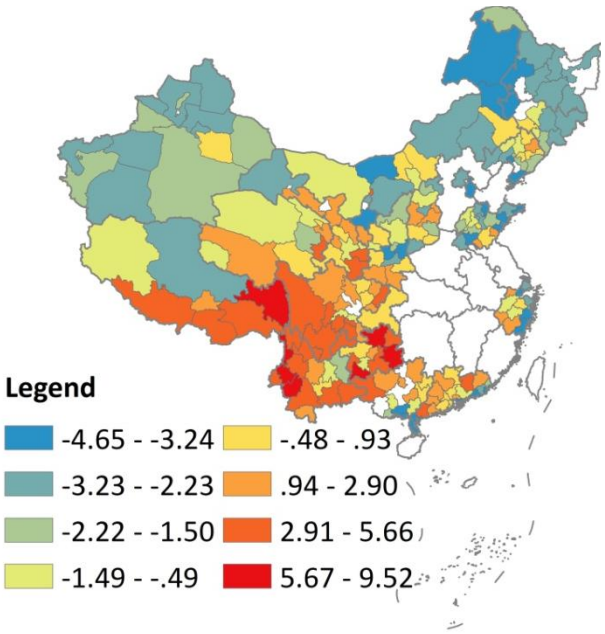
(Feng et al., 2020, Avian Research)

