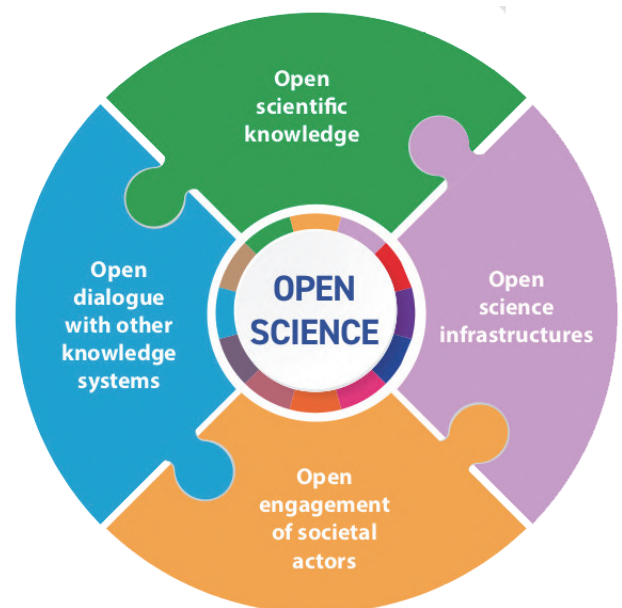


2025 ASIAN BIODIVERSITY DATA USE GUIDE

Linking to the UN 17 Sustainable Development Goals and Open Science



GBIF CAS (Chinese Academy of Sciences) Node
Biodiversity Committee, CAS

May 2026



UN Sustainable Development Goals (SDGs)

In 2015, world leaders agreed to 17 goals for a better world by 2030. We recognise that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development. All countries and all stakeholders, acting in collaborative partnership, will implement this plan. We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet. We are determined to take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path. As we embark on this collective journey, we pledge that no one will be left behind. The 17 Sustainable Development Goals and 169 targets which we are announcing today demonstrate the scale and ambition of this new universal Agenda.

The official website: <https://www.globalgoals.org/>



Open science

Following an inclusive, transparent and multistakeholder consultative process, the UNESCO Recommendation on Open Science was adopted by the 41st session of UNESCO General Conference in November 2021. Open Science is defined as an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science infrastructures, science communication, open engagement of societal actors and open dialogue with other knowledge systems.

The official website: <https://www.unesco.org/en/open-science>

GBIF Data Status in Asia

There are currently 178,748,729 occurrences in Asia, 4.74 % of total GBIF records
(By 3 July, 2026)

TOP 10 Countries or Areas have most occurrences in Asia		
Country or area		
Number of occurrences		
43 results		
India	65,410,298	
Chinese Taipei	26,181,016	
Japan	15,522,543	
China	15,147,007	
Korea, Republic of	8,811,824	
Thailand	8,345,023	
Indonesia	5,468,110	
Malaysia	4,990,097	
Philippines	3,845,762	
Sri Lanka	3,019,164	

TOP 10 Countries or Areas contributed data in Asia		
Country or area		
Number of occurrences		
43 results		
India	65,410,298	
Chinese Taipei	26,181,016	
Japan	15,522,543	
China	15,147,007	
Korea, Republic of	8,811,824	
Thailand	8,345,023	
Indonesia	5,468,110	
Malaysia	4,990,097	
Philippines	3,845,762	
Sri Lanka	3,019,164	

TOP 10 Data Publishers contributed data in Asia		
Publisher		
Number of occurrences		
1,050 results		
Cornell Lab of Ornithology ↗	112,146,217	
iNaturalist.org ↗	8,868,587	
National Museum of Nature and Science, Japan ↗	8,343,156	
Taiwan Biodiversity Research Institute ↗	5,495,535	
Chinese Academy of Sciences (CAS) ↗	4,507,560	
MGnify ↗	2,888,683	
National Institute of Ecology ↗	2,442,797	
European Nucleotide Archive (EMBL-EBI) ↗	2,437,174	
Naturalis Biodiversity Center ↗	2,214,374	
The International Barcode of Life Consortium ↗	2,185,028	

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PREFACE

The true value of data lies in its application. As the world's premier portal for biodiversity occurrence data, the Global Biodiversity Information Facility (GBIF) remains steadfast in its mission “to mobilize the data, skills, and technologies needed to make comprehensive biodiversity information freely available for science and decisions addressing biodiversity loss and sustainable development.”

To date, GBIF has mobilized over 3.7 billion occurrence records, underpinning more than 15,000 peer-reviewed scientific articles. However, despite Asia being the largest continent on Earth, it accounts for a disproportionate 4.7% of the total GBIF records. Various systemic and infrastructural factors continue to hinder biodiversity data sharing from this region. It is imperative that we engage more individuals, institutions, and organizations across Asia to bridge this gap, fostering broader participation in global biodiversity data mobilization efforts. Urgent action is needed to ensure the region's vast biological wealth is adequately represented and accessible.

Under the “2023–2027 GBIF Strategic Framework,” GBIF continues to prioritize four key pillars: science and research, policy and partnerships, community and capacity, as well as infrastructure and data products. As we progress through 2026, the synergy between GBIF and two paramount global initiatives—the UN Sustainable Development Goals (SDGs) and the UNESCO Open Science framework—has never been more critical. Both initiatives rely fundamentally on open data infrastructures. As a designated knowledge-sharing platform for the UNESCO Open Science initiative, GBIF is uniquely positioned to amplify its contributions to these global endeavors in the years to come.

To advance the goals of the SDGs and Open Science, it is vital to demonstrate the practical utility and real-world impact of biodiversity data. Consequently, the teams from the GBIF Asia network and the GBIF Chinese Academy of Sciences (CAS) Node have curated 39 case studies from contemporary academic literature. These cases are systematically categorized by their alignment with specific SDGs, elements of Open Science, and geographic regions.

I am honored to present this work to all colleagues dedicated to biodiversity science and conservation. I would like to take this opportunity to congratulate the authors and editors on this significant achievement, with the hope that it will inspire greater data sharing and application across Asia and beyond.

Keping MA
Head of Delegation, GBIF CAS Node
Vice Chair & Secretary General, Biodiversity Committee, CAS
Professor, Institute of Botany, CAS

21 May, 2026

INTRO

The 17 UN Sustainable Development Goals (SDGs) represent a shared global aspiration for a better quality of life and a more sustainable future. Open Science serves as a vital mechanism to engage diverse stakeholders and align research endeavors toward achieving these goals. At the core of this mission lies biodiversity—a foundational element for human well-being, planetary health, and the success of the SDGs. As we navigate through 2026, the era of big data and artificial intelligence (AI) is no longer merely approaching; it is actively driving digital transformation and reshaping global scientific cooperation.

Over the years, major biodiversity data infrastructures, notably the Global Biodiversity Information Facility (GBIF), have been firmly established. However, glaring disparities in data sharing persist across regions. Notably, Asia—despite being the largest continent—contributes a disproportionately low 4.7% of the total GBIF records. Bridging this gap is imperative. It is urgent to mobilize more individuals, institutions, and organizations across the region to participate in data-sharing efforts, ensuring a sustainable and equitable future for our planet.

To provide exemplary guidance, the teams from the National Science Library, Chinese Academy of Sciences (CAS), and the Institute of Botany, CAS, have systematically curated recent peer-reviewed articles published in 2025. These articles were sourced from comprehensive databases, including Web of Science (WoS), Dimensions, and the GBIF literature database. Each selected article has been meticulously annotated with classifications and tags, highlighting 1–4 representative case studies per SDG. Crucially, every case study is analyzed through the lens of Open Science, mapping its integration with key elements: Open Scientific Publications (OSP), Open Research Data (ORD), Open Source Software (OSS), Open Educational Resources (OER), Local communities (LC), and Indigenous peoples (IP).

This guide is primarily dedicated to researchers and students committed to biodiversity conservation and management, as well as to policymakers seeking to navigate the critical intersections between biodiversity, the SDGs, and Open Science. Furthermore, it extends to all citizens, professionals, and organizations joining the collective challenge of addressing socio-environmental needs while safeguarding our planet.

On behalf of the Editorial Committee.

Zheping Xu
Node Manager, GBIF CAS

21 May, 2026

1.1 ANALYSIS OF GLOBAL TRADE PATTERNS AND INDUSTRIAL LAYOUT IN MEDICINAL PLANTS: A CASE STUDY OF *EUCOMMIA ULMOIDES* OLIVER

China

Challenge

Eucommia ulmoides Oliver. (*E. ulmoides*), known as "living fossil", is a Tertiary daughter species and endemic plant of China, with high medical, economic, and ecological value. As a vital component of Traditional Chinese Medicine (TCM) resources, *E. ulmoides* plays a crucial role in targeted poverty alleviation and rural revitalization in impoverished mountainous regions in central and western China. However, with global warming and over-exploitation of *E. ulmoides*, wild resources are on the verge of extinction and the habitat range is shrinking, which seriously restricts its sustainable development.

Contribution

1.China's *E. ulmoides* industry currently yields 1,408 tons annually (\$6.13 million), with a growing reliance on imports. However, global warming threatens to reduce global suitable habitats by 49.901%. In China, highly and moderately suitable growing areas will shrink drastically by 66.9%–85.9% and 20.5%–59.4%, respectively. This significant loss of suitable land will make it extremely difficult to meet future trade demands. 2.Global trade patterns within the *E. ulmoides* industry, revealing trends in suitable cultivation regions and resource availability, and provided data support and case studies for production planning, trade competition, and sustainable development of medicinal plants.

Citation

Luo, H., Zhang, H., Zhang, X., Zhang, G., & Huang, L. (2025). Analysis of global trade patterns and industrial layout in medicinal plants: A case study of *Eucommia ulmoides* oliver. *Industrial Crops and Products*, 225. <https://doi.org/10.1016/j.indcrop.2025.120555>

1 NO POVERTY



Data Uses

Distribution data of *E. ulmoides* was obtained from the Global Biodiversity Information Facility (GBIF, <https://www.gbif.org>), the Chinese Virtual Herbarium (CVH, <http://www.cv5.cvh.org.c/>), National Specimen Information Infrastructure (NSII, <http://www.nsii.org.cn/>) and previous literature.

Open Sciences

Open scientific publications; open research data; local communities

Affiliations

- 1.Institute of Medicinal Plant Development, Chinese Academy of Medical Sciences & Peking Union Medical College, China
- 2.Jiangxi University of Chinese Medicine, China

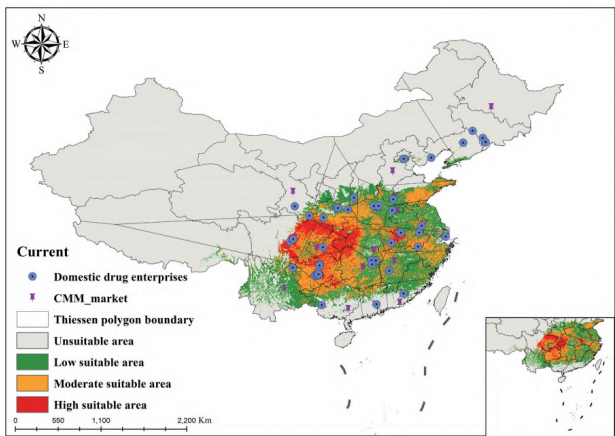


Fig. 6. Thiessen polygonal analysis of the industrial layout of *E. ulmoides* in China in the current period.

1.2 ASSOCIATION OF IUCN-THREATENED INDIAN MANGROVES: A NOVEL DATA-DRIVEN RULE FILTERING APPROACH FOR RESTORATION STRATEGY

India

Challenge

Mangroves are key sources of livelihood for local inhabitants in the Sundarban region. The degradation of mangrove habitats can result in declines in fish and crab populations, lowering the income and food security of these communities. The loss of mangroves in the Indian Sundarban region can have a major effect on poverty levels by lowering the availability of livelihood possibilities and exposing inhabitants nearby to greater risk of natural catastrophes and climate change effects. Indian mangroves provide a unique testbed for restoration frameworks due to their high biodiversity and the presence of critically endangered species.

Contribution

Applying a novel three-stage framework to four IUCN-listed Indian mangrove species reveals that frequent co-occurrence among taxonomically distinct taxa enhances ecosystem resilience. These findings provide actionable guidelines for optimizing species selection and co-planting in restoration efforts. Crucially, this adaptable framework offers a scalable model for biodiversity conservation across various ecosystems. By prioritizing the restoration of mangroves, this study helps build resilience against natural disasters, reducing the economic burden on vulnerable populations.

Citation

Ghosh, M., Mondal, S., Fajriyah, R., Mondal, K. C., & Roy, A. (2025). Association of IUCN-threatened Indian mangroves: A novel data-driven rule filtering approach for restoration strategy. Ecological Informatics,89. <https://doi.org/10.1016/j.ecoinf.2025.103164>



Data Uses

Species occurrence data were compiled from Mangrove Reference Database and Herbarium, World Mangroves Database, Environmental Information System (ENVIS), WWF State of the Art Report on Indian Sundarbans, Forest Survey of India Mangrove Cover Assessment Reports, and the World Bank Group Report on Indian Sundarbans, with taxonomic details referenced via the WoRMS ID, ITIS TSN, and GBIF taxon ID.

Open science

Open scientific publications; open source software and source code;

Affiliations

- 1.Department of Information Technology, Jadavpur University, India
- 2.Department of Statistics, Islamic University of Indonesia, Indonesia
- 3.West Bengal Biodiversity Board, India

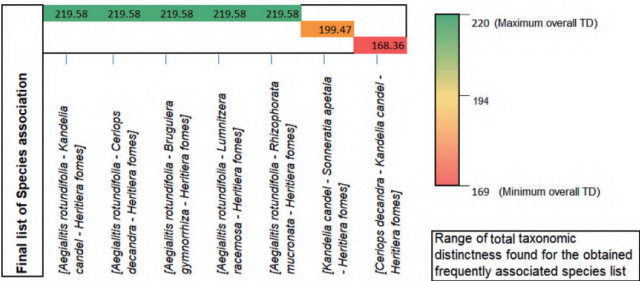


Fig. 10. List of ranked associations for Heritiera fomes obtained by subjective measure of total taxonomic distinctness for an association.

2.1 NON-NATIVE SPECIES IN AQUACULTURE: BURGEONING PRODUCTION AND ENVIRONMENTAL SUSTAINABILITY RISKS

Global

Challenge

Rising global food demands and technological advancements have led to unprecedented growth in the aquaculture industry. This rapid expansion has facilitated the translocation of species beyond their native ranges. The vast majority of global non-native production takes place in low-income countries, where addressing hunger, livelihood opportunities, or economic development often shape policy priorities and can take precedence over biodiversity conservation. While farming non-native species boosts global food supply, it also poses environmental and socio-economic risks when escapees establish in non-native ecosystems.

Contribution

1. Both native and non-native production increased over time, with non-native species showing greater interannual variability. Fishes largely dominated total aquaculture production with 940million tonnes, of which 182million tonnes were non-native production (19%). Non-native algae and crustacean production exceeded that of native species, accounting for 67% and 55% of total production, respectively.
2. Aquaculture can boost local economies, especially in low- and middle-income countries where most of the production occurs, but the introduction of non-native species entails considerable risks that must be addressed through biosecurity policies to safeguard biodiversity, minimizing damage to ecosystems and local livelihoods.

