



Лаборатория изучения
экологических функций
почв

Институт проблем экологии и
эволюции им. А.Н. Северцова
РАН



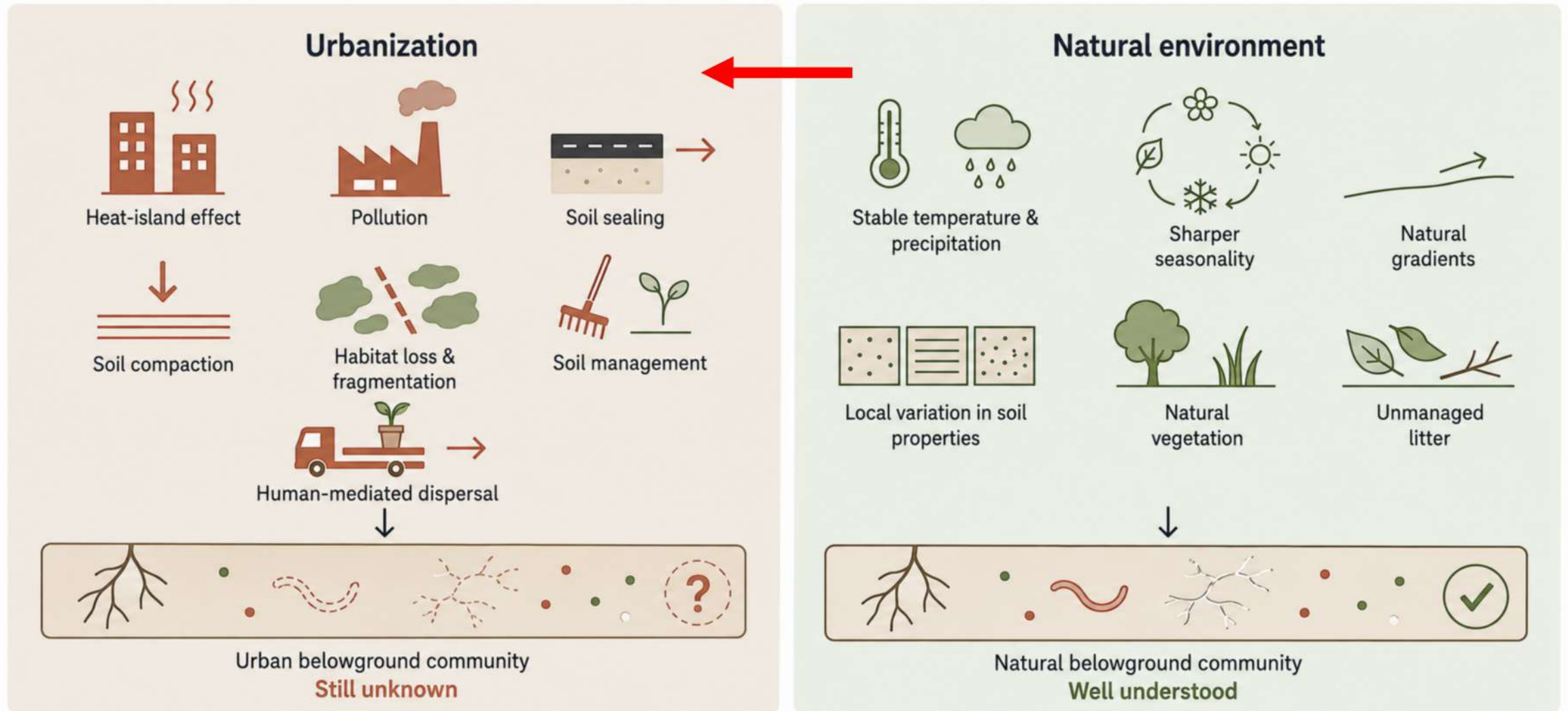
Synergistic effects of urbanization and natural environmental gradients on the functional community assembly of oribatid mites (Acari: Oribatida)

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Scientific Supervisor: **Dr. Andrey Zaytsev**

Background



Концептуальные проблемы	Что такое «критические блоки»?	Связь трейты → процессы → функции	Масштабирование уровней организации	
Методологические проблемы	Стандартизация трейтов почвенной фауны	Измерение функций почвы	Связывание данных разных типов	
Данные и наблюдения	Недостаток данных по почвенной фауне	Cryptic (black) diversity	Контроль условий	Лабораторные эксперименты
Пространственно-временная динамика	Пространственная неоднородность	Временная изменчивость	Глобальные изменения	
Моделирование	Трофические взаимодействия	Нетрофические взаимодействия	Выбор типа моделей	Нелинейность и критические точки
Синтез	Универсальность vs контекст	Предсказательная сила	Управление экосистемами	