稳定的古气候使年轻的鸟类聚集在一起

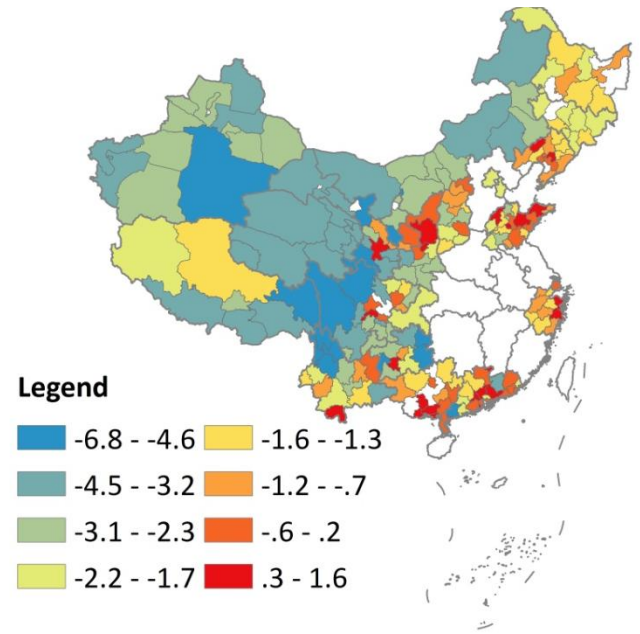
温度变化



系统发育结构



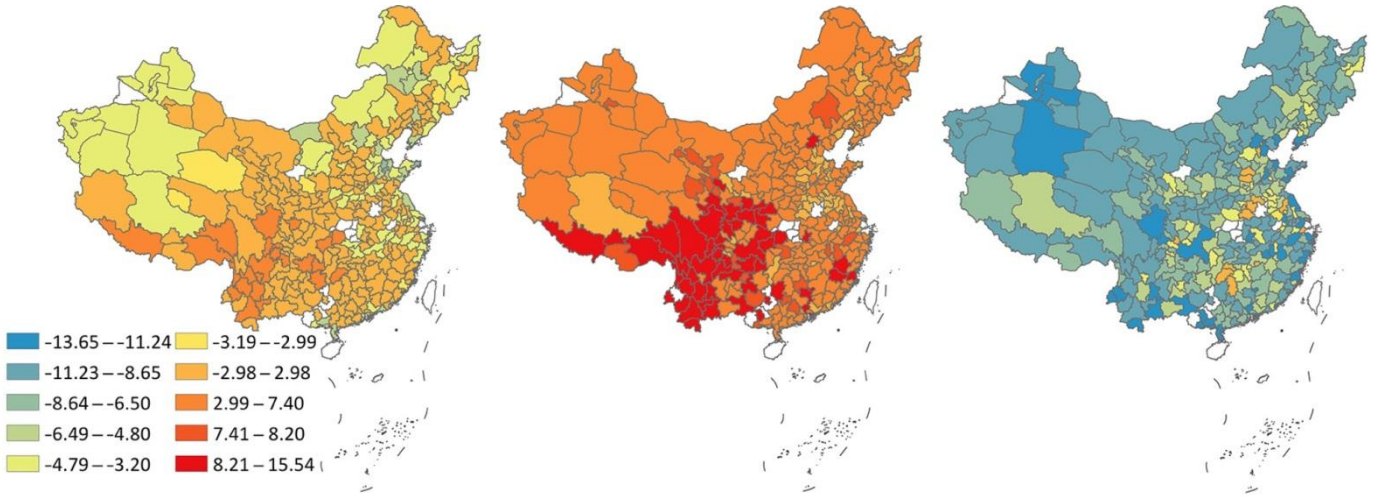
系统发育多样性

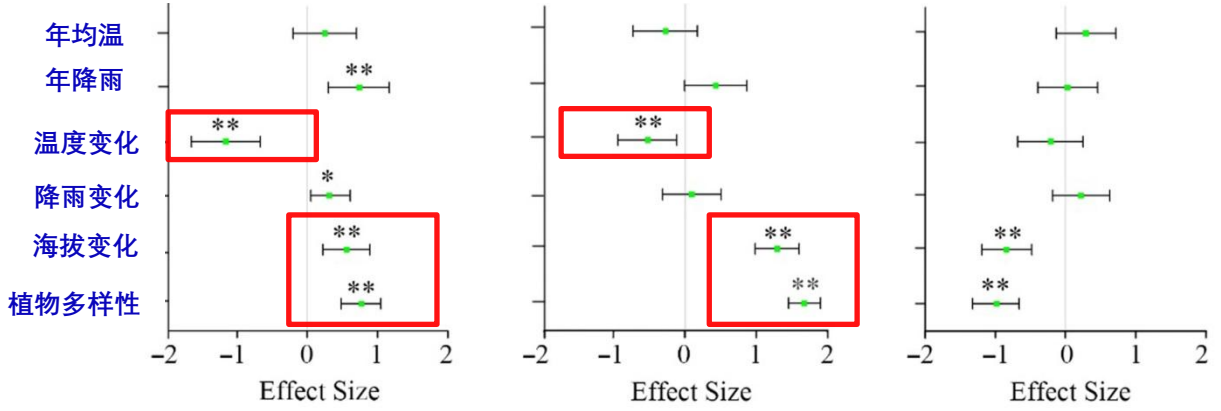


(Wang et al., 2020, J Biogeo)