Citation

Officialdegui, F. J., Soto, I., Balzani, P., Cuthbert, R. N., Haubrock, P. J., Kourantidou, M., Manfrini, E., Tarkan, A. S., Kurtul, I., Macêdo, R. L., Musseau, C. L., Roy, K., & Kouba, A. (2025). Non - Native Species in Aquaculture: Burgeoning Production and Environmental Sustainability Risks. *Reviews in Aquaculture*,17(3). <https://doi.org/10.1111/raq.70037>

2 ZERO HUNGER



Data Uses

Native origins for cultured non-native species were derived from global databases, GBIF, and web scraping.

Open Sciences

Open scientific publications; open source software and source code

Affiliations

1. University of South Bohemia in České Budějovice, Czech Republic
2. Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, UK
3. Bournemouth University, UK

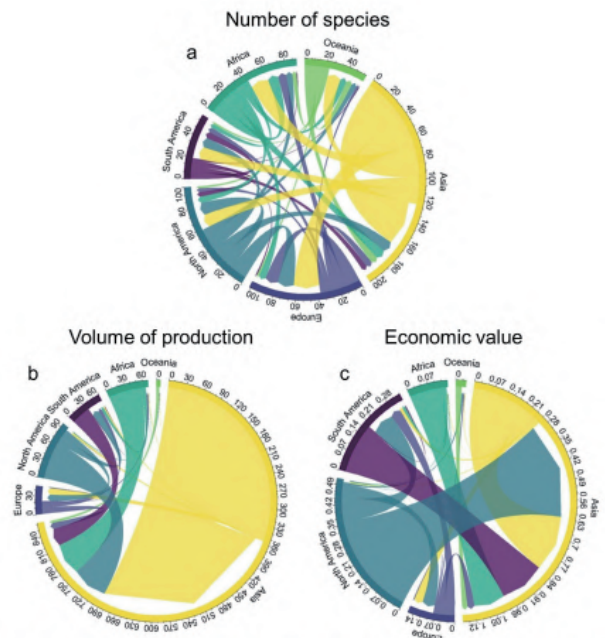


FIGURE 5 | Flows of the number of non-native species used in aquaculture (a), the volume of aquaculture production (in million tonnes) (b) and their economic value (in 2017 USD billion) (c) originating from non-native species between the continents of species origin and the continents producing non-native aquaculture. While arrow thickness represents the number of species or production quantity farmed in receiving continents, arrows indicate known native ranges and final recipient regions of reported aquaculture production (colored according to the continent of origin). Note that intracontinental flows represent introductions between countries within the same continent.

2.2 EDIBLE SPECIES OF BORAGINALES

Iran

Challenge

Edible Boraginales species are widely consumed in various regions, yet their potential remains undervalued in mainstream agriculture and nutrition. Many of these plants play crucial roles in local diets but lack comprehensive scientific evaluation of their cultivation and nutritional benefits. It is necessary to embrace the exploration of novel edible resources and consider expanding our culinary repertoire to secure our future food supply.

Contribution

1. The edible species of Boraginales have several documented uses. They may be consumed raw, cooked, or both. They can be eaten alone as food, a snack, or in salads. They are also used as additions to other foods, as side dishes, or processed into drinks and desserts. Specifying the geographical range of these plants, we aim not only to identify them as potential future food sources but also to provide a clear reference for experts and farmers interested in cultivating them in similar geographic regions.
2. Edible Boraginales species that are consumed only in a specific region, temperate regions favor leafy herbaceous taxa, whereas seasonally dry and wet tropical regions emphasize fleshy fruits, especially within *Cordia* and *Ehretia*. Representative records illustrate this contrast: leafy parts are used in Europe/Turkey/Iran and North America, and fruit are used in Africa, the Neotropics, and South/Southeast Asia.

Citation

Nazari, H., & Ghahremaninejad, F. (2025). Edible species of Boraginales. *Ethnobotany Research and Applications*, 32. <https://doi.org/10.32859/era.32.15.1-30> .

2 ZERO HUNGER



Data Uses

Native origins for cultured non-native species were derived from global databases, GBIF, and web scraping.

Open Sciences

Open scientific publications; open educational resources

Affiliations

1. Department of Biology, Bu-Ali Sina University, Iran
2. Department of Plant Sciences, Faculty of Biological Sciences, Kharazmi University, Iran



Figure 1: Edible species of Boraginales in traditional herbal markets of Iran.

3.1 WILDFIRE-DERIVED DEFORESTATION, CLIMATE, AND BIODIVERSITY VARIABLES ANALYSIS IN CAMBODIA

Cambodia

Challenge

In Southeast Asia, Cambodia has the highest rate of wildfire, and during the early 2000s, fire activity has dramatically grown. Since wildfires are frequently multidimensional, it is still challenging to assess the relative significance of each component. Therefore, forest fire examination is necessary to distinguish the areas of deforestation and related climate change as an environmental problem in Cambodia.

Contribution

1. This study concludes that the integration of satellite-derived biophysical indices (LST, NBR, FPAR, GPP, NPP, ET, PET, LAI) with machine learning models (RF and SVM) via the GEE platform provides a robust, unprecedented framework for assessing forest fire dynamics in Cambodia from 2005 to 2023.
2. By filling a critical gap in long-term, local-level fire research, the findings reveal complex interactions between forest fires, land degradation, and climate change. Ultimately, this methodology serves as a scalable and replicable model for global environmental analysis, while providing Cambodian policymakers with essential, actionable data to mitigate fire risks, enhance forest management, and build climate resilience.

Citation

Halder, B., Rana, B., Juneng, L., Alshehri, F., Ahmed, K. O., Pramanik, M., Ahmed, M. F., Pande, C. B., Shafik, S. S., & Yaseen, Z. M. (2025). Wildfire-derived deforestation, climate, and biodiversity variables analysis in Cambodia. *Physics and Chemistry of the Earth, Parts A/B/C*, 139.

<https://doi.org/10.1016/j.pce.2025.103894>



Data Uses

None GBIF data was used

Open Sciences

Open scientific publications

Affiliations

1. Department of Earth Sciences and Environment, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Malaysia
2. Department of Remote Sensing and GIS, Vidyasagar University, India
3. Department of Geology and Geophysics, College of Science, King Saud University, Saudi Arabia
4. Civil Engineering Department, Tishk International University, Iraq
5. Urban Innovation and Sustainability, Department of Development and Sustainability, School of Environment, Resources and Development, Asian Institute of Technology (AIT), Thailand
6. Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia (UKM), Malaysia
7. Institute of Energy Infrastructure, Universiti Tenaga Nasional, Malaysia
8. Experimental Nuclear Radiation Research Group, Scientific Research Center, Al-Ayen University, Iraq
9. Civil and Environmental Engineering Department, King Fahd University of Petroleum & Minerals, Saudi Arabia

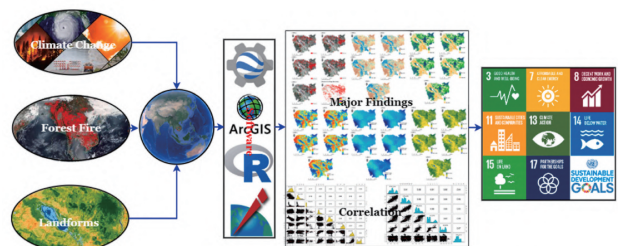


Fig. 2. Adopted methodology of the study. This study focused on the forest fire in Cambodia, which effects the landforms.



3.2 THE IMPACTS OF CLIMATE CHANGE ON THE GLOBAL RANGE OF *CULICOIDES PUNCTATUS* (MEIGEN, 1804) WITH NOTES ON ITS STATUS IN SAUDI ARABIA

Saudi Arabia

Challenge

Biting midges, particularly *Culicoides* species, pose significant health risks to humans and animals due to their biting behavior and ability to transmit diseases. Saudi Arabia is home to a diverse range of *Culicoides* species, and studies have identified numerous *Culicoides* midges in different regions of the country. Understanding their behavior and distribution patterns is crucial for predicting and controlling the spread of viral infections.

Contribution

1. This study employs species distribution modeling to assess the environmental suitability and potential future distribution of *Culicoides punctatus*, a species known for causing allergic reactions in horses and acting as a vector for bluetongue virus (BTV) and African horse sickness virus (AHSV).
2. This study contributes to our understanding of the ecological implications of climate change on *Culicoides* midges and the associated viral infections. It provides valuable insights for designing effective management strategies, conservation efforts, and mitigation measures to minimize the impact of biting midges on human and animal health.

Citation

Al-Malki, E. S. (2025). The impacts of climate change on the global range of *Culicoides punctatus* (Meigen, 1804) with notes on its status in Saudi Arabia. *PeerJ*, 13, e18916.
<https://doi.org/10.7717/peerj.18916>

Data Uses

Species occurrence records for *C. punctatus* were collected from the Global Biodiversity Information Facility (GBIF) (<https://doi.org/10.15468/DL.XZ36FW>) (GBIF.Org, 2023), and environmental data representing. Climate variables were obtained from WorldClim.

Open Sciences

Open scientific publications; open research data

Affiliations

Majmaah University, Department of Biology, College of Science in Zulfi, Saudi Arabia

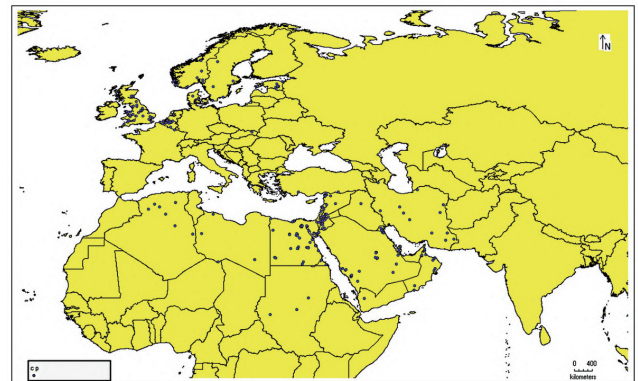


Figure 1: Occurrence records map. Cropped map of the Old World showing occurrence records of *Culicoides punctatus*.

3.3 HABITAT SUITABILITY FOR TROPICAL ASIAN STINGLESS BEES ACROSS ANTHROPOGENIC LANDSCAPES

Thailand

Challenge

Stingless bees are key pollinators of both wild plants and crops in tropical Asia and are exploited for honey production and pollination services. Despite their importance, little is known about their habitat preferences in anthropogenic landscapes

Contribution

1. The habitat suitability for stingless bee community is strongly influenced by landscape factors including distance to nearest forest, proportions of paddy fields, forest, field crops, and villages.
2. Guide decision makers to support actions toward protecting and sustainably managing this important pollinator group, Asian stingless bees, particularly in response to ongoing environmental changes.

Citation

Wayo, K., Haydon, D. T., Piraonapicha, K., & Nelli, L. (2025). Habitat suitability for tropical Asian stingless bees across anthropogenic landscapes. *Journal of Insect Conservation*, 29(2).
<https://doi.org/10.1007/s10841-025-00660-0>



Data Uses

The Global Biological Information Facility (GBIF.org 2023; <https://www.gbif.org>), data from Wayo et al. (2020), and new data from additional field surveys. The first dataset was obtained from the “Digitizing and data basing of bee specimens in Thailand” retrieved from the GBIF data repository, which included records for 39 described genera and 155 bee species.

Open Sciences

Open scientific publications

Affiliations

1. School of Biodiversity, One Health & Veterinary Medicine, University of Glasgow, UK
2. Futuristic Science Research Center, School of Science, Walailak University, Thailand
3. Research Center for Theoretical Simulation and Applied Research in Bioscience and Sensing, Walailak University, Thailand
4. Entomology Section, Queen Sirikit Botanic Garden, The Botanical Garden Organization, Thailand



4.1 ETHNOBOTANY IN THE DIGITAL AGE: OPPORTUNITIES AND CHALLENGES OF TRADITIONAL KNOWLEDGE DIGITIZATION

India

Challenge

The research identifies several critical obstacles in the field of ethnobotany, primarily the risk of losing traditional medicinal knowledge due to its reliance on oral transmission and the aging of practitioners. Additionally, there are significant difficulties in ensuring data accuracy during the collection and translation of oral traditions into digital formats. Ethical concerns are also prominent, particularly regarding biopiracy, the protection of indigenous intellectual property rights, and ensuring equitable benefit sharing with local communities. Finally, the paper highlights the lack of accessibility for marginalized communities who may lack the technical expertise or resources to engage with digital databases.

Contribution

1. This paper provides a comprehensive review of the importance of digitization in bridging ancient medicinal wisdom with modern science. It details how the integration of traditional knowledge with bioinformatics tools can accelerate drug discovery and promote sustainable harvesting practices.
2. The authors analyze the specific roles of global databases such as TKDL, BOLD, and GBIF in safeguarding and validating traditional knowledge. The review proposes the adoption of emerging technologies like Artificial Intelligence (AI) for predictive data analysis and blockchain for securing data authenticity and intellectual property.

Citation

Magare, D. A., & Patil, M. B. (2025). Ethnobotany in the digital age: Opportunities and challenges of traditional knowledge digitization. *World Journal of Biology Pharmacy and Health Sciences*, 21(01), 235-242.
<https://doi.org/10.30574/wjbphs.2025.21.1.0043>

Data Uses

The study references the use of several major digital repositories to manage ethnobotanical information. The Barcode of Life Database (BOLD) is utilized for DNA barcoding and genetic validation of medicinal plant species. The Traditional Knowledge Digital Library (TKDL) serves to document Indian medicinal practices to prevent unauthorized patenting or biopiracy. Furthermore, GBIF is used for mapping the distribution of medicinal plants to support conservation efforts, while tools like FreeDELTA and NaviKey are applied for taxonomic classification and species identification.

Open Sciences

Open scientific publications; open research data; open source software and source code

Affiliations

Department of Botany for UG, PG, and Research at J.E.S's Arts, Science and Commerce College, Nandurbar, India.

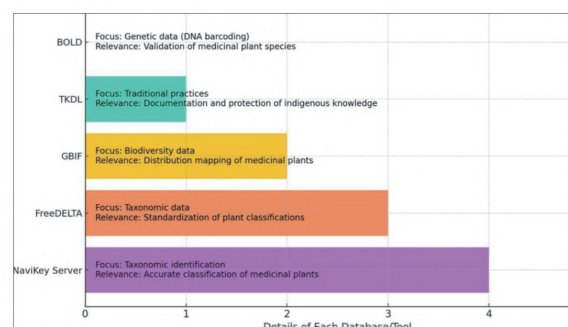


Figure 1 Database and tools for Traditional Knowledge Digitization



4.2 CHINA'S NATIONAL BOTANICAL GARDENS: AN INNOVATIVE MODEL TO SUPPORT GLOBAL BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT

China

Challenge

The planet is currently experiencing an unprecedented biodiversity crisis, with anthropogenic activities accelerating extinction rates to approximately 1,000 times the natural background level due to habitat destruction, climate change, and over-exploitation. China faces significant pressure as more than 4,000 plant species are on the brink of extinction, and approximately 1,200 are listed as national key protected wild plants. Historically, the effectiveness of plant conservation in China was limited by fragmented governance and uneven development among its botanical gardens.

Contribution

This initiative establishes a national system of botanical gardens as a flagship strategic framework to lead China's wild-plant conservation and ecological civilization, formulating a comprehensive layout plan to integrate 16 institutions by 2035, targeting the ex-situ conservation of over 80% of national key protected plants and 70% of threatened species. Proposing a synergistic five-dimensional development framework encompassing conservation, research, resource utilization, public popularization, and horticultural display, it implements a "1+N" management model of one core garden plus multiple satellite sites to secure key plant taxa across diverse climates and ecosystems. Furthermore, the system promotes integrated management by explicitly aligning National Botanical Gardens with neighbouring National Parks for shared research and species recovery, thereby directly advancing the Kunming-Montreal Global Biodiversity Framework by addressing specific targets related to ecosystem restoration, species protection, and genetic diversity.

