ACADEMY OF SCIENCES OF THE REPUBLIC OF UZBEKISTAN

The 3rd International Symposium of Mapping Asia Plants

MAP and new opportunities for large scale knowledge of plant diversity in Central Asia

Tojibaev Sh. Komiljon

China, Beijing, 2024

Mapping Asia Plants

MAP

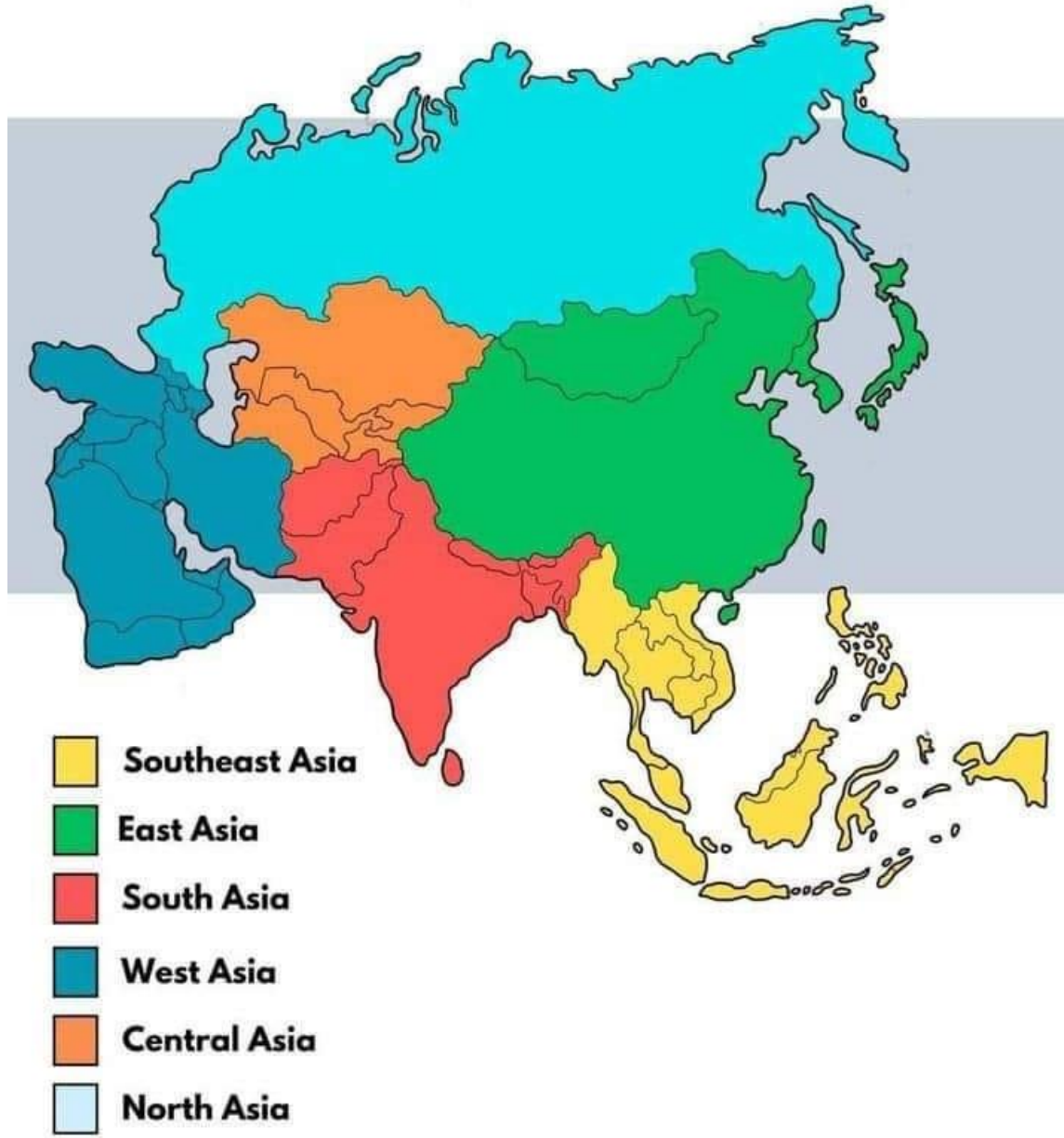
Illustration: www.istockphoto.com

RankingRoyals

MOST PLANT SPECIES BY COUNTRY

Data Collected between 2017-2021

		Plant species count			
01	Brazil	34,387	16	Russia	12,500
02	China	31,362	17	Madagascar	11,832
03	Colombia	24,025	18	Costa Rica	11,000
04	Mexico	23,385	19	Papua New Guinea	10,973
05	South Africa	21,250	20	Panama	10,462
06	Peru	19,812	21	Argentina	10,221
07	Australia	19,324	22	Philippines	10,107
08	Indonesia	19,232	23	Tanzania	10,100
09	Ecuador	18,466	24	Turkey	10,001
10	Myanmar	16,000	25	DR Congo	8,860
11	United States	15,500	26	Guatemala	8,763
12	Venezuela	15,381	27	Vietnam	8,500
13	India	15,000	28	Iran	7,500
14	Bolivia	14,729	29	Honduras	7,188
15	Malaysia	14,060	30	Guyana	7,112