稳定的古气候促进鸟类的演化速率

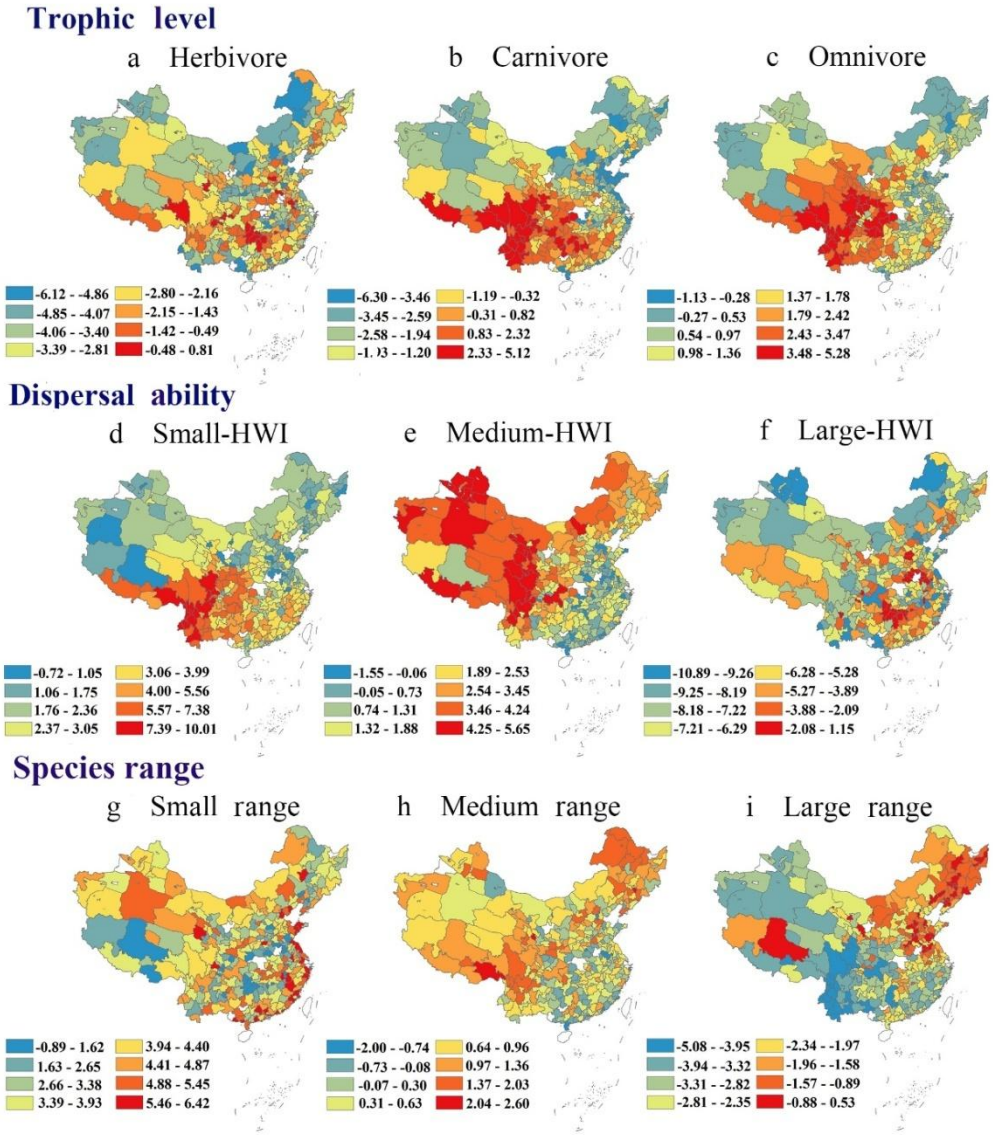
所有鸟演化速率　　雀形目演化速率　　非雀形目演化速率