Перспективы изучения функций почв и почвенной multifunctionality

Research object: Oribatid mites

Globally widespread

High diversity and density

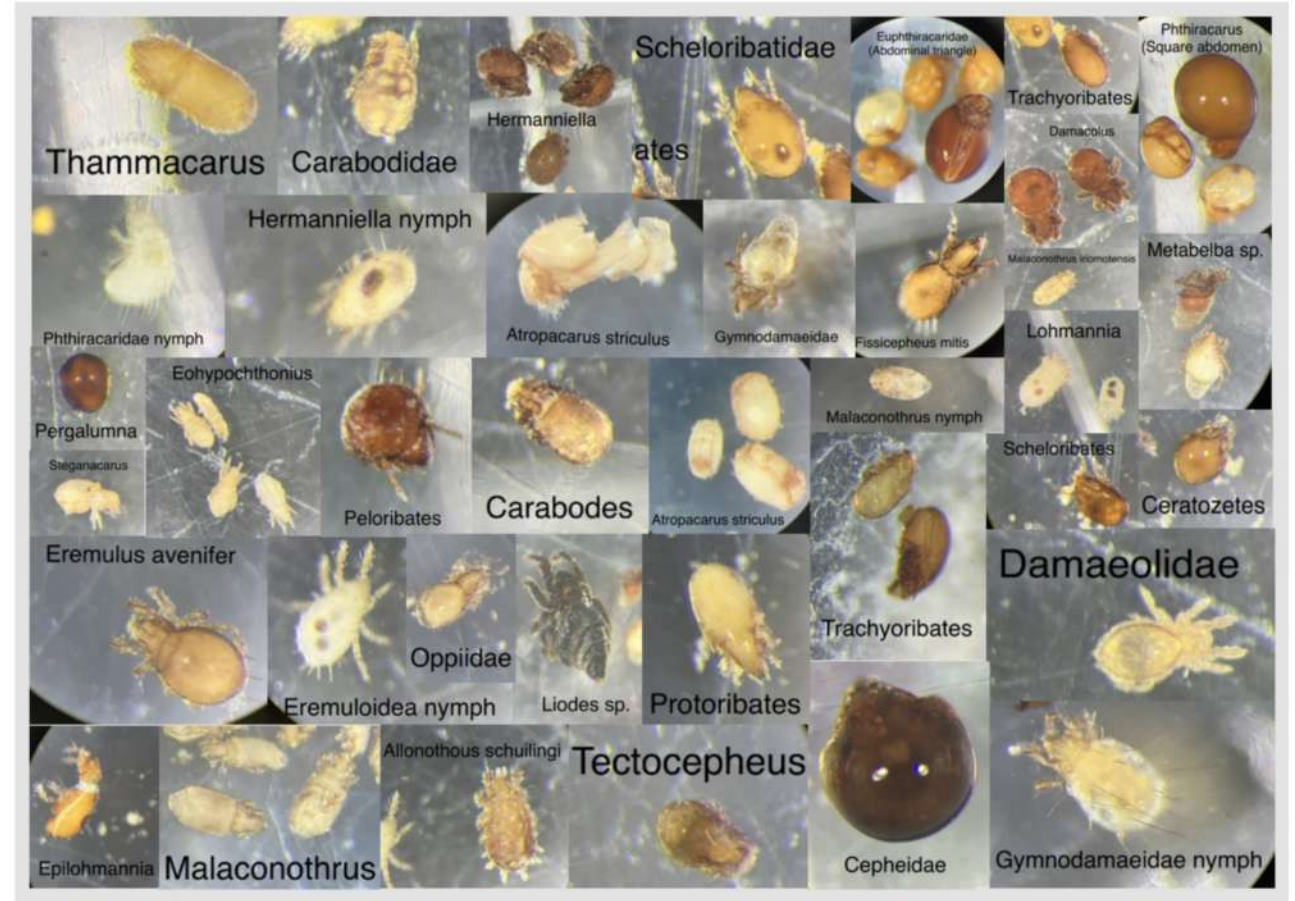
Significant role in ecosystems

Sensitive to environmental changes

★ Multiple functional traits

Classification of oribatid functional traits

Vertical distribution (After Krivolutsky, 1995)	Surface dwelling
	Litter dwelling
	Soil dwelling
	non-specialized dwelling
Feeding preference (After Siepel & Ruiter-Dijkman, 1993; Kaneko, 1988)	Herbivorous
	Fungivorous
	Herbifungivorous
	Omnivorous
Reproduction mode (After Norton, 1990)	Sex
	Parthenogenetic
Size class (Directly measured)	<500 µm
	500-900 µm



Pilot Study

- **Coastal city:** Shenzhen

- **Number of sites:** 24

Urban: 12

Natural: 12

- **Distance gradient:**

Class 1: 15-68m,

Class 2: 800-913m,

Class 3: 2332-3847m,

Class 4: 4559-4706m.