Source: World Rainforests, Several Academic Sources

www.rankingroyals.com

RankingRoyals

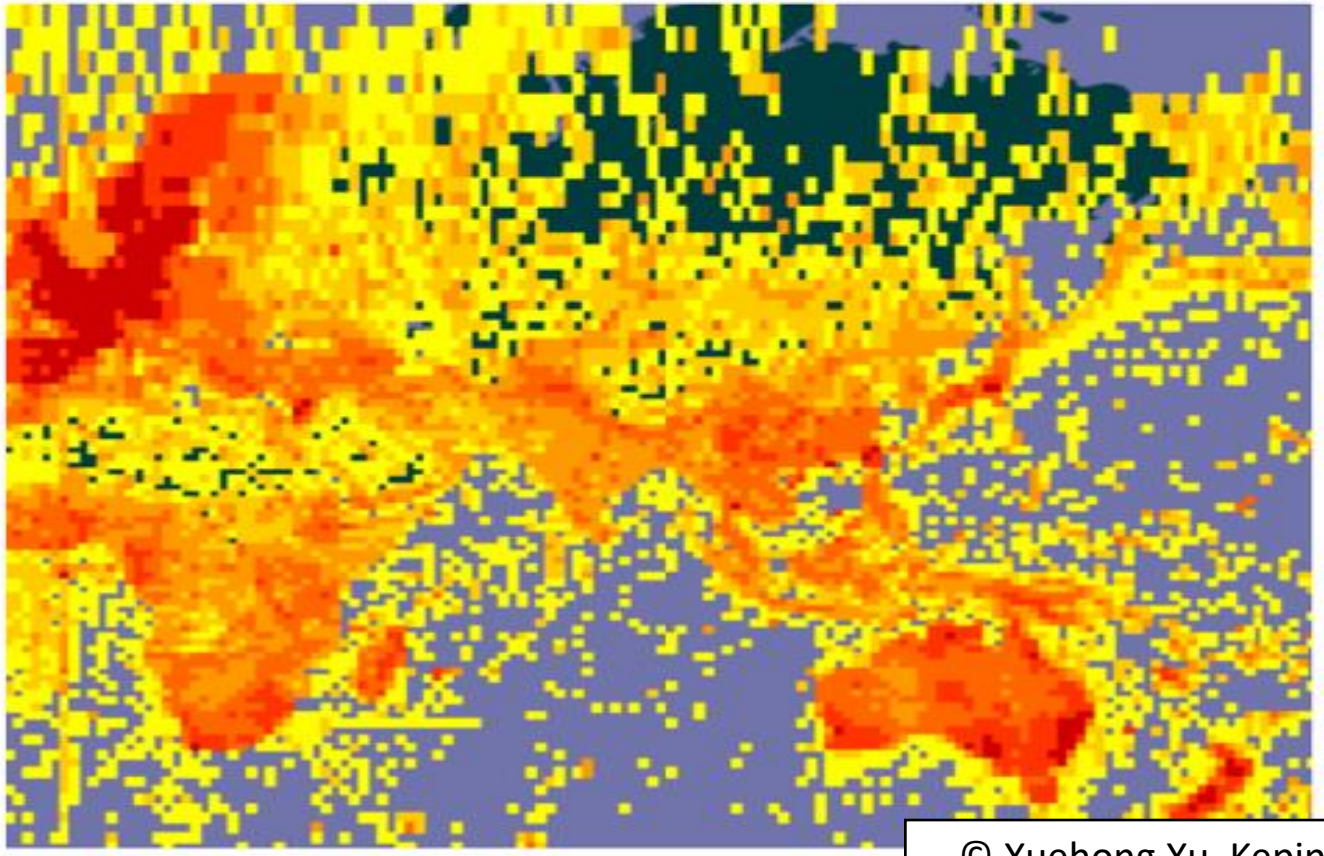
Mission for MAP

A better mapping infrastructure for plant diversity conservation in Asia

Goals for MAP

Access to
- Geographic range maps, diversity maps;
- Species checklists;
- Standardized botanical observation datasets;
- Standardized workflow and informatics

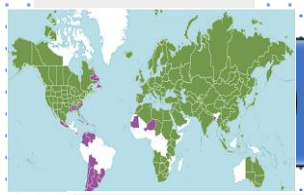
engine for the integration, access, and discovery of disparate sources of botanical information in Asia.



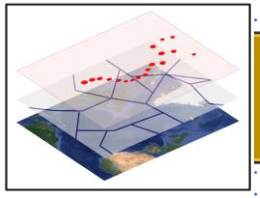
Some successes of the project

Progress on the major NF projects and Floristic information analysis for each country

New flora monographs and new checklists of regional floras



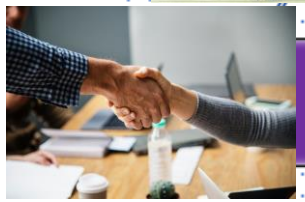
Plant species distribution and conservation programs



Digitization of herbarium specimens and Georeferenced Databases

Large numbers of new records and new species

Dozens of regional seminars and conferences were held, with the participation of hundreds of scientific institutions, scientists, and volunteers



Extensive cooperation and global integration (GBIF, IUCN, BIEN, ABCDNet)

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: http://www.elsevier.com/locate/gecco

Review Paper

Mapping Asia plants: Current status on floristic information in Southwest Asia

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: http://www.elsevier.com/locate/gecco

Original Research Article

Mapping Asia Plants: Historical outline and review of sources on floristic diversity in North Asia (Asian Russia)

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: http://www.elsevier.com/locate/gecco

Review Paper

Mapping Asia Plants: Current status of floristic information for Central Asian flora

Contents lists available at ScienceDirect

Global Ecology and Conservation

journal homepage: http://www.elsevier.com/locate/gecco

Review Paper

Mapping Asia Plants: Current status of floristic information for Northeast Asia

nearly 40,000 species of vascular plants

plants

MDPI

Review

Mapping Asia Plants: Historical Outline and Review of Sources on Floristic Diversity in South Asia

Cui Xiao [1,2], Zhixiang Zhang [1], Keping Ma [2] and Qinwen Lin [3,*]

Order Article Reprints

Open Access Article

Mapping Asia Plants: Plant Diversity and a Checklist of Vascular Plants in Indonesia

by Jing Sun [1,2], Bo Liu [3], Himmah Rustiami [4], Huiyun Xiao [1,2], Xiaoli Shen [1,*] and Keping Ma [1,2,*]

Order Article Reprints

Open Access Review

Mapping Asia Plants: Historical Outline and Review of Sources on Floristic Diversity in South Asia

by Cui Xiao [1,2], Zhixiang Zhang [1], Keping Ma [2] and Qinwen Lin [3,*]

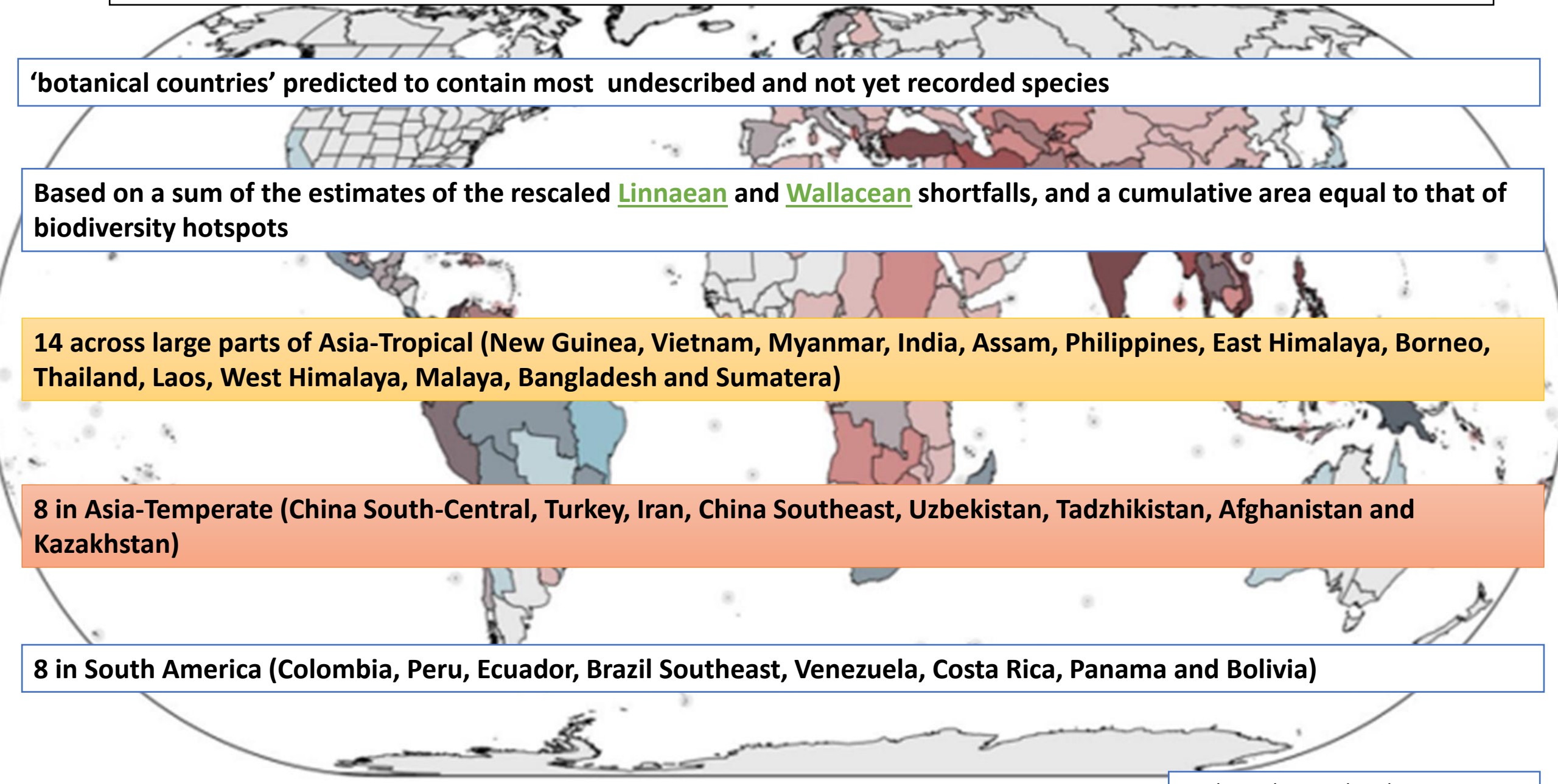
Mapping Asia Plants and Globally Biodiversity Knowledge Shortfalls

In an attempt to categories global knowledge limits, seven biodiversity shortfalls have been described