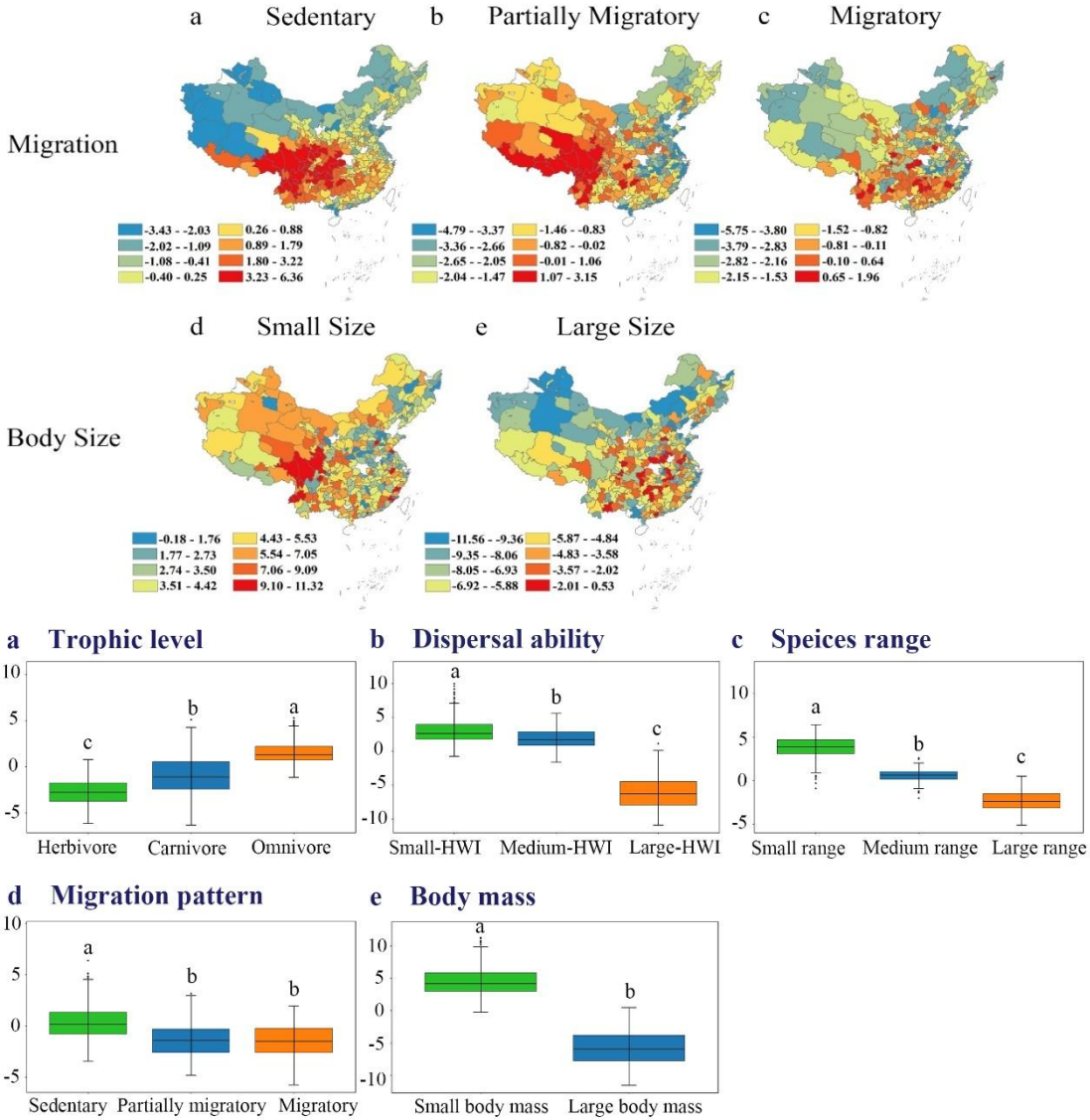
(Wang et al., 2024, J Biogeo)