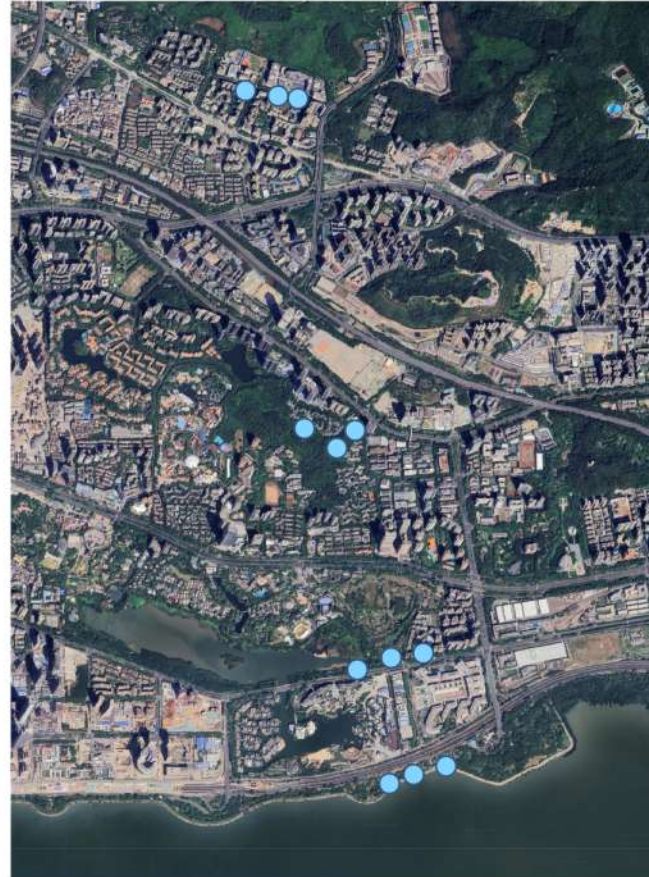
2130 individuals, **57** morphospecies

Urban: 29; Natural: 51

7 new reported species or morphospecies in
China (based on Liu & Chen, 2024)