Citation

He, T., Zhou, Z., Dong, H., Yuan, L., Guo, L., Wang, Y., Zheng, M., Qin, Y., Gu, Y., Jackson, P. W., & Ren, H. (2026). China's National Botanical Gardens: An innovative model to support global biodiversity conservation and sustainable development. *Plant Diversity*, 48, 219-224.
<https://doi.org/10.1016/j.pld.2025.11.005>

Data Uses

The system utilizes the National Living Plant Collection Information System. It builds upon existing frameworks like the Plant Information Management System (PIMS) and references global tools such as PlantSearch and GBIF to evaluate conservation efficacy and identify gaps.

Open Sciences

Open scientific publications

Affiliations

1. Wildlife Conservation Monitoring Center, National Forestry and Grassland Administration, China
2. Wildlife Conservation Department, National Forestry and Grassland Administration, China
3. Missouri Botanical Garden, USA
4. Guangdong Provincial Key Laboratory of Applied Botany, South China Botanical Garden of the Chinese Academy of Sciences, China South China National Botanical Garden, China

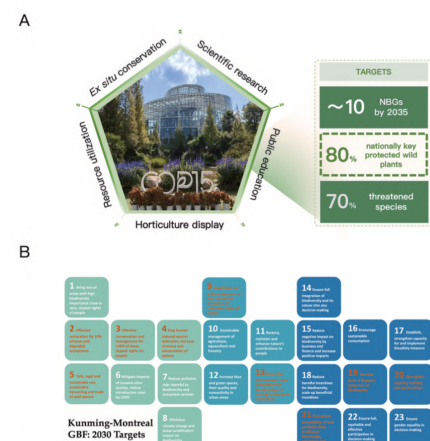


Fig. 1. Main functions and targets of China's NBGs and their contributions to the Kunming-Montreal GBF. A, Main functions and targets of China's NBGs; B, 23 targets of Kunming-Montreal Global Biodiversity Framework and the contributions of China's NBGs to specific targets (in dark red color).

5.1 OPEN AND FAIR DATA SHARING ARE BUILDING BLOCKS TO BOLSTER BIODIVERSITY CONSERVATION IN SOUTHEAST ASIA

Southeast Asia

Challenge

Southeast Asia (SEA) is a global center for biodiversity, containing four of the world's 34 biodiversity hotspots, yet this natural wealth is severely threatened by rapid urbanization, deforestation, pollution, and climate change. While biodiversity data is essential for effective conservation, it is often inaccessible in the region because it remains unpublished, unorganized, or subject to institutional gatekeeping. Furthermore, there is a significant disparity in data mobilization capacity, with approximately 41% of regional occurrence records contributed by foreign researchers and institutions. Taxonomic biases also persist, as birds account for 62% of the records while groups like amphibians and reptiles remain poorly reported. Systemic obstacles such as limited financial resources, a lack of institutional infrastructure, insufficient academic credit for data publishing, and ongoing geopolitical conflicts further hinder the adoption of open data practices.

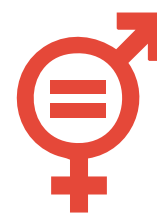
Contribution

This study provides a comprehensive overview of the status and trends of biodiversity data availability across 11 Southeast Asian geopolitical territories using the Global Biodiversity Information Facility (GBIF), identifying critical gaps in data sharing that highlight geographic and taxonomic biases limiting the effectiveness of conservation prioritization in the region. To address these challenges, the paper proposes the "open-NOTE" framework—comprising the steps of Normalise, Organise, Train, and Engage—as a practical and actionable strategy to promote open and FAIR data sharing among researchers and institutions. Furthermore, it argues for the mainstreaming of open and FAIR data principles into national biodiversity agendas, scientific norms, and funding policies to accelerate regional conservation efforts.

Citation

Tanalgo, K. C. (2025). Open and FAIR data sharing are building blocks to bolster biodiversity conservation in Southeast Asia. *Biological Conservation*, 307, 111192.
<https://doi.org/10.1016/j.biocon.2025.111192>.

5 GENDER
EQUALITY



Data Uses

The paper synthesizes a total of 17,126,598 occurrence records from Southeast Asia reported to the GBIF repository as of April 2024. It analyzes these records based on major taxonomic groups and data sources, noting that 66% come from human observations—predominantly through citizen science platforms like eBird and iNaturalist—and 27% come from preserved specimens.

Open Sciences

Open research data

Affiliations

Biodiversity Synthesis+ Centre of the Ecology and Conservation Research Laboratory (Eco/Con Lab), Department of Biological Sciences, College of Science and Mathematics, University of Southern Mindanao, Philippines.

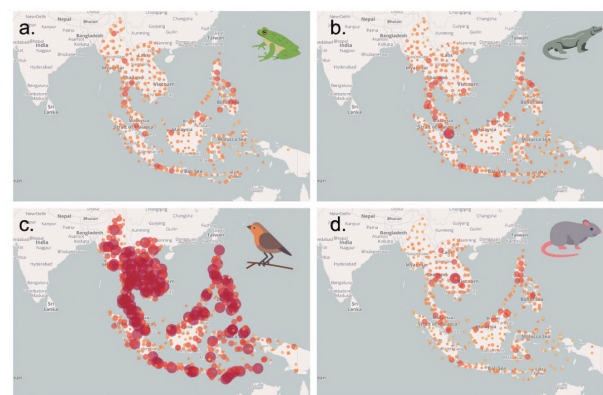


Fig. 2. Overview of distribution of occurrence records for four terrestrial vertebrate groups—(a) amphibians, (b) reptiles, (c) birds, and (d) mammals—across Southeast Asia, based on data from the Global Biodiversity Information Facility (GBIF) (2000–2024). Note: The map was generated using the GBIF web platform.



6.1 PREDICTING HABITAT SUITABILITY AND RANGE DYNAMICS OF THREE ECOLOGICALLY IMPORTANT FISH IN EAST ASIAN WATERS UNDER PROJECTED CLIMATE CHANGE

East Asia

Challenge

Climate change has triggered habitat shifts and increased vulnerability for ecologically important fish in East Asian waters. Current marine protected areas provide insufficient coverage for core habitats. Benthic and pelagic fish show divergent environmental responses. Limited species occurrence records and lack of integrated anthropogenic data reduce modeling reliability. Shifting species ranges also create transboundary fisheries management challenges.

Contribution

This study quantifies habitat suitability and range dynamics of three ecologically important fish under multiple climate change scenarios, identifies the dominant environmental drivers shaping their distributions, reveals contrasting range contraction and expansion patterns across species, evaluates severe conservation gaps in current protected area systems, locates climatically stable refuge regions, and provides scientific evidence to support adaptive, cross-border marine conservation and fisheries management.

Citation

Nneji, I. C., Mambo, W. W., Zheng, Z., Oladipo, S. O., Zhao, H., Lu, W., Nneji, L. M., Lin, J., & Liu, W. (2025). Predicting Habitat Suitability and Range Dynamics of Three Ecologically Important Fish in East Asian Waters Under Projected Climate Change. *Biology (Basel)*, 14 (11).
<https://doi.org/10.3390/biology14111476>

Data Uses

Species occurrence data were obtained from GBIF and OBIS; environmental layers were retrieved from Bio-ORACLE based on CMIP6 projections; protected area data were collected from the WDPA and Chinese national protected area datasets; and calibration areas were defined using the MEOW marine ecoregion framework.

Open Sciences

Open scientific publications

Affiliations

1. Guangdong Provincial Key Laboratory of Marine Disaster Prediction and Prevention, Guangdong Provincial Key Laboratory of Marine Biotechnology, Institute of Marine Sciences, Shantou University, China
2. International Joint Research Center for Marine Ecological Protection and Disaster Prevention, Shantou University, China
3. Department of Biology, Howard University, USA

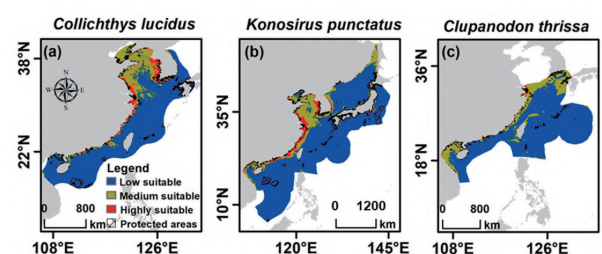


Figure 5. Conservation gaps between current potential distribution ranges and existing marine protected areas (MPAs). Gap analysis results for (a) *Collichthys lucidus*, (b) *Konosirus punctatus*, and (c) *Clupanodon thrissa*.



6.2 KURDISH ETHNOMEDICINE IN THE CONTEXT OF HISTORIC MIGRATION

Iran

Challenge

The study faced challenges including forced displacement of Kurds from NW to SE Iran (16th–18th century), leading to a vastly different climate, flora, and healthcare access. Balochi Kurds lost their native Kurdish language yet retained medicinal knowledge. SE Iran has poor healthcare infrastructure, higher disease burden, and limited prior ethnobotanical records, while fieldwork also involved security issues and gender barriers.

Contribution

1. This paper provides the first comparative ethnomedicinal study of Kurdish descendants in SE Iran (Balochi Kurds) versus Kurds in NW, approximately 300 years after migration. It identifies adaptive patterns such as continuation of uses (e.g., *Mentha longifolia*, *Peganum harmala*), plant substitutions (e.g., *Thymus* spp. replaced by *Zataria multiflora*; different *Salvia* species), adoption of Balochi knowledge (e.g., *Capparis spinosa* for fractures, *Zygophyllum* for diabetes), and loss or abandonment of certain uses (e.g., *Eryngium*, *Euphorbia*, *Tribulus*).
2. The study documents 278 plant species and 4,722 use reports, covering diverse practitioners including herbalists, midwives, bonesetters, and ritual healers. It demonstrates the resilience of medicinal knowledge despite language loss and environmental change, and shows how poorer formal healthcare in SE Iran drives more complex preparations and greater reliance on traditional medicine.

Citation

Wayo, K., Haydon, D. T., Piraonapicha, K., & Nelli, L. (2025). Habitat suitability for tropical Asian stingless bees across anthropogenic landscapes. *Journal of Insect Conservation*, 29(2).
<https://doi.org/10.1007/s10841-025-00660-0>

Data Uses

Plant specimens were identified using *Flora Iranica*, *Flora of Pakistan*, *Flora of Turkey*, and digital resources such as GBIF and JSTOR Global Plants, with voucher specimens deposited in public herbaria (Z+ZT, Zurich and MPH, Tehran).

Open Sciences

Open research data

Affiliations

1. Department for Systematic and Evolutionary Botany and Botanical Garden, University of Zurich, Switzerland
2. Department of Biomedical Sciences, University of Cagliari, Cittadella Universitaria, Italy
3. Department of Biology, Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, Iran



Fig. 2. A herbalist applying smoke therapy to treat skin burns caused by boiling water (SE Iran). A) Charcoal is prepared and resin of *Platanus atlantica* and leaves of *Arenaria sieberi* added. B) The smoke is captured with a blanket and the injured skin fumigated. Finally, *Peganum harmala* seed smoke is applied as a disinfectant. C) A mixture of warm milk and *danshik* (seed powder of *Platanus lanceolata*, imported from Pakistan) is applied on the burned skin, and D) covered with a bandage which lasts for 24 h. The procedure is repeated for several days.



6.3 ECOLOGICAL NICHE MODELING OF TWO COOCCURRING DESERT SPECIES IN SAUDI ARABIA: IMPLICATIONS FOR BIODIVERSITY AND CLIMATE RESILIENCE

Saudi Arabia

Challenge

Global biodiversity is facing unprecedented threats from climate change, with tropical and arid-zone species among the most vulnerable. In Saudi Arabia, extreme temperatures and limited water availability amplify these risks for native desert flora. Although ecological niche modeling is widely used, its application in arid and hyper-arid regions remains limited due to logistical challenges of ecological sampling in extreme environments and the scarcity of high-resolution occurrence data. A key gap is the lack of integrative, multi-species modeling that addresses co-occurring species and their potential interactive responses to changing climatic conditions, which is essential for understanding ecosystem resilience under climate stress.

Contribution

1. This study assesses the current and future potential distributions of *Ochradenus baccatus* and its co-occurring species *Vachellia tortilis* in Saudi Arabia using MaxEnt ecological niche models.
2. Future projections under SSP2-4.5 and SSP5-8.5 scenarios for mid-century (2041-2060) and late-century (2061-2080) reveal a substantial decline in suitable habitat for *O. baccatus* and increasing fragmentation of co-occurrence zones, while *V. tortilis* retains broader ecological tolerance. High-suitability zones are concentrated along the western mountainous escarpments, but are projected to shift toward east-central and northern regions. Hotspot analysis identifies climatically stable southwestern highlands as potential future refugia, providing a framework for conservation planning and climate resilience strategies in Saudi Arabia.

Citation

Al-Bakre, D. A. (2025). Ecological niche modeling of two co-occurring desert species in Saudi Arabia: implications for biodiversity and climate resilience. *BMC Plant Biol*, 25(1), 1706.
<https://doi.org/10.1186/s12870-025-07820-z>

Data Uses

Species occurrence data are compiled from field surveys (2022-2024), GBIF, and regional floristic literature

Open Sciences

Open scientific publications

Affiliations

Department of Biology, College of Science, University of Tabuk, Saudi Arabia

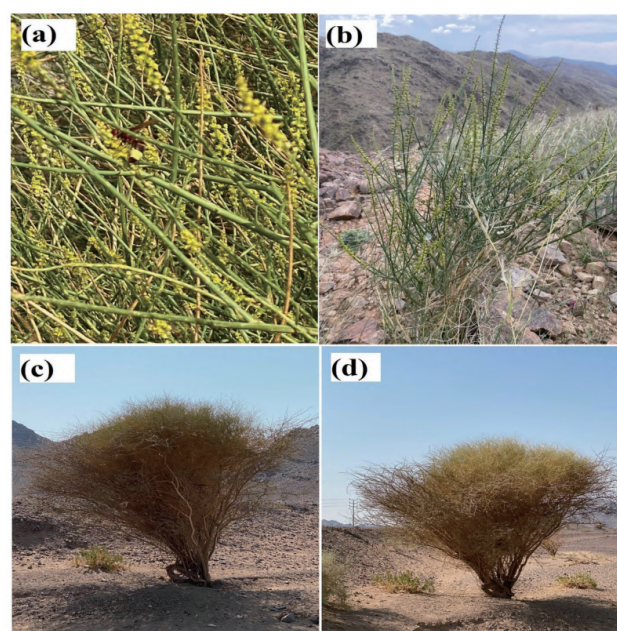


Fig. 1 Field photographs of *O. baccatus* illustrating its morphological characteristics and ecological associations. **a** Close-up of flowering branches displaying the yellow inflorescences typical of *O. baccatus*; **b** an isolated individual of *O. baccatus* growing independently on rocky slopes; **c** and **d** show *O. baccatus* co-occurring with *V. tortilis* in arid habitats



7.1 UNLOCKING GLOBAL CLIMATE MITIGATION POTENTIAL WITH JATROPHA BIODIESEL FROM MARGINAL LANDS

Global

Challenges

Global arable land scarcity and the urgent need to phase out fossil fuels necessitate identifying sustainable alternatives for bioenergy without competing with food production. Most bioenergy crops are cultivated on agricultural land, creating potential food-fuel conflicts if expanded onto arable land. Previous *Jatropha* initiatives have faced significant challenges including unrealized yield promises, inadequate farmer incentives, land tenure issues, and widespread project failures. Additionally, natural vegetation regeneration on marginal lands provides limited carbon sequestration due to the same biophysical constraints that define these lands, making it insufficient to meet climate mitigation goals alone.