鸟类性状也会影响演化速率格局



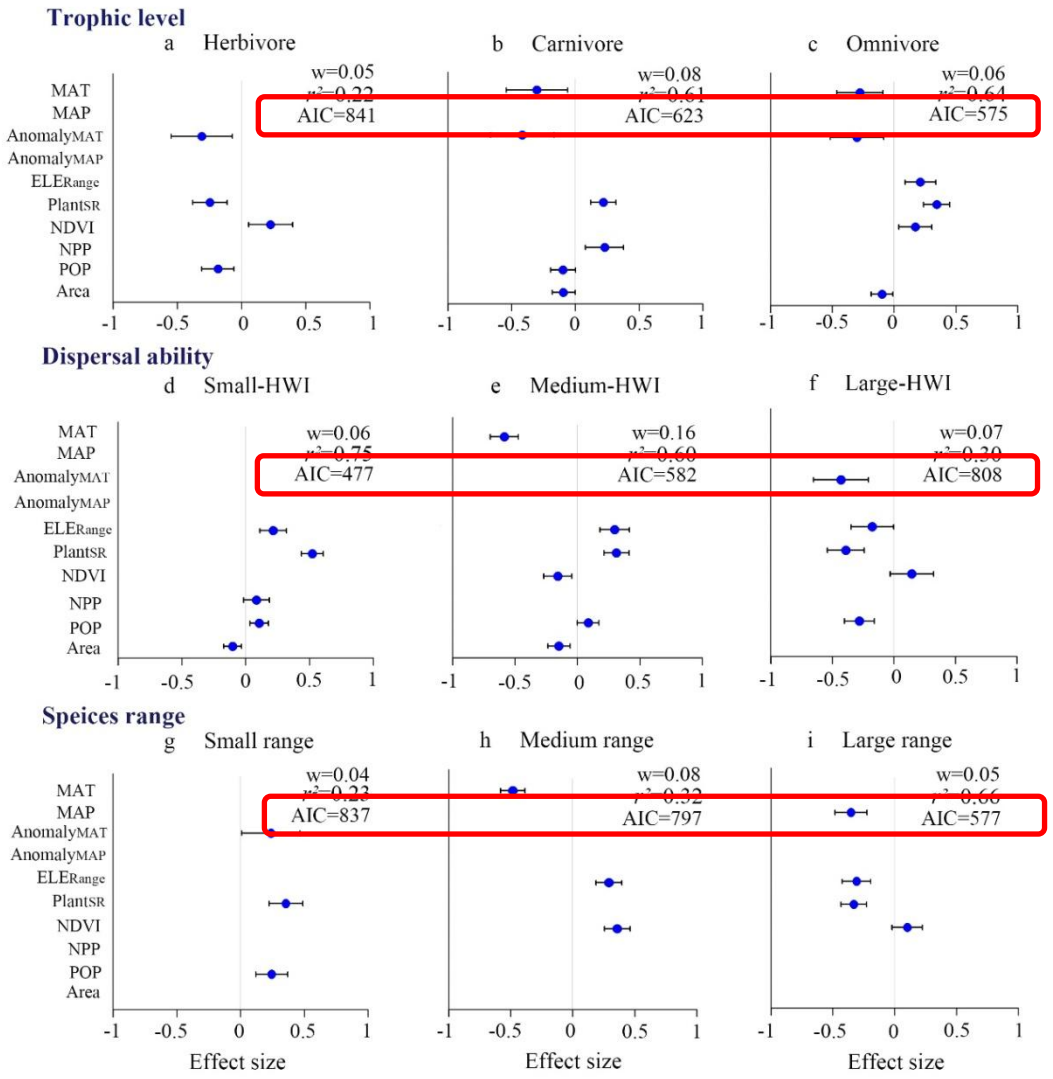
(Wang et al., under review)

鸟类性状也会影响演化速率格局



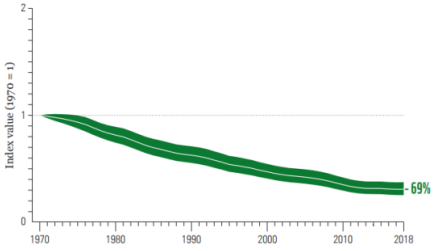
(Wang et al., under review)