Shortfall	Aspect of biodiversity	Definition
Linnean	Species	Most of the species on Earth have not been described and cataloged (Brown & Lomolino 1998)
Wallacean	Geographic distribution	Knowledge about the geographic distribution of most species is incomplete; it is inadequate at all scales most of the time (Lomolino 2004)
Prestonian	Populations	Data on species abundance and population dynamics in space and time are often scarce (Cardoso et al. 2011)
Darwinian	Evolution	Lack of knowledge about the tree of life and the evolution of species and their traits (Diniz-Filho et al. 2013)
Raunkiæran	Functional traits and ecological functions	Lack of knowledge about species' traits and their ecological functions
Hutchinsonian	Abiotic tolerances	Lack of knowledge about the responses and tolerances of species to abiotic conditions
Eltonian	Ecological interactions	Lack of knowledge on species' interactions and these interactions' effects on individual survival and fitness

Hortal et al., 2015

The world's 33 global biodiversity dark spots



‘botanical countries’ predicted to contain most undescribed and not yet recorded species

Based on a sum of the estimates of the rescaled Linnaean and Wallacean shortfalls, and a cumulative area equal to that of biodiversity hotspots

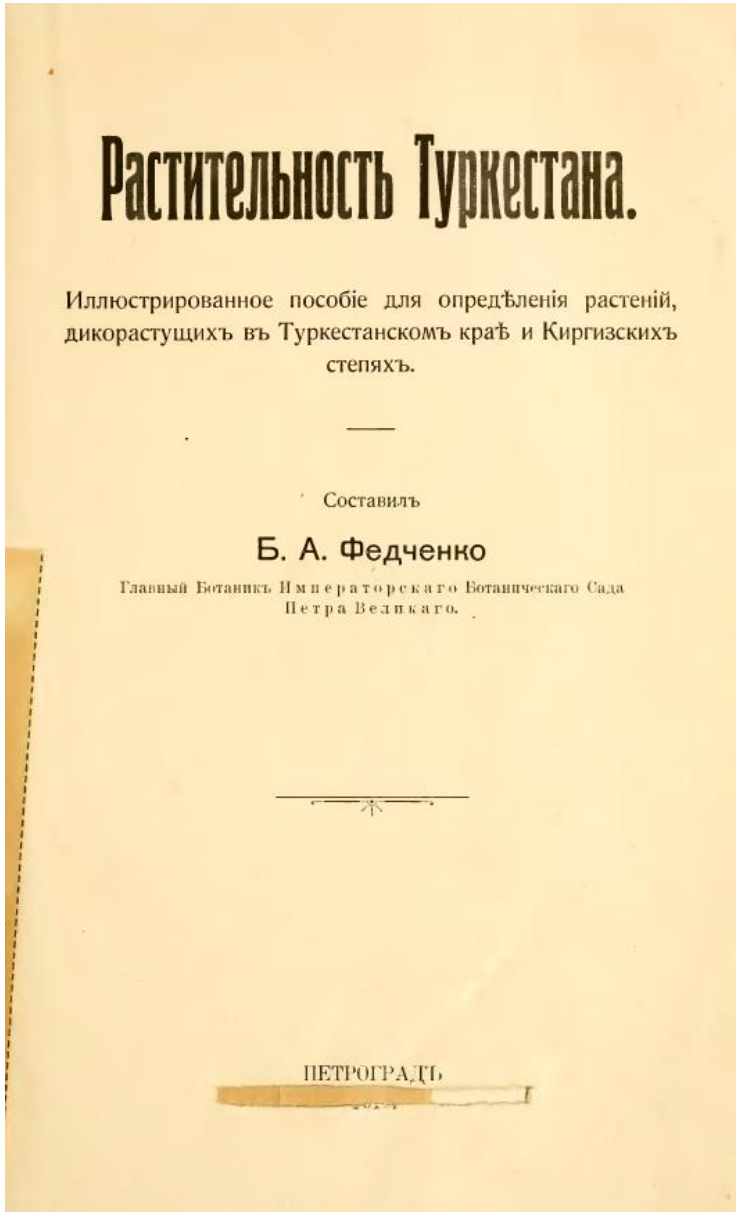
14 across large parts of Asia-Tropical (New Guinea, Vietnam, Myanmar, India, Assam, Philippines, East Himalaya, Borneo, Thailand, Laos, West Himalaya, Malaya, Bangladesh and Sumatera)

8 in Asia-Temperate (China South-Central, Turkey, Iran, China Southeast, Uzbekistan, Tadzhikistan, Afghanistan and Kazakhstan)

8 in South America (Colombia, Peru, Ecuador, Brazil Southeast, Venezuela, Costa Rica, Panama and Bolivia)

Ondo et al. New Phytologist, 2024

The Linnean shortfall and MAP role in its solution (Central Asian example)



Растительность Туркестана.

Иллюстрированное пособіе для опредѣленія растеній, дикорастущихъ въ Туркестанскомъ краѣ и Киргизскихъ степяхъ.

Составилъ

Б. А. Федченко

Главный Ботаникъ Императорскаго Ботаническаго Сада Петра Великаго.

ПЕТРОГРАДЪ

CONSPECTUS FLORAE ASIAE MEDIAE

TOMUS XI

Scientficum editor:
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Redactore tomi undecimi
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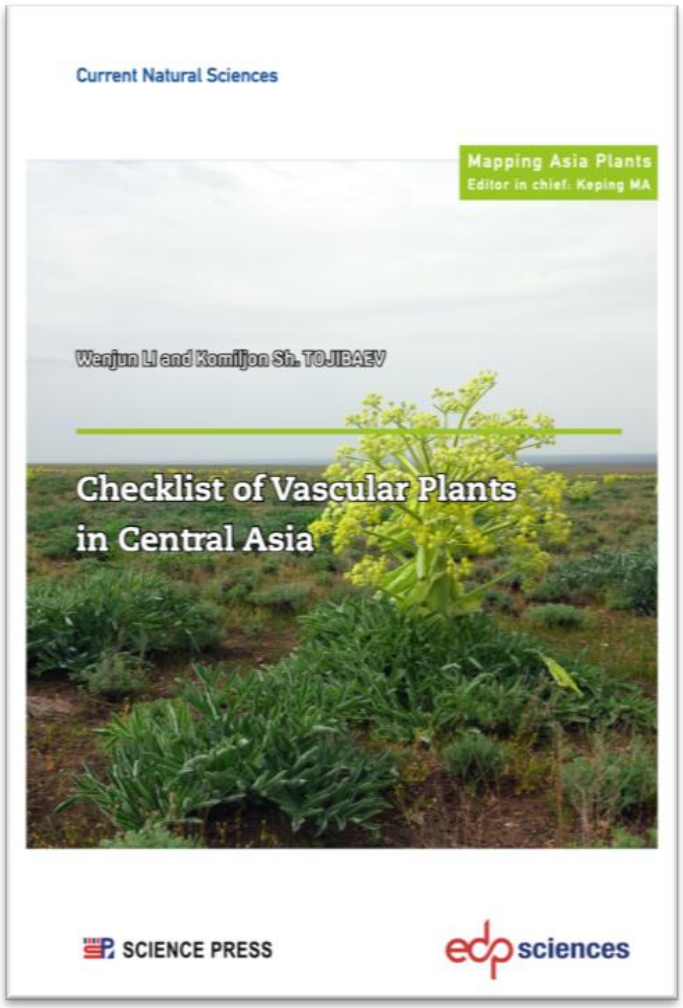
Ductu et consilio A. I. VVEDENSKY inchoatus et R. V. KAMELINIO finitus

Editio Academiae scientiarum Republicae Uzbekistan Tashkent – 2015

by Khassanov, 2015

9341 spec., 1300 gen., 161 fam.



***Li and Tojibaev,* in press**

9640 spec., 1199 gen., 139 fam.