Contribution

This study presents a global assessment of marginal land suitable for cultivating *Jatropha curcas* using a machine learning approach (boosted regression tree) to generate a high-resolution potential distribution map. It integrates life cycle assessment to quantify greenhouse gas (GHG) mitigation potential of *Jatropha*-based biodiesel under three future scenarios (varying land resources and RCPs, high-input, rain-fed). Results indicate approximately 2559 Mha of global marginal land is suitable for *Jatropha*, with biodiesel production capable of mitigating up to 5597 million metric tons of GHG emissions annually, offsetting ~11% of global emissions in 2022. The study also demonstrates that this bioenergy pathway delivers significantly greater GHG mitigation than carbon sequestration via natural vegetation regrowth ($\leq 6 \text{ Mg C ha}^{-1} \text{ yr}^{-1}$).

Citation

Yu, Z., & Zhang, F. (2025). Unlocking global climate mitigation potential with *jatropha* biodiesel from marginal lands. *Journal of Cleaner Production*, 536. <https://doi.org/10.1016/j.jclepro.2025.147179>

Data Uses

Species occurrence data for *Jatropha curcas* are obtained from the Global Biodiversity Information Facility (GBIF).

Open Sciences

Open scientific publications

Affiliations

1. College of Economics and Management, Nanjing Forestry University, China
2. Key Laboratory of Land Surface Pattern and Simulation, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China

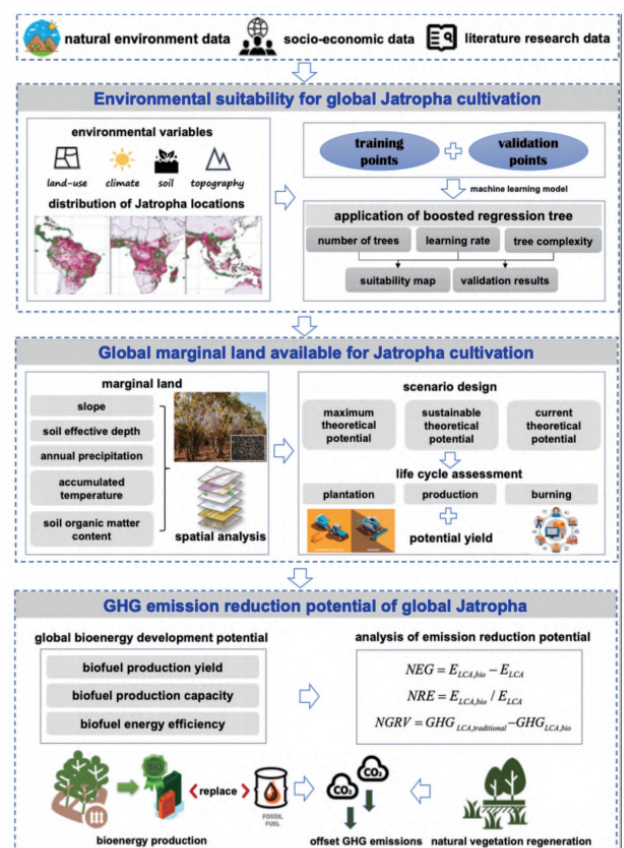


Fig. 1. Research framework.

7.2 THE GLOBAL LAND-WATER-CLIMATE NEXUS OF DROUGHT-TOLERANT SUCCULENT PLANTS FOR BIOENERGY IN ABANDONED CROPLANDS AND ARID MARGINAL LANDS

Global

Challenges

Two main open challenges for a global deployment of bioenergy crops are land availability and differing water-usage requirements. Climate change has been dramatically restructuring agriculture and damaging crops, threatening the achievement of global food security and bioenergy goals. The gradual bioenergy deployment consistent with the green-growth paradigm cannot be achieved at the expense of biodiversity transgressions or unsustainable use of land and water. An extended discussion about the potentialities of CAM species for large-scale bioenergy has been hindered by the lack of global bioenergy potential estimations for this group of species that can be contrasted with more studied C3 and C4 bioenergy crops, and the lack of interlinkages between high-resolution soil characteristics, water supply, management intensity, ecological constraints, and land availability with CAM crop yields.

Contribution

1. This study estimates under a bottom-up approach the global bioenergy potentials of four relevant CAM species (*Agave tequilana*, *A. salmiana*, *A. fourcroydes*, and *Opuntia ficus-indica*) on recently abandoned croplands and arid marginal lands, unravelling the interdependencies between land availability, water requirements, and climatic conditions at the global scale.
2. It identifies a potential of $16\text{--}36 \text{ EJ yr}^{-1}$ in abandoned croplands, which is comparable to miscanthus under similar conditions, but with water requirements only 24–30% of those for C3 and C4 bioenergy crops. It also identifies a carbon sequestration potential via plant growth of $-3.09 \text{ Pg C yr}^{-1}$ between 1960 and 2020, revealing an underestimated opportunity in arid marginal lands. A country-scale prioritization analysis groups 147 countries into four clusters based on bioenergy productivity, water scarcity, indoor air pollution, and income, highlighting health benefits in low-income countries.

Citation

Carvajal, M. A., Quiroz, M., Alaniz, A. J., Vergara, P. M., Valenzuela-Aguayo, F., & Hidalgo-Corrotea, C. (2025). The global land-water-climate nexus of drought-tolerant succulent plants for bioenergy in abandoned croplands and arid marginal lands. *J Environ Manage*, 379, 124747. <https://doi.org/10.1016/j.jenvman.2025.124747>



Data Uses

Species occurrence records are obtained from GBIF

Open Sciences

Open scientific publications

Affiliations

1. Departamento de Gestión Agraria, Facultad Tecnológica, Universidad de Santiago de Chile, Chile
2. Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, Chile

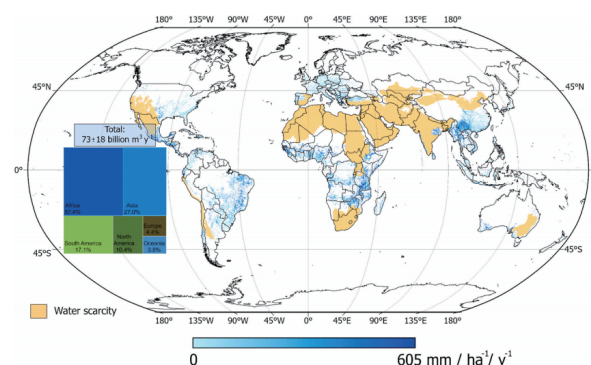


Fig. 4. Total water withdrawal with agricultural management for the optimal CAM species model in abandoned croplands outside areas under water scarcity. The map is aggregated to ~5 km resolution for improved visualization.



8.1 ASSESSING THE ESTABLISHMENT RISK FOR PARTHENOGENETIC POPULATIONS OF *LISSORHOPTRUS ORYZOPHILUS* IN GLOBAL RICE-GROWING AREAS AND POTENTIAL ECONOMIC IMPACT IN CHINA

Global

Challenges

Quantifies global establishment risk and regional economic impacts of parthenogenetic invasive pests under climate change; integrates species distribution modeling with economic loss assessment to address gaps in biotic invasion risk frameworks for globally important crop pests.

Contribution

identifies dominant climatic drivers for global habitat suitability of parthenogenetic *Lissorhoptrus oryzophilus* populations; detects novel climatic niche expansion in invaded Asian regions compared to native North America; quantifies potential economic losses and control benefits in China's rice industry; provides a combined modeling framework for invasive pest risk assessment and economic evaluation.

Citation

Li, L., Jin, Z., Li, M., Xue, Y., Guo, J., Jia, D., Ma, R., Lu, Z., Xian, X., & Liu, W. (2024). Assessing the establishment risk for parthenogenetic populations of *Lissorhoptrus oryzophilus* in global rice-growing areas and potential economic impact in China. *Front Plant Sci*, 15, 1506418.

<https://doi.org/10.3389/fpls.2024.1506418>

Data Uses

1500 filtered global occurrence records from GBIF, BOLD Systems and published literatures

Open Sciences

Open scientific publications, open research data, open source software and source code

Affiliations

1. College of Plant Protection of Shanxi Agricultural University, Jinzhong, China,
2. State Key Laboratory for Biology of Plant Diseases and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing, China

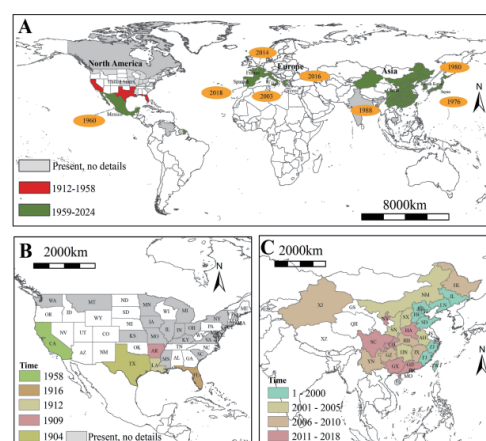


FIGURE 2
(A) Global invasion history reconstruction of *Lissorhoptrus oryzophilus*; (B) Historical spread dynamics of *L. oryzophilus* in the United States; (C) Historical spread dynamics of *L. oryzophilus* in China.



8.2 PYROSOMES, *PYROSOMA ATLANTICUM*: HIGHLIGHTING PLANKTON AS AN IMPORTANT FOOD SOURCE FOR CORAL REEFS IN TIMOR-LESTE

Timor-Leste

Challenges

Addresses the long-standing paradox of hyper-diverse coral reefs thriving in oligotrophic waters; resolves underestimation of subsurface intrusive upwelling undetectable by satellites; clarifies trophic roles of large gelatinous plankton in coral nutrition; links regional oceanography to reef resilience under ocean warming and acidification.

Contribution

Identifies dominant climatic drivers for global habitat suitability of parthenogenetic *Lissorhoptrus oryzophilus* populations; detects novel climatic niche expansion in invaded Asian regions compared to native North America; quantifies potential economic losses and control benefits in China's rice industry; provides a combined modeling framework for invasive pest risk assessment and economic evaluation.

Citation

Kim, C. J. S., & Kelley, R. (2025). Pyrosomes, *Pyrosoma atlanticum*: Highlighting plankton as an important food source for coral reefs in Timor-Leste. *Ecology*, 106(6), e70095.

<https://doi.org/10.1002/ecy.70095>

Data Uses

GBIF global occurrence records for *Pyrosoma atlanticum*

Open Sciences

Open scientific publications

Affiliations

1. School of Earth and Atmospheric Sciences, Queensland University of Technology, Brisbane, Queensland, Australia
2. Centre for Data Science, Queensland University of Technology, Brisbane, Queensland, Australia
3. Resilience Centre, Queensland University of Technology, Brisbane, Queensland, Australia
4. School of the Environment, The University of Queensland, Brisbane, Queensland, Australia
5. Independent Researcher, BYOGUIDES, Alligator Creek, Queensland, Australia

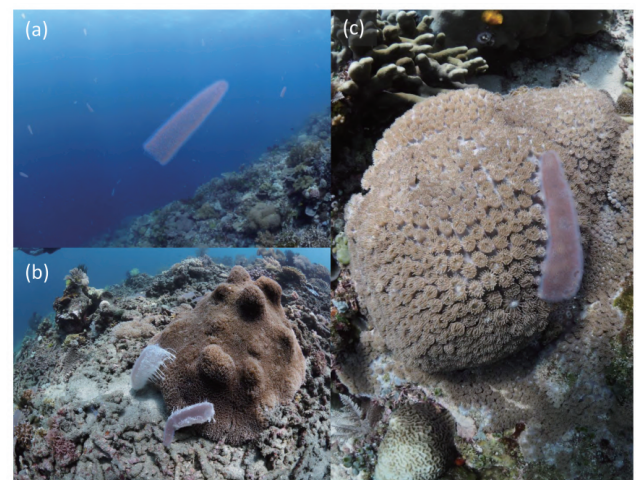


FIGURE 1 (a) A bloom of *Pyrosoma atlanticum* seen looking out on the reef slope at Haruina, or Beloi Barrier Reef on Atauro Island, in Timor-Leste at ~10 m depth on September 24, 2019. (b) Two *P. atlanticum* ensnared by mesenterial filaments of the Scleractinian corals *Hydnothpora cf. pilosa* and (c) *Duncanopsammia pelata*, both on a shallow (<10 m) reef in Be'hau, Timor-Leste, on October 8, 2019. Pyrosomes are roughly 20 cm. See Video S2. Credit for all media: Catherine J. S. Kim.

9.1 AI-DRIVEN CONSERVATION OF THE ENDANGERED TWISTED YEW (*TAXUS CONTORTA* GRIFF.) IN THE WESTERN HIMALAYA

Himalaya

Challenges

Taxus contorta is a rare, endangered medicinal plant endemic to the West Himalayas, valued for producing the anti-cancer compound Taxol. It faces high extinction risks due to overexploitation, climate change, and skewed sex ratios in single-gender (male- or female-only) populations, which lead to inbreeding and low genetic diversity. Traditional Species Distribution Modeling (SDM), such as MaxEnt, requires extensive georeferenced data and large spatial scales, which are often unavailable in data-deficient regions like Swat, Pakistan. Furthermore, these traditional models typically do not provide the single GPS points necessary for the fine-scale propagation efforts required for species with small ecological amplitudes.⁰

Contribution

1. Employs ChatGPT-driven artificial intelligence (AI) as a novel, knowledge-based tool to rapidly identify favorable propagation sites by integrating ecological traits, climatic preferences, and geographic context.
2. Demonstrates high predictive accuracy, with 92% geographic accuracy for generated coordinates in the Swat district and 100% accuracy for species-specific general knowledge.
3. Successfully identifies 21 unique optimal propagation sites and validates the model by confirming 16 previously undocumented natural populations through field surveys.
4. Provides a practical conservation strategy to restore sex equilibrium by adding male or female twigs to existing single-sex populations at AI-identified locations.
5. Proposes a bidirectional integration of AI analysis, remote sensing, and traditional SDM as a scalable framework for the effective conservation of endangered plants in resource-limited regions.

Citation

Din, S., Ali, H., Panagopoulos, T., Alam, J., Malik, S., & Sher, H. (2025). AI-Driven Conservation of the Endangered Twisted Yew (*Taxus contorta* Griff.) in the Western Himalaya. *Sustainability*, 17(19), 8541. <https://doi.org/10.3390/su17198541>



Data Uses

The study utilizes field data from 11 single-sex *T. contorta* populations documented between 2019 and 2021 in the Swat district. Environmental variables were retrieved from the NASA POWER agroclimatology database. Additionally, the researchers used occurrence records from (GBIF) to establish the species' core altitudinal range (1800–3100 m).