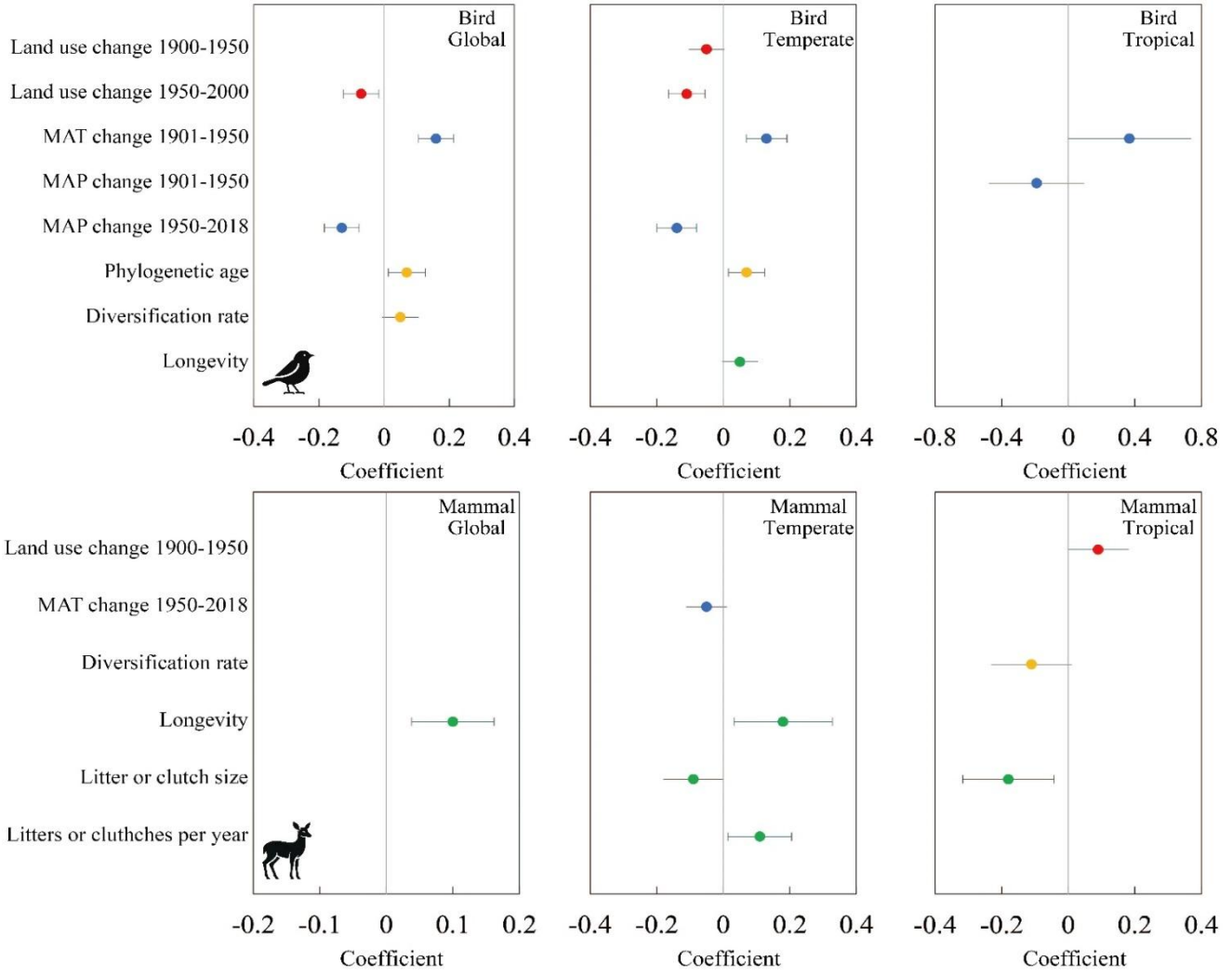
鸟类性状也会影响演化速率格局与环境因子的关系



(Wang et al., under review)

气候变化、人类活动、物种性状影响鸟类种群动态





(Ma et al., 2024, PRSB)