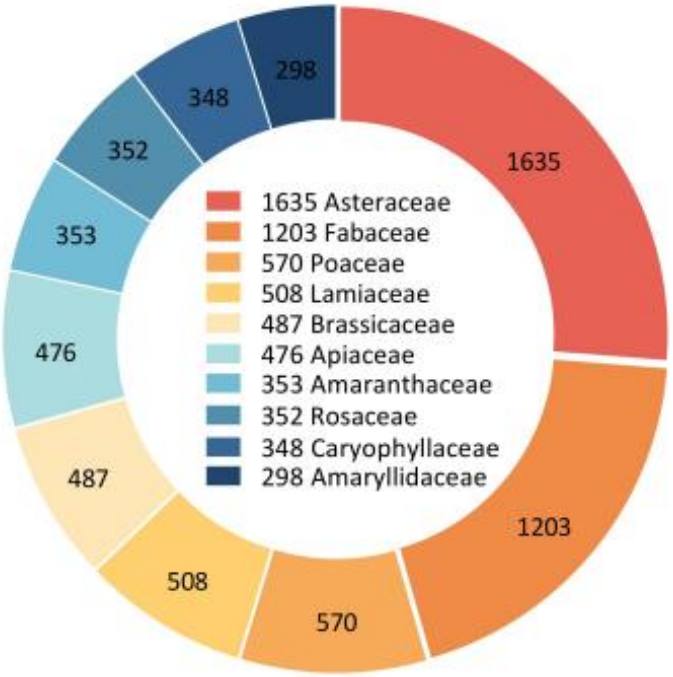

Allium chorkesaricum F.O. Khass. & Tojibaev
Allium fritschii F.O. Khass. & Yengalycheva
Allium haneltii F. O. Khass. & R. M. Fritsch
Allium kuramense F. O. Khass. & N. Friesen
Allium marmoratum Seregin
Allium michaelis F.O. Khass. & Tojibaev
Allium orunbaii F. O. Khass. & R. M. Fritsch
Aulacospermum multicaule Pimenov & Tojibaev
Hedysarum sunhangii Tojibaev & Juram.
Iris khassanovii Tojibaev & Turginov
Kuramosciadum corydaliifolium Pimenov & al.
Parrya tojibaevii German & Madaminov
Ranunculus tojibaevii Schegol. & Turginov
Stipa adamii
Stipa kotuchovii
Erysimum kamelinii
Sterigmostemum schmakovii
Tulipa annae
Tulipa auliekolica
Tulipa ivasczenkoae
Tulipa kolbintsevii
Tulipa lemmersii
Tulipa turgaica
Ranunculus talassicus
Allium bekeczalicum Lazkov
Allium formosum Sennikov & Lazkov
Bunium sary-cheleki Lazkov & Kljuykov
Corydalis bosbutooensis Lazkov
Corydalis subverticillata Lazkov
Cousinia echinocephala Sennikov
Eremurus czatkalicus Lazkov
Festuca tzveleviana Lazkov
Polygonum toktogulicum Lazkov
Stipa narynica
Silene sussamyrica Lazkov
Tulipa talassica Lazkov
KAZAKHSTAN
KZ
Syr Darya
Ustyurt Plateau
Caspian Sea
Turan Lowland
Kyzylkum Desert
Stipa × balkanabatica
Iris kurbanovii
UZ
UZBEKISTAN
TURKMENISTAN
TM
KYRGYZSTAN
KG
Tarim
Stipa × dzungarica
Stipa × pseudomacroglossa
Stipa × subdrobovii
Stipa caucasica subsp. nikolai
Stipa caucasica var. fanica
Stipa zeravshanica
TAJIKISTAN
TJ

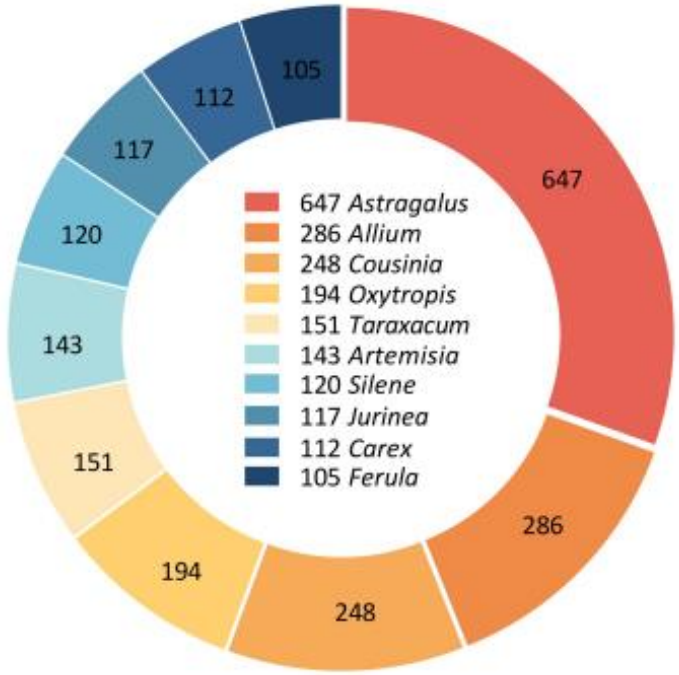
Species richness

Taxonomic composition of the native vascular flora of Central Asia

	Family	Genera	Species and infraspecific taxa
Lycophytes	2	3	6
Ferns	14	25	64
Gymnosperm	3	6	36
Angiosperms:	120	1165	9534
monocots	25	213	1591
dicots	95	952	7943
Total	**139**	**1199**	**9640**

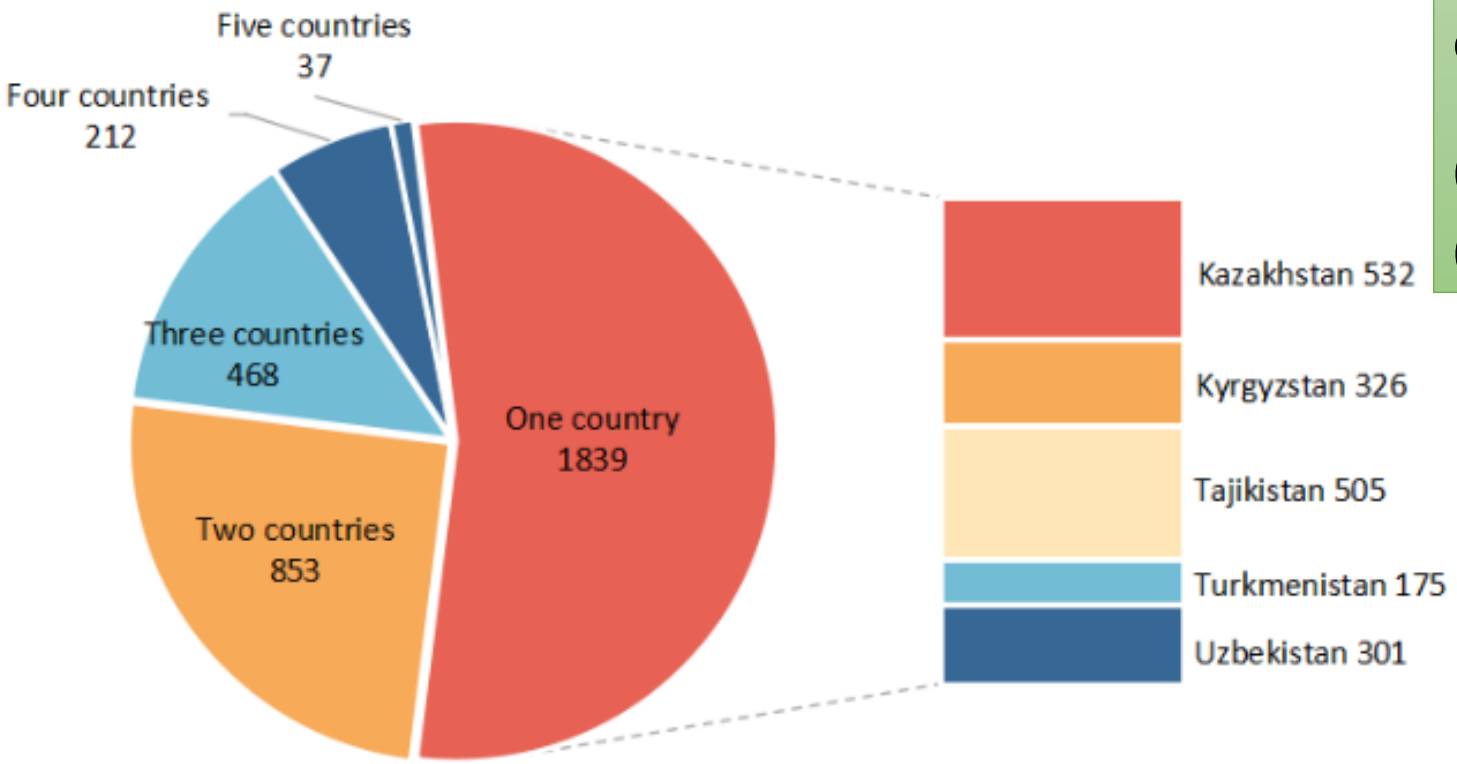
Families	Genera	Species	Source
125	1151	8094	CFAM (1969–1993)
161	**1300**	**9341**	Khassanov (2015)
+36	+149	+1247	