Open Sciences

Open scientific publications

Affiliations

1. Center for Plant Sciences and Biodiversity, University of Swat, Pakistan Faculty of Science and Technology, University of Algarve, Portugal
2. Department of Botany, Hazara University, Pakistan

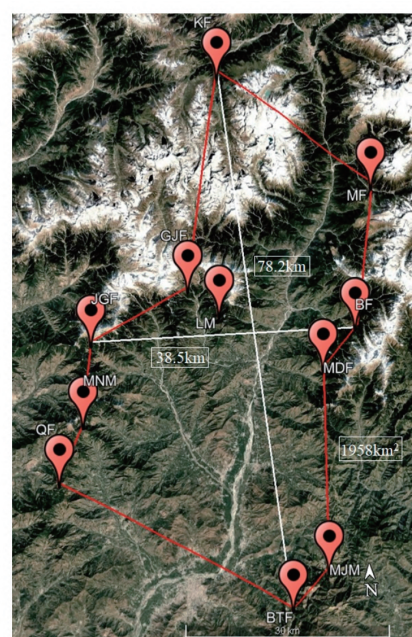


Figure 1. Distribution of natural populations of *T. contorta* in Swat, Pakistan. Locality abbreviations: Kalam (KF), Mankyal (MF), Bashigram (BF), Gabin Jabba (GJF), Jarogo (JGF), Lalko (LM), Miandam (MDF), Malam Jabba (MJM), Manrai (MNM), and Qalagai (QF). F and M, the end of abbreviations, correspond to F (female), M (male).

9.2 INCREASING INVASION DEBT THROUGH GOOD INTENTIONS: THE RISK AND RESPONSIBILITIES OF GREENING INITIATIVES IN THE MIDDLE EAST

Middle East

Challenges

Alien invasive species pose a significant threat to biodiversity in the Middle East's arid desert ecosystems. Large-scale greening efforts, such as the Middle East Green Initiative (MGI) and Saudi Green Initiative (SGI), aim to plant billions of trees but risk inadvertently introducing and spreading invasive plant species. This leads to an "invasion debt," where the full ecological and economic impacts of introduced species are delayed over time. Current challenges include a lack of local research, lagging policy enforcement, and the continued commercial availability of restricted invasive species through online marketplaces and local nurseries.

Contribution

1. Advocates for the integration of stronger research, management, and policy to prevent the accidental introduction of invasive alien plants through sustainable greening initiatives.
2. Employs species distribution modelling (SDM) using MAXENT to predict the potential establishment of 63 terrestrial invasive plant species across the Arabian Peninsula.
3. Identifies that 94% of species regulated in Saudi Arabia have the potential to establish in neighboring countries, with Yemen, Oman, and Jordan being particularly suitable.
4. Uncovers significant enforcement gaps through web-scraping, revealing that 27% of regulated invasive plants remain accessible to consumers via online e-commerce platforms.
5. Proposes a multifaceted framework for future management, including science-driven nuanced regulations, invasion-sensitive urban planning, and the use of machine learning to monitor digital trade pathways.

Citation

Robeck, P., Al-Khawand, G., & Rychlak, Y. (2025). Increasing invasion debt through good intentions: the risk and responsibilities of greening initiatives in the Middle East. *Frontiers in Ecology and Evolution*, 13, 1621445. <https://doi.org/10.3389/fevo.2025.1621445>



Data Uses

The study compiled global occurrence records for 63 invasive plant species from the GBIF, resulting in over 1.1 million presence points.

Open Sciences

Open scientific publications

Affiliations

1. School of Agriculture, Food and Ecosystem Sciences, University of Melbourne, Australia
2. United Nations University Institute for Water, Environment, and Health, Canada
3. Independent Researcher, Riyadh, Saudi Arabia
4. Independent Researcher, Berlin, Germany

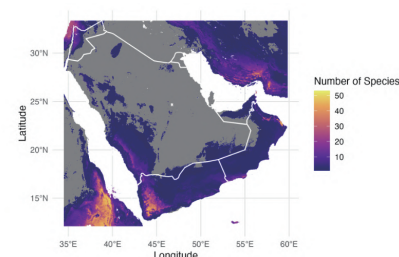
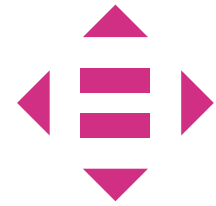


FIGURE 2
Potential distribution of invasive plant species across the Arabian Peninsula. Unsuitable areas are shown in grey. The absence of soil data in urban areas results in the absence of predictions, which are shown in white.



10.1 THE HIDDEN BIODIVERSITY KNOWLEDGE SPLIT IN BIOLOGICAL COLLECTIONS

Global

Challenges

1. Severe global biodiversity knowledge split identified in biological collections; name-bearing type specimens of freshwater and brackish fishes concentrated overwhelmingly in Global North institutions despite origins in Global South nations.
2. Persistent barriers including high access costs, bureaucratic obstacles, and geographic separation from native type specimens imposed on Global South researchers; delayed taxonomic advancement, biased biodiversity inference, and reinforced inequities within global biodiversity science documented as direct consequences.

Contribution

First quantitative global mapping of type specimen distribution for freshwater and brackish fishes conducted; GDP and colonial history confirmed as key drivers of uneven name-bearer accumulation; link established between specimen imbalance and latitudinal taxonomic gradient. Formalization of the biodiversity knowledge split concept; connection proven between specimen inequity and gaps in species discovery and conservation; evidence-based proposals advanced for specimen repatriation, equitable access frameworks, and inclusive international cooperation to decolonize biological collections and promote fair global biodiversity research.

Citation

Nakamura, G., Stabile, B. H. M., Frateles, L. E. F., Araujo, M. L., Neuhaus, E. B., Marinho, M. M. F., de Souza Leite, M., Richter, A., Ding, L., Freitas, T., Soares, B., Graca, W. J. D., Moura, M. R., & Diniz-Filho, J. A. F. (2025). The hidden biodiversity knowledge split in biological collections. *Proc Biol Sci*, 292(2058), 20251045.

<https://doi.org/10.1098/rspb.2025.1045>

Data Uses

All freshwater and brackish fish name bearers are extracted from Eschmeyer's Catalog of Fishes. Specimen occurrence records sourced from the Global Biodiversity Information Facility (GBIF).

Open Sciences

Open scientific publications, open research data, open source software and source code

Affiliations

1. Department of Genetics, Ecology and Evolution, Universidade Federal de Minas Gerais, Brazil
2. Universidade Estadual de Maringá, Brazil
3. Programa de pós-graduação em Ecologia e Evolução, Universidade Federal de Goiás, Brazil
4. Universidade Federal de Goiás, Brazil
5. Instituto Tecnológico Vale Desenvolvimento Sustentável, Brazil
6. Biosciences Institute, Universidade Federal de Mato Grosso do Sul, Brazil

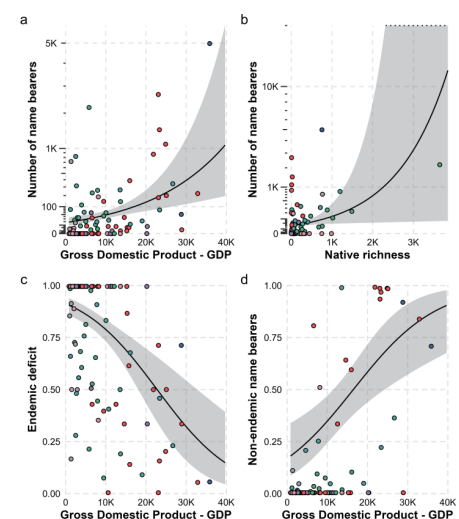
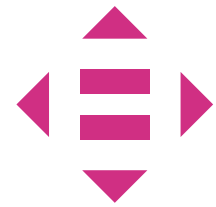


Figure 3. Influence of GDP on countries' knowledge representation of fish name bearers. The per-country GDP effect on the (a) total number of name bearers, (b) native species richness, (c) endemic deficit and (d) non-endemic representation. All the figures represent the marginal effects of the predictor variables on the response variables. The colours represent the geopolitical regions according to Word Bank. Colour codes for the regions are the same as presented in the inset map in figure 1.



10.2 DRIVERS OF EXTINCTION RISKS AND SHORTFALLS ACROSS TERRESTRIAL VERTEBRATES IN THE PHILIPPINE GLOBAL BIODIVERSITY HOTSPOT

Philippine

Challenges

Persistent knowledge shortfalls and uneven research efforts hamper effective conservation in the Philippines, a global biodiversity hotspot. Many Philippine terrestrial vertebrate species remain understudied, with reptiles notably underrepresented and their true threat status likely underestimated. Taxonomic and spatial biases lead to conservation inequities, leaving vulnerable and data-deficient species and areas overlooked. Limited research attention is given to narrowly endemic, threatened, or less charismatic taxa, while larger-bodied, widespread, and historically described species receive disproportionate focus. Weak congruence between research effort and occurrence records, along with inadequate representation of threatened species within protected areas, further exacerbates extinction risks.

Contribution

1. This study provides the first inclusive assessment of extinction risk drivers and biodiversity shortfalls for all 1,294 extant terrestrial vertebrate species in the Philippines. It estimates that 15–23% of these species are at risk of extinction, with endemic amphibians and mammals facing the highest risks (20–33%).
2. Habitat breadth emerges as the most consistent predictor of extinction risk across all groups, while body mass is significant only for mammals and herbivory for birds.
3. The study identifies habitat alteration and overexploitation as the most widespread threats, and reveals that threatened species are poorly studied despite higher conservation priority. It also highlights significant research and observation biases across taxonomic groups and geographic regions.

Citation

Tanalgo, K. C., Dela Cruz, K. C., Agduma, A. R., Lidasan, A. K., Edradan, J., Dumayas, R. K. L., Alagdon, J. S., Villaruz, B. D., & Gatoc, G. K. P. (2025). Drivers of extinction risks and shortfalls across terrestrial vertebrates in the Philippine global biodiversity hotspot. *Sci Total Environ*, 999, 180274. <https://doi.org/10.1016/j.scitotenv.2025.180274>

Data Uses

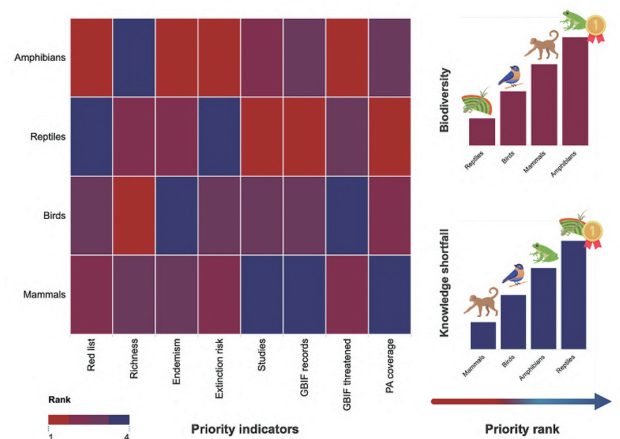
Standardized data from the IUCN Red List (version 2025-1). Species occurrence records are obtained from the Global Biodiversity Information Facility (GBIF) for 1990–2024

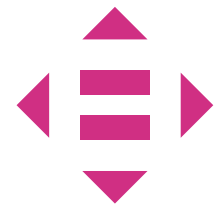
Open Sciences

Open research data

Affiliations

1. Ecology & Conservation Research Laboratory (Eco/Con Lab), Department of Biological Sciences, College of Science and Mathematics, University of Southern Mindanao, Philippines
2. The Graduate School of the University of Southern Mindanao, Philippines





10.3 BEAUTY DEMANDS SACRIFICES: IS IT POSSIBLE TO OVERCOME BOTH CLIMATE CHANGE AND ANTHROPOGENIC IMPACT FOR PAMIR-ALAY TULIPS (LILIACEAE)?

Pamir-Alay mountain

Challenges

The study faces several challenges. Wild tulips in Central Asia are neglected and threatened by habitat loss, overgrazing, climate change, and illegal collection. A knowledge gap exists regarding the current and future status of *Tulipa* species in the Pamir-Alay mountain system. Occurrence points from Afghanistan are unavailable for modeling. Species distribution models have limitations: they do not account for land use changes, invasive species, or geographic barriers such as mountains, deserts, and urbanized areas that prevent dispersal. The model suggests that western Tian-Shan is climatically suitable for three species, but numerous urbanized and agricultural lands lie between Pamir-Alay and western Tian-Shan, acting as significant barriers.

Contribution

1. This study models current and future distributions of four endangered *Tulipa* species (*T. affinis*, *T. carinata*, *T. ingens*, *T. tubergeniana*) endemic to the Pamir Alay mountain system using MaxEnt with 41 bioclimatic and ecological variables.
2. Suitable areas for *T. ingens* increase nearly twofold, while those for *T. affinis* and *T. carinata* remain constant; however, suitable habitat for *T. tubergeniana* decreases by 95.96%.
3. The study identifies protected areas in Uzbekistan suitable for translocation and reveals that western Tian Shan and Hindu Kush mountains are climatically suitable for some species outside their native ranges.

Citation

Davron, D., Temur, A., Umida, T., Sari, I., Shoxida, A., Shuxrat, A., Weibang, S., Ziyoviddin, Y., & Komiljon, T. S. (2025). Beauty demands sacrifices: is it possible to overcome both climate change and anthropogenic impact for Pamir-Alay Tulips (Liliaceae)? *Journal of Asia-Pacific Biodiversity*, 18(1), 47-56.
<https://doi.org/10.1016/j.japb.2024.05.005>

Data Uses

Distribution data are obtained from herbarium specimens (TASH, TAD, FRU), the GBIF database

Open Sciences

Open scientific publications

Affiliations

1. Namangan State University, Uzbekistan
2. Institute of Botany, Academy of Sciences of the Republic of Uzbekistan, Uzbekistan
3. Yunnan Key Laboratory for Integrative Conservation of Plant Species with Extremely Small Populations, Kunming Institute of Botany, Chinese Academy of Sciences, China
4. Key Laboratory for Plant Diversity and Biogeography of East Asia, Kunming Institute of Botany, Chinese Academy of Sciences, China
5. Department of Biology, Faculty of Science and Art, Erzincan Binali Yıldırım University, Turkey

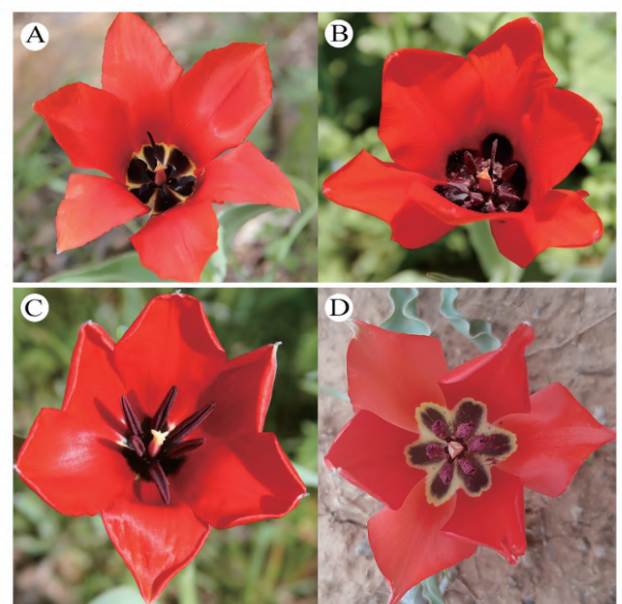


Figure 1. A, *T. affinis*; B, *T. ingens*; C, *T. carinata*; D, *T. tubergeniana*.