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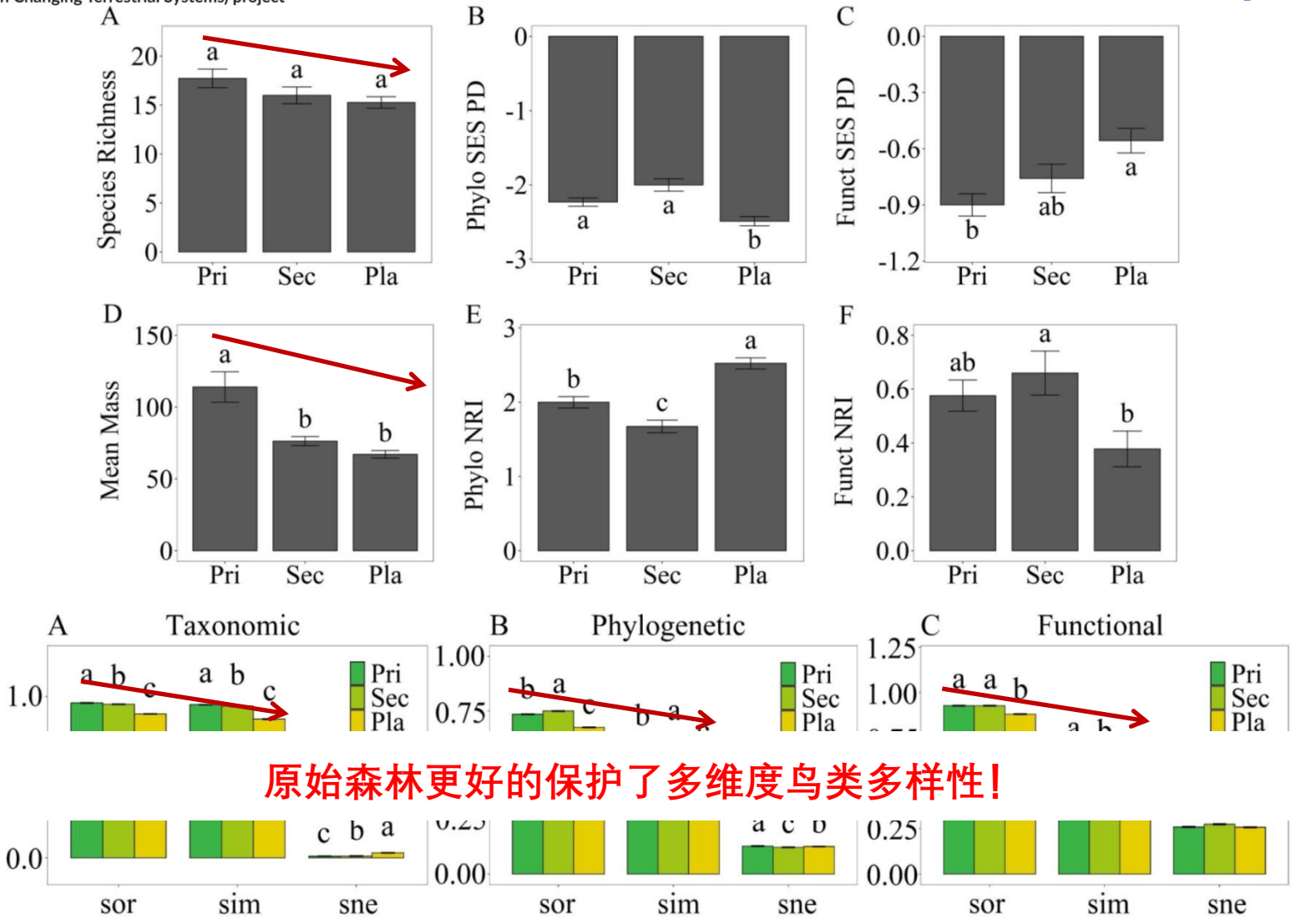
ORIGINAL RESEARCH

WILEY Ecology and Evolution

The database of the PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) project

全球不同森林类型鸟类多样性分布



原始森林更好的保护了多维度鸟类多样性！

(Liu et al., 2024, J Biogeo)

我们可以用一些数据库讲一些简单的故事!

谢谢大家的聆听！

欢迎提出批评与指导意见！