Ma et al., 2024

The endemic taxa in Central Asia from one country to five countries

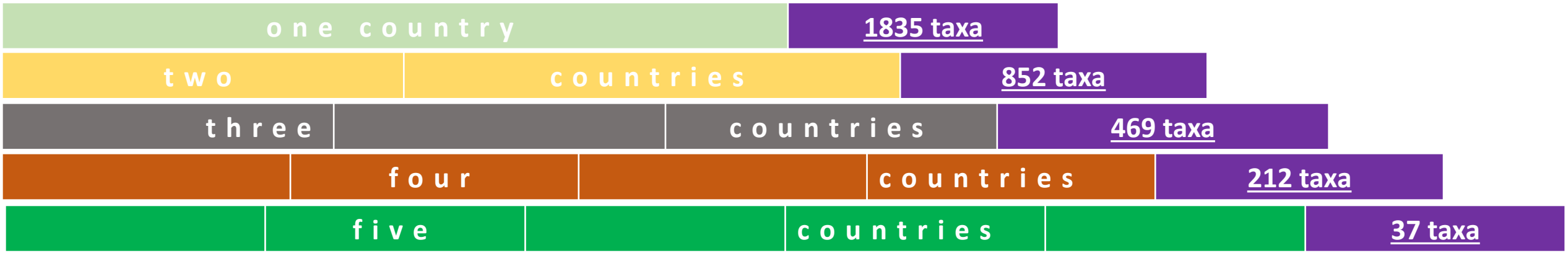


A few number of species with a wide distribution (4 or more countries) shows:

(a) Environmental heterogeneity

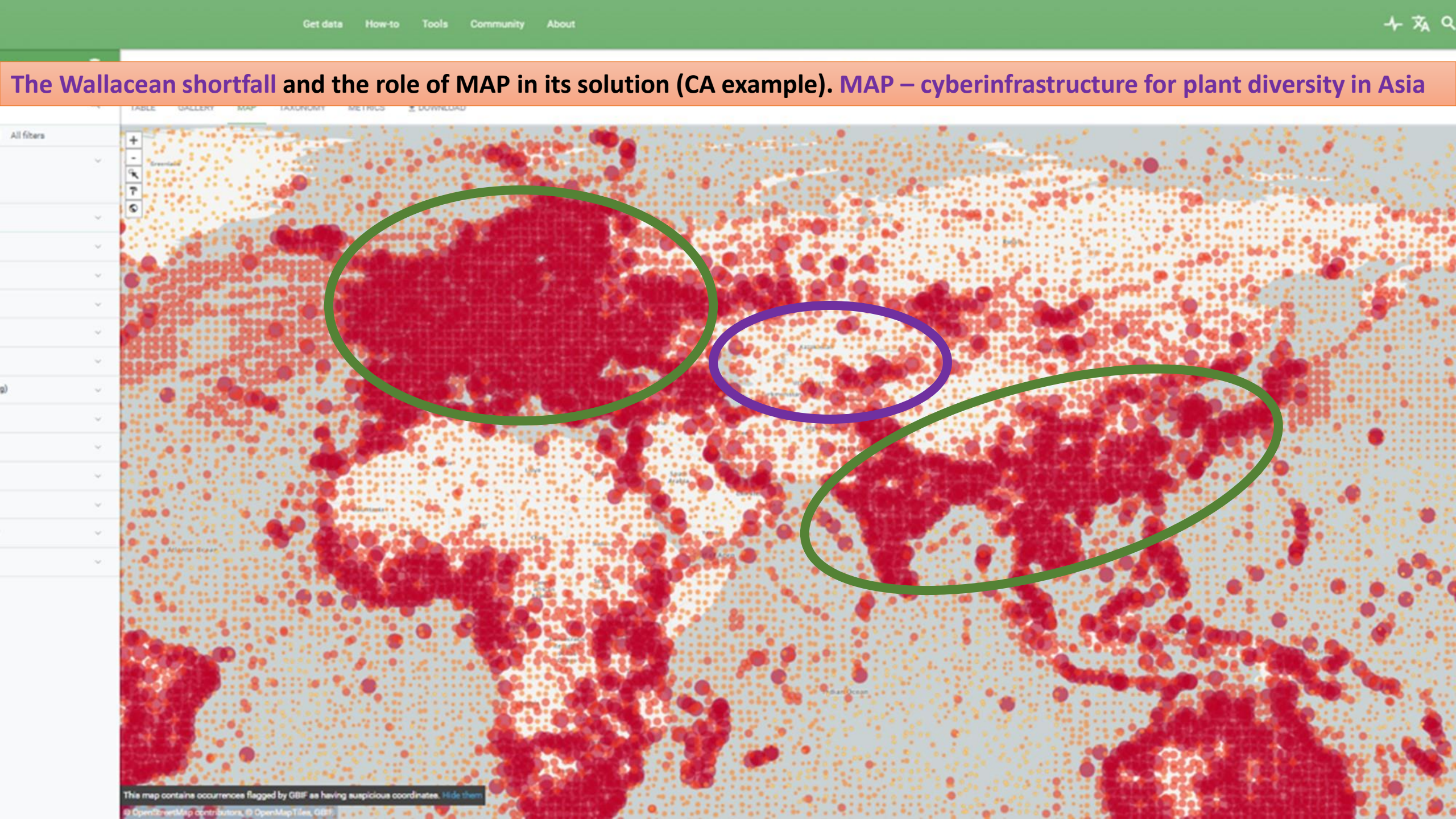
(b) Geographical heterogeneity

(a) Stein et al., 2014
(b) Duarte-Cunha et al., 2015



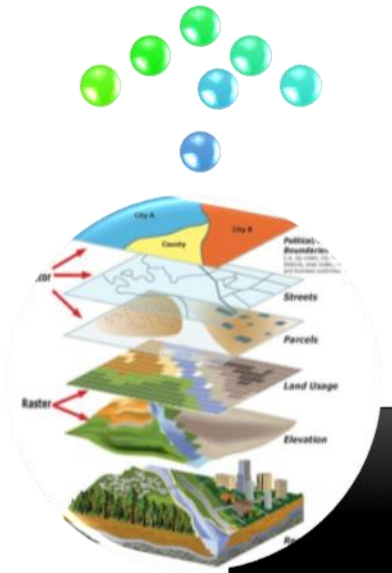
Ma et al., 2024

The Wallacean shortfall and the role of MAP in its solution (CA example). MAP – cyberinfrastructure for plant diversity in Asia



The Wallacean shortfall

geographical distributions of most species are poorly understood and usually contain many gaps (Bini et al., 2006)



Georeference Database

General information about the distribution of species

(old literature data, printed maps, etc.)