11.1 THE SHIFTING PARADIGMS OF BIODIVERSITY CONSERVATION IN SOUTH ASIA

South Asia

Challenges

South Asia faces unprecedented biodiversity loss driven by anthropogenic pressures that exceed its biocapacity, a situation expected to worsen with development. While State-led Protected Areas (PAs) are invaluable, they are often too small, fragmented, and exclusionary, neglecting non-charismatic species and restricting local access to resources. Conservation under State-community partnerships is theoretically inclusive but suffers from intrinsic power asymmetry, and community-led initiatives are geographically limited and plagued by internal inequities and funding constraints.

Contribution

The study provides a comprehensive overview of three conservation paradigms in South Asia—State-led, partnership-based, and community-led—highlighting their relative strengths and shortcomings. It proposes key interventions to enhance effectiveness, such as implementing landscape-level conservation, ensuring ecosystem representativeness, and reducing power asymmetry through greater community autonomy. Furthermore, it advocates for evidence-based, inclusive legislation and multilateral collaborations to foster socially just and inclusive biodiversity governance across the region.

Citation

Sengupta, A., Ravikanth, G., Seshadri, K. S., Bunyan, M., Ganesh, T., Rajan, P. D., Devy, M. S., & Aravind, N. A. (2025). The Shifting Paradigms of Biodiversity Conservation in South Asia. *Biotropica*, 57(2). <https://doi.org/10.1111/btp.70013>



Data Uses

World Population Review (2024), UNEPA-WCMC (2019), World Database on Protected Areas and Other Effective Area-Based Conservation Measures (WDPA-WDOECM)

Open Sciences

Open scientific publications

Affiliations

1. SM Sehgal Foundation Centre for Biodiversity and Conservation, Ashoka Trust for Research in Ecology and the Environment (ATREE), India
2. School of Natural Sciences and Engineering, National Institute of Advanced Studies, Indian Institute of Science Campus, India

TABLE 1 | Key differences between State-led, State-, and community co-managed, and community-led conservation in South Asia.

Basis of evaluation	Indicators	State-led PA networks	State and community co-management	Community-led conservation
Biodiversity protection	Size	Typically cover larger areas.	Typically cover smaller areas.	Typically cover smaller areas.
	Connectivity	Some PAs are contiguous but many are not connected.	Isolated; particularly unsuitable for species with large home ranges or migratory patterns.	Isolated; particularly unsuitable for species with large home ranges or migratory patterns.
	Ecosystem representation	Usually focused on forests and wetlands.	Usually focused on forests.	Can represent diverse ecosystems.
	Taxonomic representation	Focused on a limited diversity of taxa historically.	Rarely focused on taxonomic representation.	Rarely focused on taxonomic representation, although some examples of species-specific designation exist.
Distributive justice	Demarcation	Sacrosanct boundaries.	Porous borders.	Porous borders.
	Access	Access to space and resources is heavily curbed, thereby affecting local communities negatively.	Communities have access to spaces and resources.	Communities have access to benefits.
Procedural justice	Governance	State has the sole authority to make decisions.	State and community both have rights to make decisions.	Communities have full authority.
Recognition justice	Values	Limited scope for recognition of cultural values.	Importance given to cultural values—e.g., recognizes the spiritual significance for many indigenous groups.	Importance given to cultural values—e.g., religious sites are preserved and maintained as sites for worship and cultural heritage.
	Social Representation	None (except community reserves and conservation reserves in India that are within the PA network).	Some groups such as women or the economically underprivileged are marginalized.	Some groups such as women and the economically underprivileged are marginalized.

Note: Conservation approaches are classified as (i) those that will benefit from a paradigm shift (red cell), (ii) those directly aligned with desirable outcomes (orange cell), and (iii) those most likely to achieve desirable outcomes with some changes (blue cell).



11.2 BIOGEOGRAPHIC PATTERNS OF MEDICINAL PLANT DIVERSITY IN THE INDO-MALAYAN REALM: A MULTISCALE ASSESSMENT USING GBIF BOTANICAL RECORDS

Indo-Malayan Realm

Challenges

Studying the biogeographic patterns of medicinal plants faces multiple challenges. Firstly, the distribution and diversity of medicinal plants are influenced by a complex interplay of factors. The complexity of these factors makes it difficult to disentangle the drivers shaping distribution patterns. Secondly, issues exist regarding the quality and availability of medicinal plant data. For instance, records in databases like GBIF may suffer from duplicates, spatial outliers, and a lack of botanical validation, necessitating data cleaning and filtering. Furthermore, traditional knowledge systems for medicinal plants are often dispersed across communities and lack systematic documentation and integration, which limits the depth and breadth of the research.

Contribution

1. The research reveals distinct biogeographic structures in the distribution of medicinal plants across the region, highlighting the influence of environmental gradients, historical biogeographic boundaries, and cultural factors on species richness and community composition.
2. The study emphasizes the urgency of conserving medicinal plant diversity and proposes integrated conservation strategies that combine spatial biodiversity assessments with culturally grounded resource governance. These findings provide a scientific basis for the sustainable use and long-term conservation of medicinal plant resources in the Indo-Malayan Realm

Citation

Dewi, E. N., & Prasetyawan, F. (2025). Biogeographic Patterns of Medicinal Plant Diversity in the Indo-Malayan Realm: A Multiscale Assessment Using GBIF Botanical Records. *Journal of Nature, Plants, and Animals Studies*, 1(2), 35-43. <https://scriptaintelegutual.com/vivaterra/article/view/232>

Data Uses

Indonesian MoEF Biodiversity Report, Malaysian Biodiversity Information System, DENR-ERDB National Plant Inventory and georeferenced medicinal plant occurrence records from the Global Biodiversity Information Facility (GBIF)

Open Sciences

Open scientific publications, local communities, indigenous peoples

Affiliations

1. Universitas Negeri Semarang, Indonesia
2. Universitas Kadiiri, Indonesia



12.1 BIODIVERSITY RISK ASSESSMENT AND MANAGEMENT FOR INFRASTRUCTURE PROJECTS UNDER THE BELT AND ROAD INITIATIVE

Asia, Europe, and Africa

Challenges

Existing studies assessing the overall impacts and risks of the Belt and Road Initiative (BRI) apply different distances to estimate project impact zones, and methods to assess impacts at the project level are lacking despite their importance to risk management of individual projects. The Green Development Guidelines for Belt and Road Projects provide clear criteria for defining project risks to important biodiversity areas but standards and tools for assessing and managing impacts on species are yet to be provided. Managing the impacts of BRI projects on biodiversity is critical to global biodiversity conservation and sustainable development.

Contribution

This study develops a quantitative method to assess infrastructure projects' risks to biodiversity, using taxon-specific impact distances and criteria based on threatened species and important biodiversity areas. It rates 691 BRI projects (red/yellow/green), compares China-funded and MDB-funded projects, and provides a high-risk map to support siting and spatial planning.

Citation

Xiao, H., Li, S., Kang, A., Corlett, R. T., Ma, K., & Shen, X. (2025). Biodiversity risk assessment and management for infrastructure projects under the Belt and Road Initiative. *Conserv Biol*, 39(5), e70039. <https://doi.org/10.1111/cobi.70039>

Data Uses

Data sources include 691 geolocated BRI projects, impact distances from 128 papers, area of habitat (AOH) maps for 1,291 threatened vertebrates, protected areas (WDPA), and key biodiversity areas (BirdLife International)

Open Sciences

Open research data

Affiliations

- 1.State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, China
- 2.University of Chinese Academy of Sciences, China
- 3.School of Life Sciences, Institute of Ecology, Peking University, China
- 4.Wildlife Conservation Society, Global Conservation Program, USA
- 5.Center for Integrative Conservation, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, China

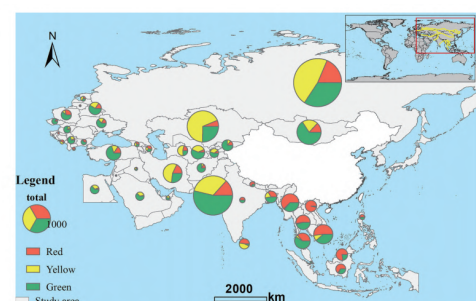


FIGURE 4 By country, proportion of Belt and Road Initiative (BRI) projects classified as red, yellow, and green (as defined in legend of Figure 3 and in the text) according to criterion II (pie size, relative to number of projects; yellow lines in inset map, economic corridors of BRI [provided by the National Remote Sensing Centre of China]).



12.2 HOME GARDEN FOR SUBSISTENCE LIVELIHOOD AND ECONOMIC ENHANCEMENT IN MANIPUR, INDIA

India

Challenges

Home gardens in Manipur remain understudied, with insufficient documentation of plant diversity, economic viability, and livelihood contributions in Imphal West and Thoubal districts. Traditional home garden practices are declining due to modernization, land scarcity, and population growth, while the links between socioeconomic factors and commercial home garden adoption remain unclear.

Contribution

This study documents rich plant diversity in home gardens of the study area, verifies their economic viability through cost–benefit analysis, identifies high-value species for local economic development, reveals significant associations of education, family size, and garden area with commercial gardening adoption, and highlights the roles of home gardens in food security, biodiversity conservation, wild edible plant domestication, and support for sustainable development goals.

Citation

Akoijam, C., Dhanaraj, Y., Dangmei, L., Loushambam, R. S., Dilip, S., & Panmei, R. (2025). Home garden for subsistence livelihood and economic enhancement in Manipur, India. *Agroforestry Systems*, 99(7). <https://doi.org/10.1007/s10457-025-01287-5>

Data Uses

Field survey data were collected from 112 home gardeners via semi-structured questionnaires and field observations. Plant taxonomic data were validated using Flora of Manipur, e-Flora India, POWO, and GBIF. Economic data include input costs, market prices, yields, and gross income for cost–benefit analysis and relative frequency of citation calculation.

Open Sciences

Open scientific publications

Affiliations

1. Guangdong Provincial Key Laboratory of Marine Disaster Prediction and Prevention, Guangdong Provincial Key Laboratory of Marine Biotechnology, Institute of Marine Sciences, Shantou University, China
2. International Joint Research Center for Marine Ecological Protection and Disaster Prevention, Shantou University, China
3. Department of Biology, Howard University, USA

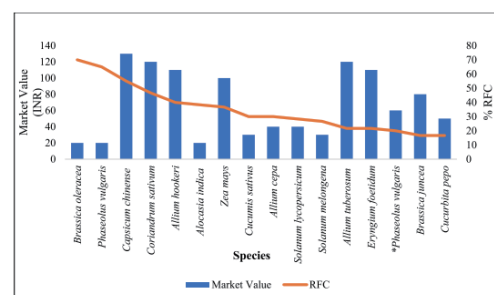


Fig. 7 Relationship between Market Value and RFC of economically important species (Imphal West District)

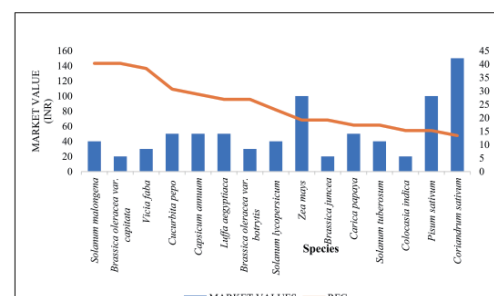


Fig. 8 Relationship between Market Value and RFC of economically important species (Thoubal District)



12.3 GLOBAL DISTRIBUTION AND SUSTAINABLE MANAGEMENT OF ASIAN CORN BORER (ACB), *OSTRINIA FURNACALIS* (LEPIDOPTERA: CRAMBIDAE): RECENT ADVANCEMENT AND FUTURE PROSPECTS

Global

Challenges

The Asian corn borer (ACB) is a destructive pest of maize throughout Asia, causing 10–30% annual yield losses in China and up to 80% infestation in late-planted corn in the Philippines. Climate change, variable voltinism (one to seven generations per year), long-distance migration, host-switching ability, and rapid development of insecticide resistance complicate management. Current management relies heavily on broad-spectrum chemical insecticides, which are unsustainable, and knowledge gaps exist regarding ACB's ecological requirements and effective sustainable control strategies.

Contribution

1. This review provides a comprehensive synthesis of ACB covering its global distribution, morphology, ecology, host plant range, economic impact, and sustainable management strategies. It details agroecological approaches, mating disruption using sex pheromones, host plant resistance, integrated genetic methods, chemical control, biological control, and botanical insecticides.
2. The review also identifies research gaps and recommends region-specific pheromones, seasonal spread modeling, yield loss relationships, and the use of artificial intelligence and machine learning for future sustainable pest management.

Citation

Abbas, A., Saddam, B., Ullah, F., Hassan, M. A., Shoukat, K., Hafeez, F., Alam, A., Abbas, S., Ghramh, H. A., Khan, K. A., Iqbal, R., Dara, M. Z. N., Ali, J., & Ri Zhao, C. (2025). Global distribution and sustainable management of Asian corn borer (ACB), *Ostrinia furnacalis* (Lepidoptera: Crambidae): recent advancement and future prospects. *Bull Entomol Res*, 115(1), 105-120. <https://doi.org/10.1017/S0007485324000919>

Data Uses

Occurrence data from the Global Biodiversity Information Facility (GBIF) and CABI to map the global distribution of ACB.

Open Sciences

Open scientific publications, open research data

Affiliations

1. College of Plant Protection, Jilin Agricultural University, China;
2. College of Plant Protection, Northwest A&F University, China;
3. State Key Laboratory for Managing Biotic and Chemical Threats to the Quality and Safety of Agro-Products, Institute of Plant Protection and Microbiology, Zhejiang Academy of Agricultural Sciences, China;
4. Institute of Entomology, Guizhou University, China;
5. The Provincial Special Key Laboratory for Development and Utilization of Insect Resources, Guizhou University; China;
6. Department of Chemistry, Government College University, Pakistan;
7. Entomological Research Institute, Ayub Agricultural Research Institute, Pakistan;
8. Biology Department, Faculty of Science, King Khalid University, Saudi Arabia;

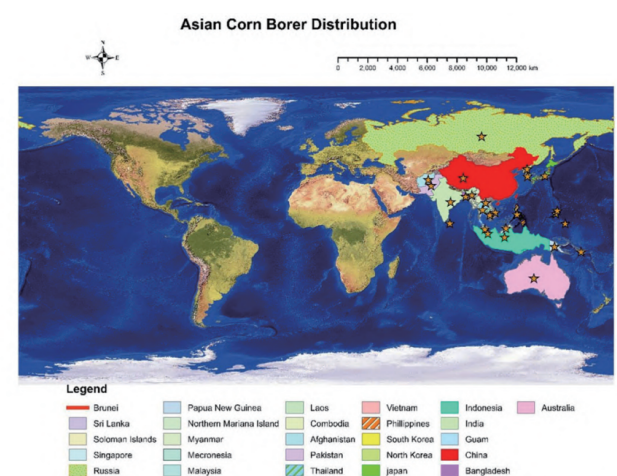


Figure 1. Map showing the global distribution of ACB. The potential distribution herein based on available information from CABI website and GBIF (Global Biodiversity Information Facility). Occurrence points were obtained through the compilation of data from secondary literature sources and the GBIF website, which serves as a comprehensive repository of biodiversity records. The map was prepared by using ArcGIS 10.8.2 software. The occurrence points were geographically mapped onto the Natural Earth Layer, and subsequently (Figure Map), the coloration of the countries where the ACB was observed underwent corresponding alterations.