Situation in Central Asia (up to 2010)

An array of hardcopy information :

- National and local flora checklists (1930–1990)
- Conspectus Florae Asiae Media (1969–1993)
- dissertations, papers, research reports

Plant dot maps and vegetation maps (hardcopy):

- vegetation map of CA countries, the whole CA
- economically important species, medicinal species

Non-digitized herbarium specimens :

- herbarium specimens of the classical period (1900–1990)
- herbarium specimens of recent decades (1990–2000)

Digital platforms or databases on the distribution of species

plantarium.ru

https://www.plantarium.ru

GBIF

iNaturalist

CALIFORNIA ACADEMY OF SCIENCES

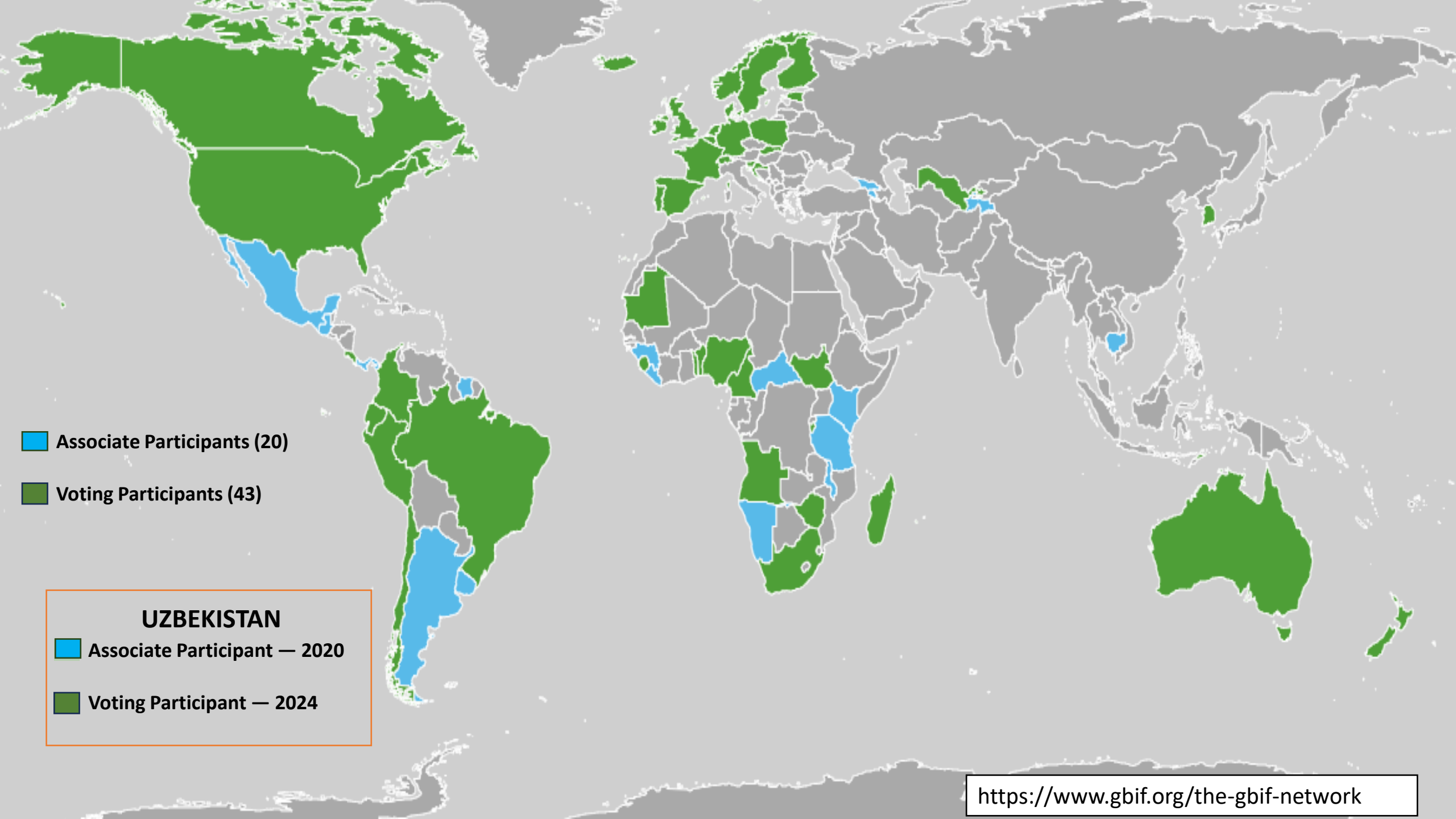
NATIONAL GEOGRAPHIC

Digitisation of herbarium collections of Central Asia is a priority

The digitization of herbarium collections is contributing to filling major knowledge gaps, but this effort is largely incomplete – so far mostly taking place at larger and wealthier institutions – meaning that it must remain a priority for many years to come

Acronym, Organization	Number of specimens	Type specimens	Digitized	Date Founded	Core area
TASH Tashkent, Uzbekistan	1.6M	3100	450 000	1920	Central Asia and surrounding areas
FRU Bishkek, Kyrgyzstan	400 000	~ 750	Not Digitized	1943	Central Asia and surrounding areas
AA Almaty, Kazakhstan	350 000	~ 500	No Information	1941	Central Asia and surrounding areas
TAD Dushanbe, Tajikistan	200 000	No Information		1981	Central Asia and surrounding areas
SAMDU Samarkand, Uzbekistan	12 500	no	Not Digitized	1927	Uzbekistan and surrounding areas

https://sweetgum.nybg.org/science/ih/


Associate Participants (20)
Voting Participants (43)
UZBEKISTAN
Associate Participant — 2020
Voting Participant — 2024
https://www.gbif.org/the-gbif-network

Efforts in Mapping Plants in Uzbekistan (1) National Herbarium of Uzbekistan (since 1920)

The main taxa of monocots have been digitized (Poaceae, Cyperaceae, *Allium*, *Eremurus*, *Gagea*, Juno etc.)

Some polymorphic families have been digitized (Lamiaceae, Amaranthaceae, Polygonaceae, Caryophyllaceae and etc.)

Number of annual new arrivals is ~ 8 000–10 000 (georeferenced specimens)

TASH is the largest collection of Central Asian plants worldwide (more than 1.6 mln. specimens since 1831)

Historical collections of first explorers of the CA flora and prominent botanists of the 20th Century (Popov, Korovin, Vvedensky, Kamelin etc)

Included in the top 30 largest herbaria of the world and 4th in Asia

Over 380,000 specimens in the database; over 180,000 specimens scanned; over 120,000 specimens barcoded

Efforts in Mapping Plants in Uzbekistan (2) The Flora of Uzbekistan Project (since 2016)

Phytotaxa 282 (2): 107–118
http://www.mapress.com/j/pt/

Article

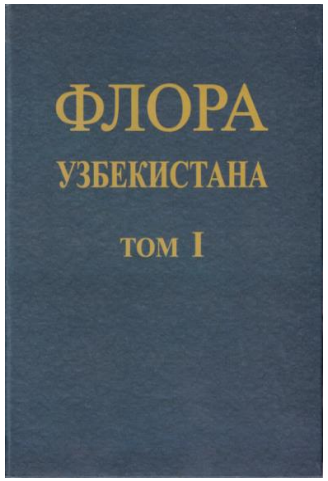
ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

http://dx.doi.org/10.11646/phytotaxa.282.2.2

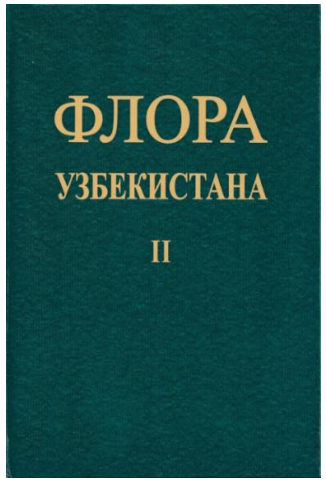
The Flora of Uzbekistan Project

ALEXANDER N. SENNIKOV[1,2,*], KOMILJON SH. TOJIBAEV[3], FURKAT O. KHASSANOV[3] & NATALYA YU. BESHKO[3]

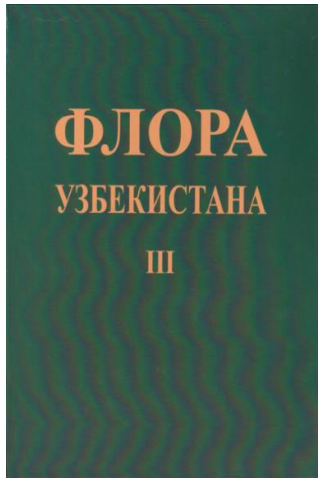
Central Asia's first updated national (Int.) flora project



vol. I
2016

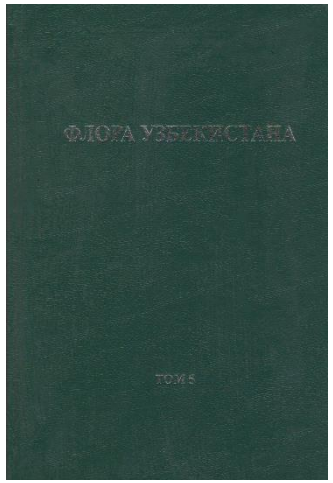


vol. II
2017

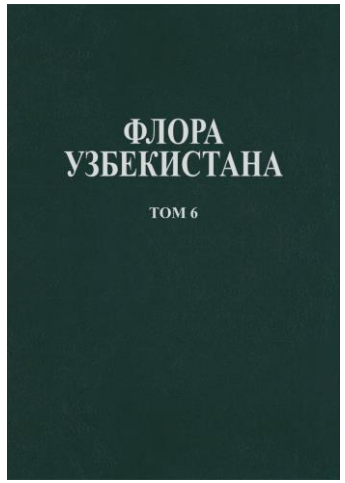


vol. III
2019

vol. IV
2022



vol. V
2022



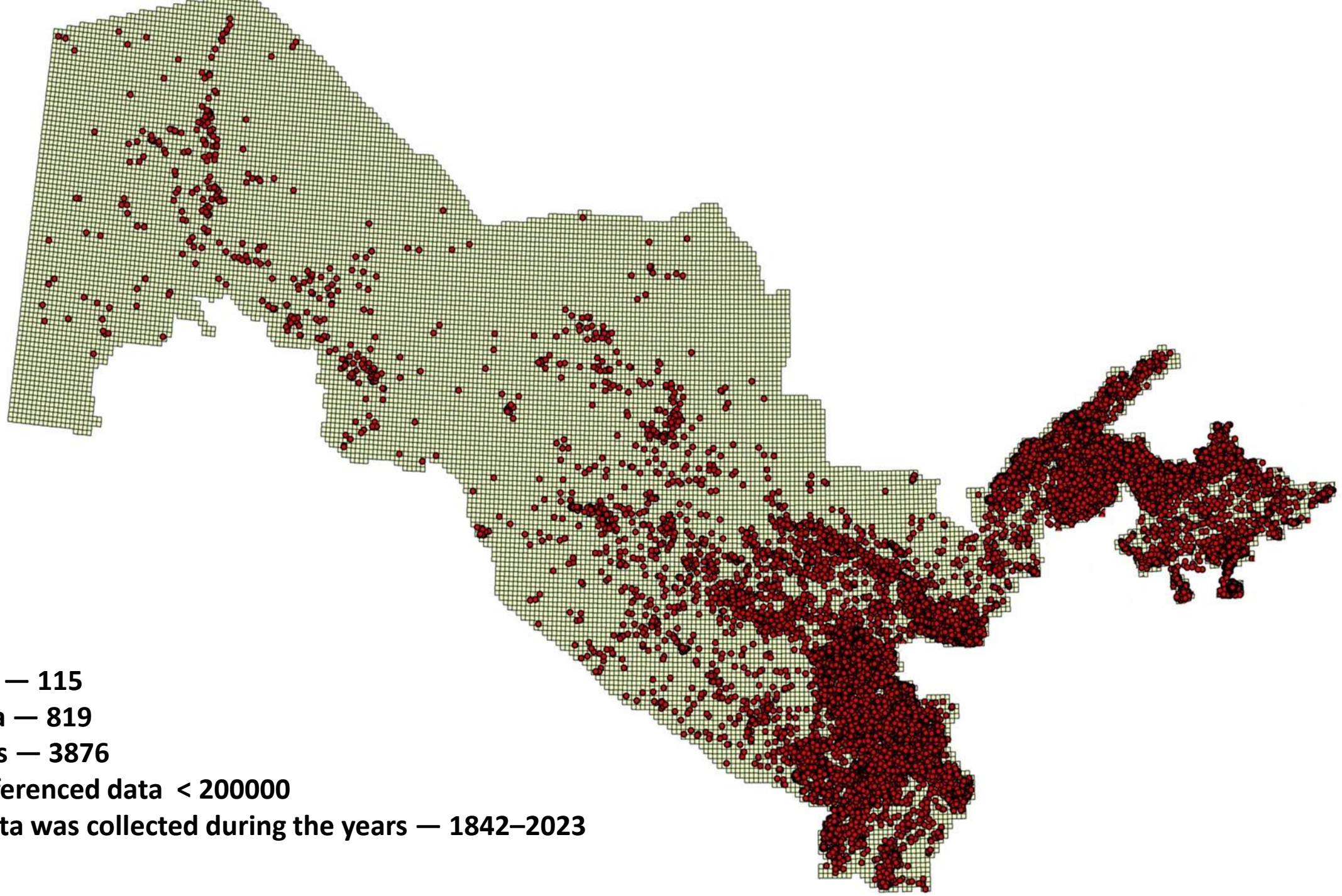
vol. VI
2023

- Institute of Biology NAK
- University of Helsinki
- Kunming Institute of Botany, CAS
- Komarow Botanical Institute
- Botanical Garden of Moscow University
- Korea National Arboretum
- Changwon National University
- Altai State University
- Tomsk State University

Organizations participating

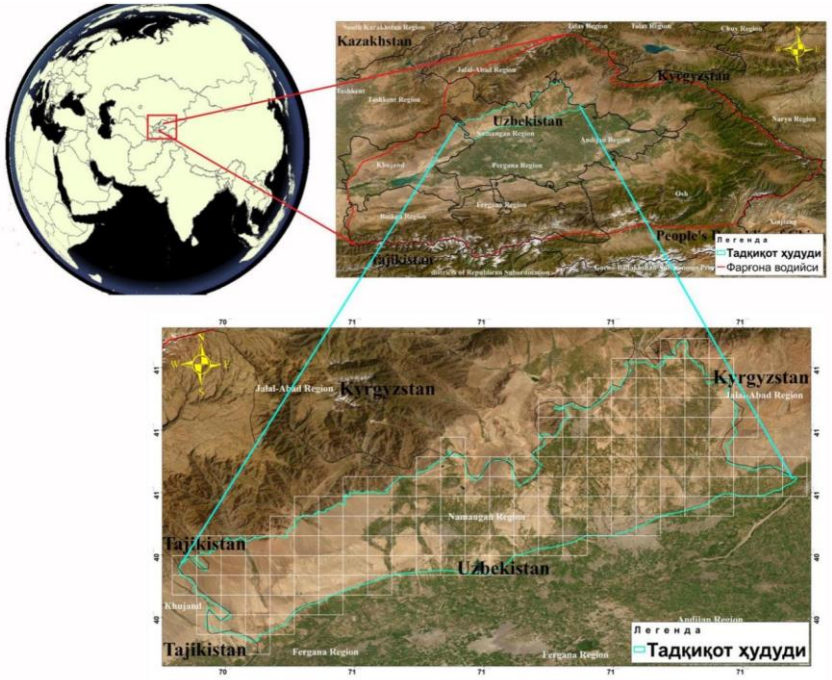
Family	Genera	Species and subspecies	%	Georeferenced specimens
20	184	820	18.9	