13.1 DISTRIBUTION PATTERNS OF SUITABLE HABITAT FOR CYCAS TANQINGII IN THE CHINA-LAOS-VIETNAM REGION UNDER THE INTERACTION OF CLIMATE CHANGE AND PEST FACTORS

China–Laos–Vietnam transboundary region

Challenges

Integrates climate change, pest stress, and abiotic factors simultaneously to model habitat suitability, addressing the common neglect of biotic interactions in traditional species distribution projections; quantifies synergistic impacts of global warming and pest expansion on endangered cycad habitats, overcoming limitations of single-factor climate modeling and improving realism of threat assessment for narrowrange endemic plants under future scenarios.

Contribution

Reveals that pest factors replace climatic precipitation as the dominant driver shaping *Cycas tanqingii* distribution under climate change; quantifies habitat contraction, centroid northwestward shift, and elevation of conservation status from Vulnerable to Endangered due to pest–climate interaction; confirms enhanced ecological niche stability when pest pressure is included, providing a biotic–abiotic integrated framework for predictive conservation of threatened cycads in transboundary regions.

Citation

Li, J., Li, C., Yue, C., Wang, W., Luo, H., Zhang, L., Chen, T., Shen, J., & Teng, Z. (2025). Distribution patterns of suitable habitat for *Cycas tanqingii* in the China-Laos-Vietnam region under the interaction of climate change and pest factors. *Ecological Indicators*, 177. <https://doi.org/10.1016/j.ecolind.2025.113794>

Data Uses

Georeferenced occurrence records from field surveys, GBIF, and local literatures

Open Sciences

Open scientific publications, open research data, open source software and source code

Affiliations

- 1. University of Montana, Missoula, MT, United States of America
- 2. ETH Zürich, Zurich, Switzerland

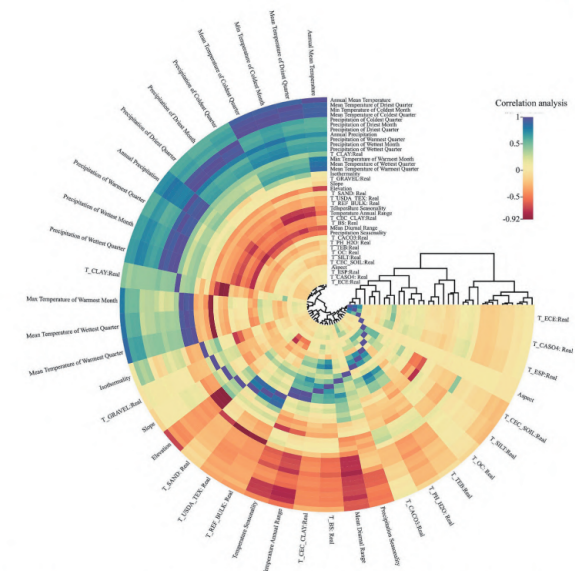


Fig. 2. Environmental variable correlation analysis. The correlations between the factors ranged from -0.92 to 1.



13.3 IMPACTS OF CLIMATE CHANGE ON LEPIDOPTERA BIODIVERSITY IN IRAN: INSIGHTS FROM LONG-TERM CLIMATE DATA AND GBIF RECORDS

Iran

Challenges

Biodiversity in Iran faces significant challenges due to anthropogenic pressures (over-grazing, over-cutting, infrastructure development, population growth) and climate change. Lepidoptera diversity is poorly studied in Iran, with only 4,812 recorded species despite 19.7% endemism, and protected areas often do not coincide with biodiversity hotspots. Comprehensive biodiversity monitoring is still developing, and existing GBIF records are biased by uneven geographic and taxonomic coverage, particularly for invertebrates. Arid and semi-arid ecoregions are severely under-sampled, and accumulation curves in these areas have not leveled off, indicating incomplete biodiversity assessments.

Contribution

This study investigates the impact of environmental factors, particularly climate change, on Lepidoptera biodiversity in Iran using long-term climate data and GBIF occurrence records. It analyzes spatial patterns of family-level richness across Iranian ecoregions, temporal trends, and climate-driven effects. The study identifies the Caspian Hyrcanian mixed forests, Zagros Mountains forest steppe, and Elburz Range forest steppe as biodiversity hotspots. It finds that rising temperatures positively influence family richness, while precipitation negatively impacts diversity, and sampling intensity is the strongest predictor of observed richness. The research highlights critical biodiversity hotspots and underscores the need for enhanced conservation efforts, especially in under-sampled arid and semi-arid regions, and recommends adaptive management strategies to mitigate climate change impacts.

Citation

Shojaaddini, M. (2025). Impacts of climate change on Lepidoptera biodiversity in Iran: insights from long-term climate data and GBIF records. *Journal of Insect Conservation*, 29(6).

<https://doi.org/10.1007/s10841-025-00723-2>

Data Uses

Lepidoptera occurrence records are obtained from the Global Biodiversity Information Facility (GBIF) on 9 November 2024, yielding 3,957 records spanning 1993–2022 from seven datasets contributed by seven countries.

Open Sciences

Open research data

Affiliations

Department of Agricultural Engineering, Technical and Vocational University (TVU), Iran

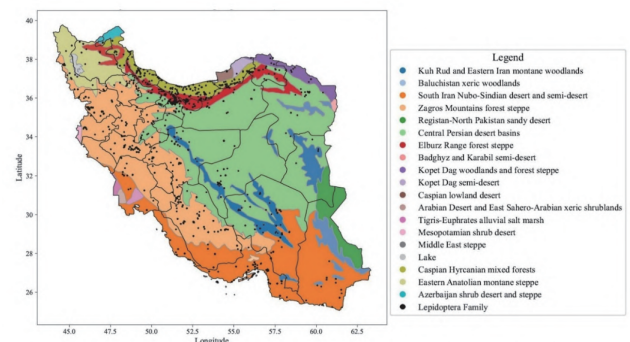


Fig. 1 Spatial distribution of lepidoptera biodiversity across Iran ecoregions. Family occurrence points were mapped as black dots

13.4 IMPACTS OF RISING TEMPERATURES AND PRECIPITATION ON THE SURVIVAL OF NEAR-THREATENED REPTILES IN PAKISTAN

Pakistan

Challenges

Pakistan is ranked high in vulnerability to climate change, especially temperature and precipitation, yet a systematic assessment of climate change's influence on species distribution and habitat suitability for reptiles is lacking. Reptiles are particularly vulnerable to temperature and moisture changes due to their biology, low dispersal ability, and narrow temperature tolerance. Habitat destruction due to climate change threatens many reptilian species, with about 30% of global reptilian species designated as threatened. In Pakistan, despite hosting diverse and exceptional reptilian fauna, the impacts of climatic fluctuations on their distribution remain unexplored.

Contribution

1. This study evaluates the impact of temperature and precipitation on four Near-Threatened reptile species (*Crossobamon orientalis*, *Eryx conicus*, *Eryx johnii*, and *Python molurus*) in Pakistan under current (1980-2019) and future conditions (2050 and 2070) using MaxEnt species distribution modeling.
2. Results project that all four species will shift their distribution toward higher northern altitudes and from central-eastern regions into lower eastern altitudes, with an average habitat loss of approximately 35% by 2050 and 50% by 2070. These findings provide a critical framework for conservation planning and improving the status of these species in Pakistan.

Citation

Shojaaddini, M. (2025). Impacts of climate change on Lepidoptera biodiversity in Iran: insights from long-term climate data and GBIF records. *Journal of Insect Conservation*, 29(6).

<https://doi.org/10.1007/s10841-025-00723-2>



Data Uses

Species occurrence records for four Near-Threatened reptiles are obtained from GBIF for the period 1980-2019, totaling 472 records.

Open Sciences

Open scientific publications

Affiliations

Department of Agricultural Engineering, Technical and Vocational University (TVU), Iran

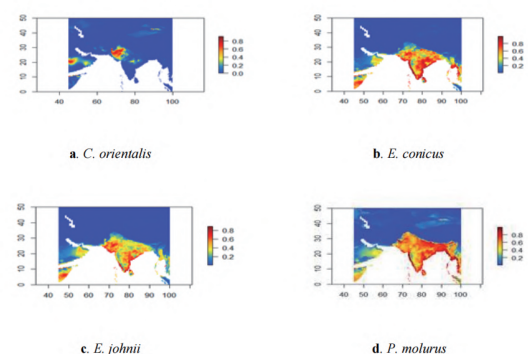


Figure 9 (a-d). Predicted distribution of four species in (2070) under the high Carbon-Emissions-Scenario (RCP 8.5).

14.1 STATUS OF DRUG DISCOVERY-BASED MARINE BIOTECHNOLOGY IN SOUTHEAST ASIA

Southeast Asia

Challenges

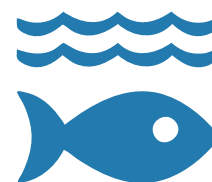
Southeast Asia (SEA) is a global hotspot of marine biodiversity, boasting some of the richest and most diverse coastal ecosystems on the planet. These made marine organisms a promising source of bioactive compounds with applications in pharmaceuticals, cosmetics and nutraceuticals. Marine natural products research in Southeast Asia is uniquely positioned at the intersection of immense biodiversity and urgent conservation needs. However, Southeast Asian countries face a complex set of challenges, including underexplored ecosystems, limited infrastructure and fragmented research efforts, that must be addressed to unlock this potential.

Contribution

1. Southeast Asian nations like the Philippines, Indonesia, Vietnam, and Thailand are yielding promising outcomes in marine biotechnology, yet gaps remain in regional participation, capacity, and infrastructure. Integrating traditional marine knowledge with modern science offers a distinct pathway to enhance drug discovery. For generations, coastal communities across the region have utilized marine fauna, such as dugongs and sea turtle eggs, for traditional remedies targeting asthma, pain relief, and maternal health. Honoring this cultural heritage within a modern biotechnological framework can drive innovative pharmaceutical discoveries.
2. Nevertheless, realizing this potential requires Southeast Asia to address pressing environmental threats, strengthen regional collaboration, and prioritize sustainability. By adopting a unified approach, the region can emerge as a global frontrunner in marine-derived drug discovery while safeguarding its invaluable marine ecosystems.

Citation

Tan, L. T., Widyantoro, C., & Hanif, N. (2025). Status of Drug Discovery-Based Marine Biotechnology in Southeast Asia. In *Marine Natural Products Research in South-East Asia* (pp. 1-62).
https://doi.org/10.1007/978-3-032-01098-8_1



Data Uses

Information on the distribution and occurrence of these underexplored marine organisms can be obtained from Global Biodiversity Information Facility (GBIF) (<https://www.gbif.org/>), World Register of Marine, Species (WORMS) (<https://www.marinespecies.org/>) and Ocean Biodiversity Information System (OBIS) (<https://obis.org/>).

Open Sciences

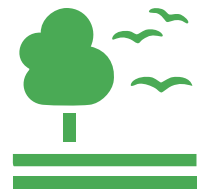
Open scientific publications

Affiliations

1. Natural Sciences and Science Education, National Institute of Education, Nanyang Technological University, Singapore, Singapore
2. Department of Chemistry, Faculty of Mathematics and Natural Sciences, IPB University, Bogor, Indonesia



Fig. 2 Traditional marine-based products, including **a** dried octopus, **b** dried cuttlefish, **c** dried seahorses, **d** dried sea cucumbers, **e** sea cucumber medicinal oil and **f** red marine algae supplements



15.1 CONTRIBUTIONS TO THE KNOWLEDGE OF PITVIPERS (VIPERIDAE, *GLOYDIUS*) IN THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA: IDENTIFICATION, DESCRIPTION OF SPECIMENS, AND GEOGRAPHICAL DISTRIBUTION

Democratic People's Republic of Korea

Challenges

Overcomes extreme barriers to field research in a data-scarce region; resolves long-standing taxonomic uncertainty and incomplete distribution records for *Gloydus* pitvipers; mitigates issues of degraded specimens, imprecise locality data, and historical misidentification; addresses sampling bias and absence of verified occurrence records for robust niche modeling.

Contribution

Provides first validated morphological and molecular data for three *Gloydus* species in the region; clarifies species boundaries and revises historical taxonomy based on integrative evidence; generates high-predictability ecological niche models to map suitable habitats; delivers actionable data for snakebite risk assessment and conservation planning.

Citation

Shin, Y., Othman, S. N., Kohler, D. B., Maslova, I., Messenger, K. R., & Borzee, A. (2025). ,Contributions to the knowledge of pitvipers (Viperidae, *Gloydus*) in the Democratic People's Republic of Korea: identification, description of specimens, and geographical distribution. *Zookeys*, 1249, 193-221. <https://doi.org/10.3897/zookeys.1249.142916>

Data Uses

Occurrence records from GBIF, iNaturalist, and national ecosystem surveys

Open Sciences

Open scientific publications, open research data

Affiliations

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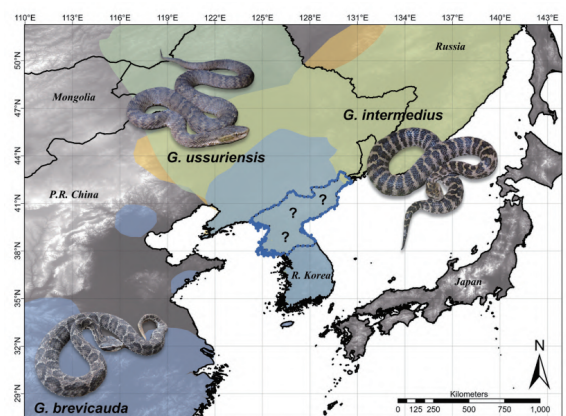


Figure 2. The overall geographical distributions of *Gloydus ussuriensis* (green), *G. breviceauda* (blue), and *G. intermedius* (orange) in continental northeast Asia. The defined ranges for *G. ussuriensis* and *G. intermedius* are based on the range polygons obtained from the IUCN Red List of Threatened Species (<https://www.iucnredlist.org/>). The range map for *G. breviceauda* is based on the combination of iNaturalist and GBIF data, IUCN range map, and personal data of KRM. The location of DPR Korea is outlined in blue. The question marks across DPR Korea denote the uncertain distributions of *Gloydus* species within the nation. The map was made in ArcGIS Pro v. 2.6.0 with the WorldClim 1 km elevation raster as a base map. This map is not meant to be a precise range map for these species but rather a general representation of their geographic distributions around DPR Korea. The inset photographs of three *Gloydus* species were taken by YS.



15.2 THE FIRST CHECKLIST OF ALIEN VASCULAR PLANTS OF KYRGYZSTAN, WITH NEW RECORDS AND CRITICAL EVALUATION OF EARLIER DATA. CONTRIBUTION 3

Kyrgyzstan

Challenges

A severe deficiency of reliable distribution data for alien plants in Central Asia exists in global databases, despite a long tradition of botanical research in the region. Many historical records are based on misidentified specimens, for example the previous record of *Sisymbrium irio* from Kyrgyzstan was rejected as based on a misidentified specimen of *S. loeselii*. The pathways, periods and sources of introduction are often obscure due to incomplete or uncritical literature. Modern field surveys are lacking, and cultivated or naturalised plants are underrepresented in regional manuals, which hinders accurate assessment of invasion status and trends. Political and economic history, such as Soviet grain crises and independence-era trade shifts, must be carefully linked to introduction events. Distinguishing native from alien occurrences requires extensive herbarium and literature re-evaluation

Contribution

1. This paper provides the first comprehensive checklist and critical evaluation of alien vascular plants in Kyrgyzstan, with a detailed treatment of eight Brassicaceae species. Taxonomic confusions are clarified: *Hesperis matronalis* s.str. is excluded from Central Asia, and *H. pycnotricha* is recognised as the cultivated and escaping taxon. New country records are reported (*Sisymbrium irio*), and previous erroneous records are rejected.
2. Introduction periods (from Neolithic to post-Soviet), pathways (grain contaminants, ornamental escape, nursery material, unaided dispersal) and sources (Eastern Europe, Caucasus, Iran, etc.) are reconstructed for each species. A new combination, *Mutarda arvensis* var. *orientalis* (L.) Sennikov, is proposed. The work significantly improves understanding of plant invasion history in Central Asia and links botanical evidence to major historical events.

Citation

Sennikov, A., Lazkov, G., & German, D. A. (2025). The first checklist of alien vascular plants of Kyrgyzstan, with new records and critical evaluation of earlier data. Contribution 3. Biodivers Data J, 13, e145624. <https://doi.org/10.3897/BDJ.13.e145624>

Data Uses

Occurrence data were compiled from major herbaria (AA, ALTB, FRU, LE, MW, P, TASH) examined de visu or as digital images, supplemented by field observations and critically filtered citizen-science records from iNaturalist and Plantarium. The full checklist is published as a dynamic dataset in GBIF (Sennikov & Lazkov, 2024c).

Open Sciences

Open scientific publications; open research data

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Figure 2. [doi](#)

Naturalised stands of *Armoracia rusticana* along a bridge across the Ishim River, Astana City (photo by Yu. Morozova, 1 June 2023). Source: <https://www.inaturalist.org/observations/166388104> (Plantarium 2024).



15.3 PLANTS CLONAL STRATEGIES ARE WELL ASSOCIATED WITH ARIDITY GRADIENTS: INSIGHTS FROM LAMIACEAE FAMILY IN THE SW AND CENTRAL ASIA

SW and Central Asia

Challenges

Clonal reproduction in arid and semi-arid conditions remains underexplored, as previous research has largely focused on wet and cold environments. The role of clonal strategies in extremely arid conditions has never been studied, despite their potential importance for plant persistence and ecosystem resilience. Understanding how clonal growth forms distribute along aridity gradients is essential for predicting plant responses to climate change, but large-scale patterns in Southwest and Central Asia are lacking.

Contribution

This study provides the first systematic analysis of belowground growth forms (BGFs) in the Lamiaceae family across Southwest and Central Asia, examining how clonal and non-clonal species associate with precipitation gradients and habitat types. It identifies that clonal species, particularly those with hypogeogenous and epigeogenous rhizomes, are prevalent at both extremes of the precipitation gradient (arid deserts and wetlands/forests), while non-clonal species dominate mesic montane steppe shrublands with moderate and seasonal water availability. The findings challenge the assumption that clonality is rare in dry environments and highlight the adaptation of clonal strategies to drought stress.

Citation

Mahmoudi, C., Noroozi, J., Ranjbar, M., Man, M., Khalvati, S., Klimesova, J., & Herben, T. (2025). Plants clonal strategies are well associated with aridity gradients: insights from Lamiaceae family in the SW and Central Asia. *AoB Plants*, 17(6), plaf069. <https://doi.org/10.1093/aobpla/plaf069>

Data Uses

Species distribution data are obtained from the Global Biodiversity Information Facility (GBIF), yielding 29,310 records after cleaning, and from regional floras including Flora Iranica and Flora of Iran.

Open Sciences

Open scientific publications; open source software and source code

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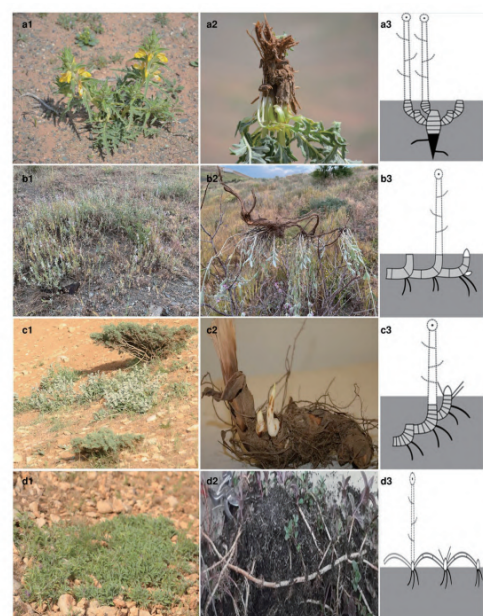


Figure 1 Representative Lamiaceae species illustrating the four BGFs. Photographs show habit (left column), excavated belowground organs (middle column), and schematic diagrams (right column). a) *Phlomis schottii*—main root; b) *Stachys infusa*—hypogeogenous rhizome; c) *Phlomis alvifolia*—epigeogenous rhizome; d) *Stachys lavandulifolia*—stoloniferous form.



16.1 BEYOND SPATIAL BIAS: UNDERSTANDING THE COLONIAL LEGACIES AND CONTEMPORARY SOCIAL FORCES SHAPING BIODIVERSITY DATA

Global

Challenges

Persistent colonial legacies and contemporary social forces identified as root causes of global biodiversity data inequities beyond conventional spatial bias; uneven data distribution, ownership, and accessibility shaped by colonial collecting histories, international development infrastructure gaps, and divergent data-sharing cultures; open-access platforms like GBIF fail to resolve structural inequalities, with data control remaining concentrated in high-income OECD regions and limited access for Global South communities.

Contribution

Shift from technical bias framing to political ecology analysis of biodiversity data; identification of three core social forces (colonial legacies, international development infrastructures, contemporary data cultures) driving global data patterns; mixed-methods evidence of enduring colonial imprints on data ownership and publication; insights into virtual repatriation as a response to historical extraction; critical assessment of open science limitations in addressing structural inequities in global biodiversity knowledge systems.

Citation

Faxon, H., & Chapman, M. (2025). Beyond spatial bias: understanding the colonial legacies and contemporary social forces shaping biodiversity data. *Environmental Research Letters*, 20(6).
<https://doi.org/10.1088/1748-9326/add6b6>

Data Uses

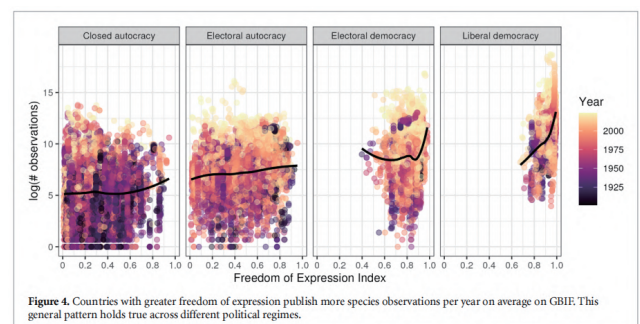
GBIF occurrence records and metadata analyzed for global species observation patterns; Colonial Dates Dataset employed to map colonial influences on data ownership.

Open Sciences

Open scientific publications

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16.2 TRACING HOLOTYPE TRAJECTORIES: MAPPING THE MOVEMENT OF THE MOST VALUABLE HERBARIUM SPECIMENS

Global

Challenges

Persistent colonial legacies resulting in severe geographic imbalance of plant holotype distributions; majority of holotypes from biodiversity-rich Global South regions concentrated in European and North American herbaria, creating long-distance access barriers for local researchers; incomplete and uneven digitization of herbarium collections alongside limited representation of Global South holdings in global open databases exacerbating inequities in taxonomic research and biodiversity governance.

Contribution

First global spatiotemporal analysis of 119,361 vascular plant holotype trajectories across 225 years; quantification of declining median distance between collection and storage locations from 8,800 km to 750 km, indicating rising local retention in Africa, Asia, and Latin America; identification of colonial history, herbarium age, scientific capacity, and regulatory frameworks as key drivers of holotype distribution; evidence-based support for postcolonial shifts in biological specimen governance and calls for strengthened local herbarium infrastructure and equitable data access.

Citation

Tomaszewski, D., Walas, Ł., & Guzicka, M. (2025). Tracing holotype trajectories: Mapping the movement of the most valuable herbarium specimens. *Plants, People, Planet*. <https://doi.org/10.1002/ppp3.70071>

Data Uses

Holotype records for Tracheophyta extracted from GBIF (<https://doi.org/10.15468/dl.ntadjy>), herbarium metadata obtained from Index Herbariorum (<https://sweetgum.nybg.org/science/ih/>)

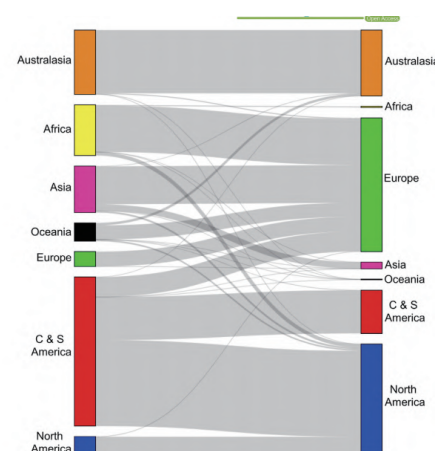
Open Sciences

Open scientific publications, open research data

Affiliations

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4. Center for integrative conservation & Yunnan Key Laboratory for the Conservation of Tropical Rainforests and Asian Elephants, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, China.

FIGURE 3 Flow of specimens subsequently designated as holotypes between the regions of their collection (left) and the regions where they are deposited (right).





17.1 SPATIAL OCCURRENCE RECORDS AND DISTRIBUTIONS OF TROPICAL ASIAN BUTTERFLIES

Tropical Asia

Challenges

Critical Wallacean shortfall restricts invertebrate conservation in tropical Asia due to insufficient fine-scale butterfly distribution data. Strong spatial bias concentrates occurrence records in accessible, densely populated regions while remote areas remain extremely undersampled. Coarse country-level data and non-transparent expert-based range maps fail to support precise conservation assessment. Scattered records from citizen science, publications, and regional databases remain unstandardized and poorly integrated for large-scale biogeographic analysis.

Contribution

1. Largest standardized occurrence dataset of tropical Asian butterflies is established with 730,190 verified records covering 3,752 species. 10 km resolution ensemble species distribution models with high predictive accuracy are generated for 1,576 species. Major butterfly diversity hotspots are identified and temperature seasonality is confirmed as the dominant environmental driver.
2. International multi-institutional cooperation is conducted to aggregate heterogeneous data from GBIF, published literature, regional databases, and unpublished expert datasets across tropical Asia. Open data, open code, and reproducible analytical framework are provided to promote cross-border data sharing, joint biodiversity assessment, and collaborative conservation planning, supporting international partnership for sustainable biodiversity management.

Citation

Yau, E. Y. H., Jones, E. E., Tsang, T. P. N., Xing, S., Corlett, R. T., Roehrdanz, P., Lohman, D. J., Lee, A. K. C., Hai, C. W. C., Chowdhury, S., Hill, J. K., Badon, J. A. T., Gan, C. W., Basset, Y., Chen, I. C., Benedick, S., Jain, A., Ki, T. L. T., Kunte, K. Bonebrake, T. C. (2025). Spatial occurrence records and distributions of tropical Asian butterflies. *Sci Data*, 12(1), 1004. <https://doi.org/10.1038/s41597-025-05333-w>

Data Uses

Data usage information for this GBIF-derived dataset is available GBIF37 (<https://doi.org/10.15468/dl.9wyfb6>), B2D2 Database of Butterflies

Open Sciences

Open scientific publications; open research data; open source software and source code

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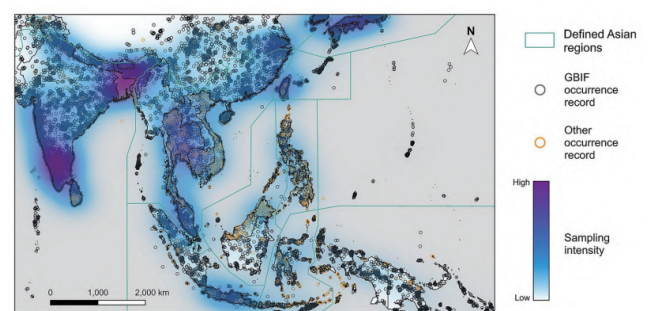


Fig. 1 Distribution of GBIF and other occurrence records in our study area. Sampling intensity was estimated by running kernel density on the coordinates of all available occurrence data of every species. Regions of Asian landmasses based on the ecoregions and biogeographic realms as revised by Dinerstein *et al.*⁷⁸, as well as Wallace's Line, Huxley's Line, and Weber's Line.

17.2 EVALUATING THE QUALITY OF VGI AND AUTHORITATIVE DATA IN RED-CROWNED CRANE CONSERVATION: A COMPARATIVE STUDY

Japan

Challenges

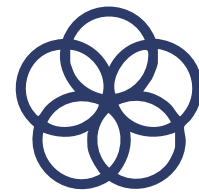
Volunteered Geographic Information (VGI) suffers from persistent data quality concerns, including coordinate errors, misclassification, sampling bias, uneven temporal coverage, and lack of standardization. Prior studies have largely assessed VGI quality within single data types or single platforms, lacking a unified analytical framework that accommodates heterogeneous VGI datasets (vector species observations and raster land use data) in a real-world application context. Ecological conservation requires integrating both species distribution points and environmental raster layers, yet the structural differences between these data types lead to distinct quality issues that are rarely evaluated together. The absence of systematic validation mechanisms limits the reliability of VGI for scientific research and policy decision-making.

Contribution

This study introduces a task-oriented evaluation framework that systematically compares VGI and authoritative datasets across three dimensions highly relevant to ecological conservation: thematic accuracy, coverage, and hotspot distribution. Using red-crowned crane conservation in Hokkaido, Japan as a case study, the framework is applied to vector species distribution data (eBird vs. GBIF) and raster land use classification data (OSM vs. CASEarth). The findings reveal that eBird outperforms GBIF in thematic accuracy (100% vs. 85% basic information completeness) and spatial coverage, while GBIF provides longer temporal coverage. For land use, OSM performs well in forest classification (producer's accuracy near 100%) but poorly in cropland and grassland (0% accuracy), with significant coverage gaps. The study provides a reproducible model for spatial data quality comparison across multiple data types and geographic contexts.

Citation

Gao, Y., Jin, J., & Wang, S. (2025). Evaluating the quality of VGI and authoritative data in red-crowned crane conservation: a comparative study. *Big Earth Data*, 1-24.
<https://doi.org/10.1080/20964471.2025.2601434>



Data Uses

VGI vector data are obtained from eBird (4,978 records, each with 50 fields) and authoritative vector data from GBIF (5,341 records, each with 33 fields).

Open Sciences

Open scientific publications

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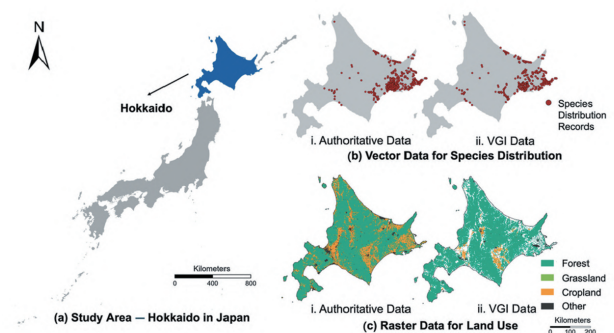


Figure 1. Study area and data sources.

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Note: The abbreviations in open science: OSP: Open scientific publication; ORD: Open research data; OSS: Open source software and source code; OER: Open educational resources; LC: Local communities; IP: Indigenous peoples.

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