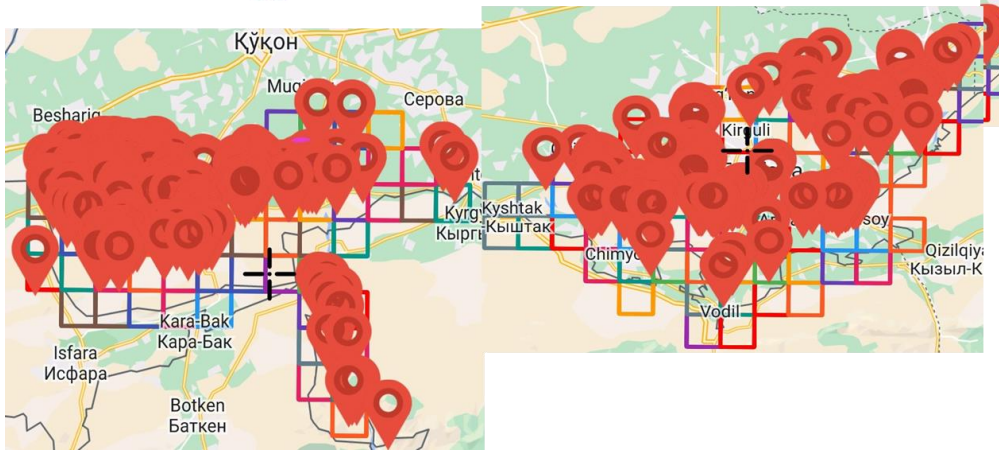
Amaryllidaceae (*Allium*), Primulaceae, Plantaginaceae, Scrophulariaceae, Campanulaceae, Plumbaginaceae, Caprifoliaceae, Gentianaceae, Boraginaceae, Apiaceae and **Brassicaceae**, **Lamiaceae**

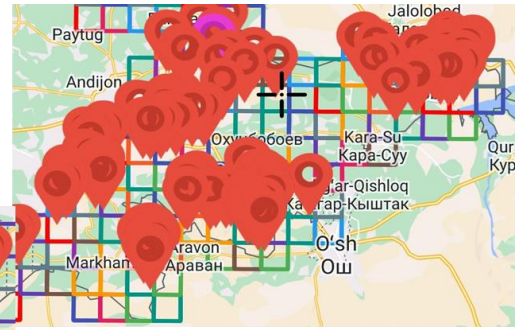


Family — 115
Genera — 819
Species — 3876
Georeferenced data < 200000
The data was collected during the years — 1842–2023

Efforts in Mapping Plants in Uzbekistan (4) The local plant diversity researchers and PhD students





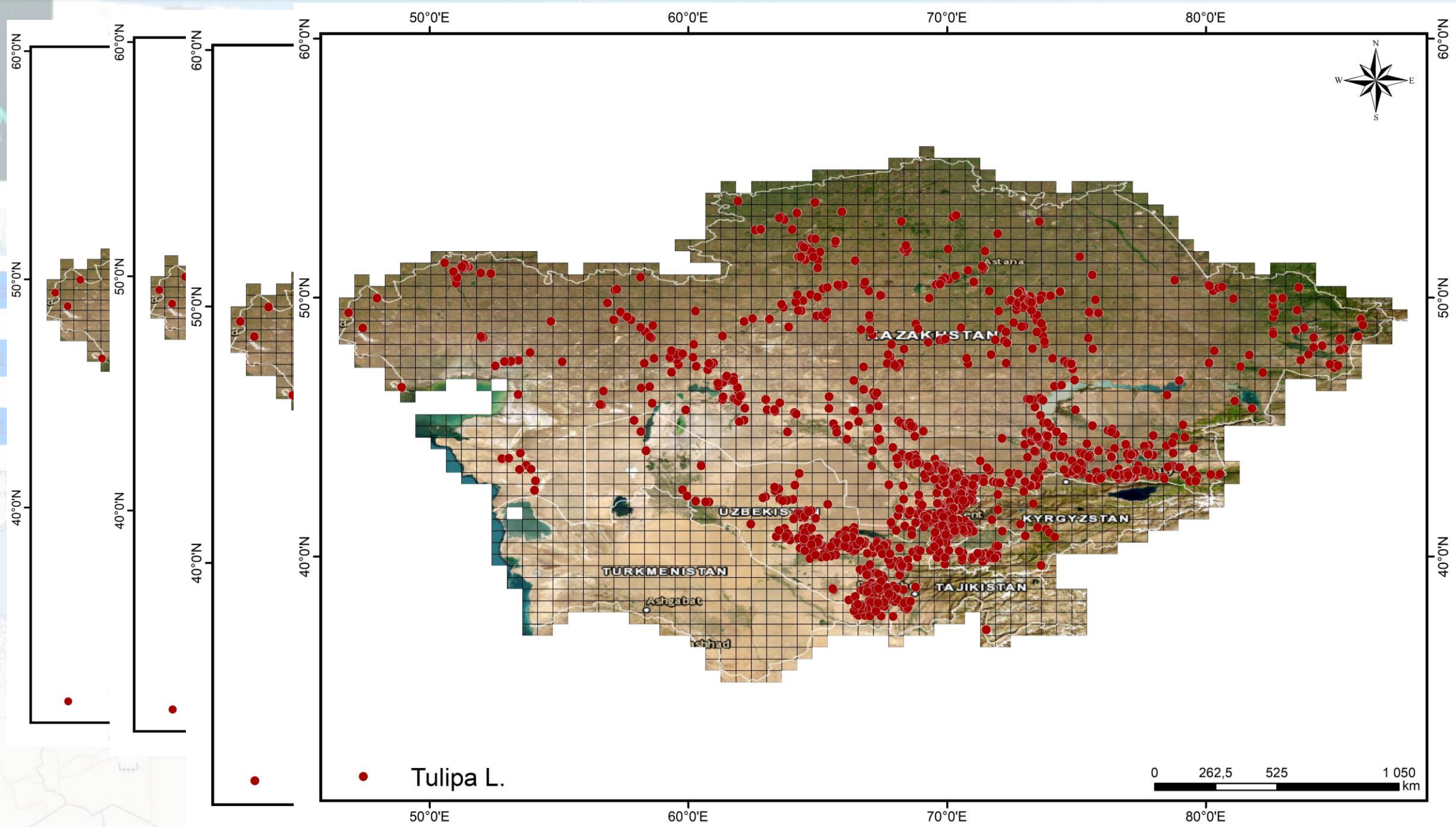


Local floristic research makes a major contribution to the expansion of georeferenced database

More than **20,000** herbarium specimens have been collected from the Fergana Valley in two years (2023–2024)

New regional digital platform for mapping plant diversity

New regional digital platform for mapping plant diversity



Collection Map

Species Map

ca.org

CONCLUSIONS

Despite the results achieved for many decades, Central Asia can still be included in the world's 33 global diversity darkspots. This is largely due to the limited array of geoinformation

Mapping Asia Plants (MAP) project as a better mapping infrastructure for plant diversity conservation in Asia:

- **can play a key role in filling these biodiversity shortfalls**
- **strengthen cooperation between Central Asian countries in sharing biodiversity information**
- **strengthen collaboration with other Asian countries**
- **serve to improve the level of large-scale knowledge of Central Asian biodiversity**
- **priority regions for future collection according to several socio-economic and environmental scenarios**

Thank you for your attention!

ANSO
The Alliance of National and International Science Organizations for the Belt and Road Regions

Biodiversity Committee, Chinese Academy of Sciences (CAS)

ACADEMY OF SCIENCES OF THE REPUBLIC OF UZBEKISTAN

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ACADEMY OF SCIENCES REPUBLIC OF UZBEKISTAN INSTITUTE OF BOTANY
Since 1940