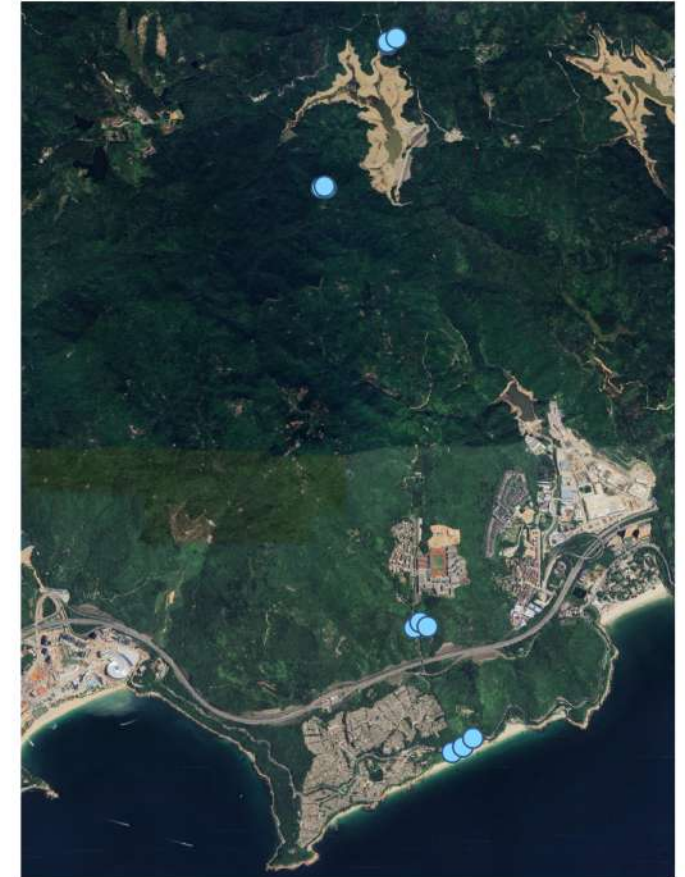


Shenzhen Urban



Shenzhen Nature

0 250 500 m



Key Results

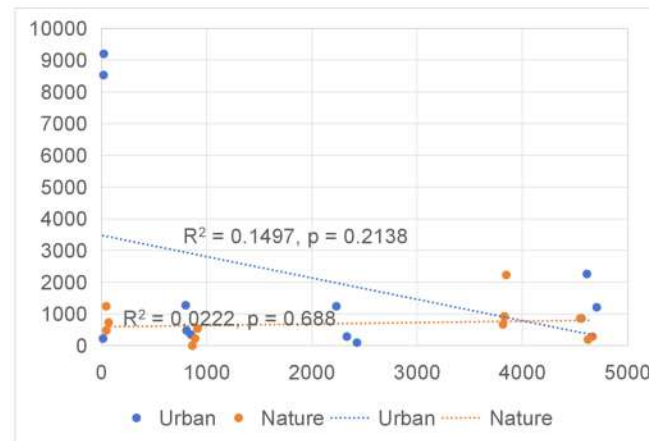
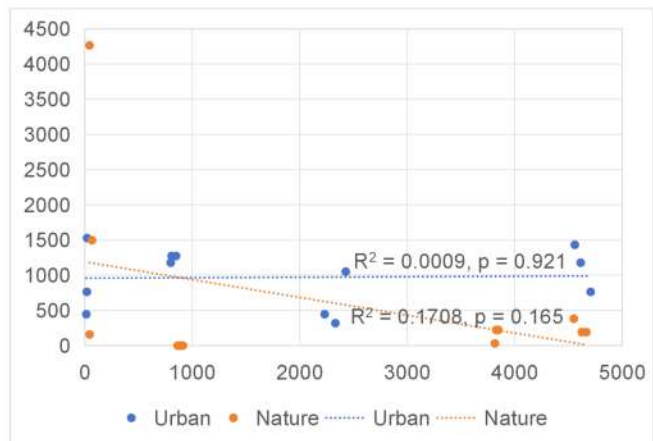
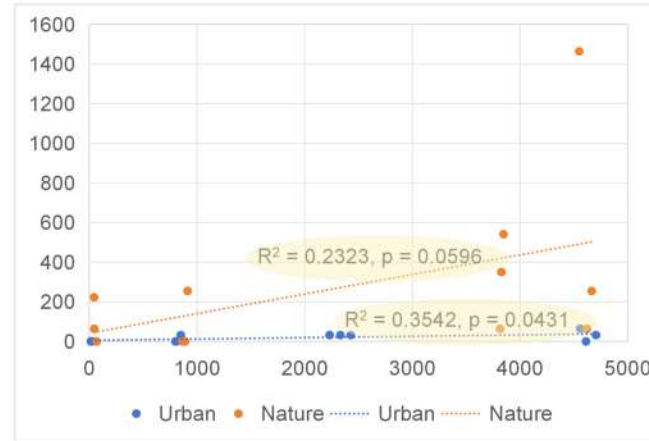
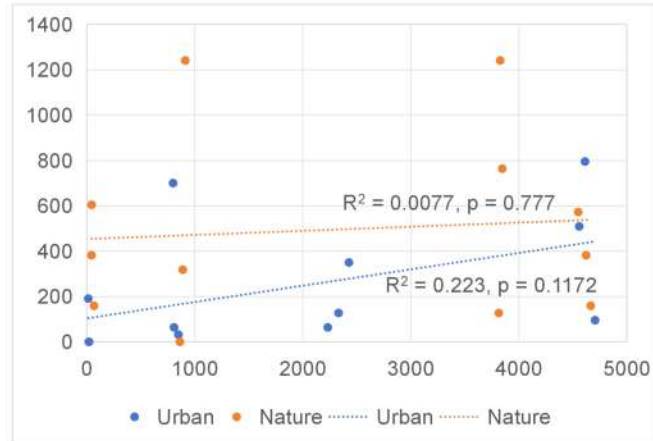


Fig. 1. Abundance of functional level oribatid mites per urbanization class along the distance from the sea by vertical distribution traits. X axion as the distance from the sea, Y axion as the density per square meter.

- Litter dwellers demonstrated a nearly significant positive trend in the natural area going away from the sea coast. Such trend was not revealed in the urban area.

Key Results

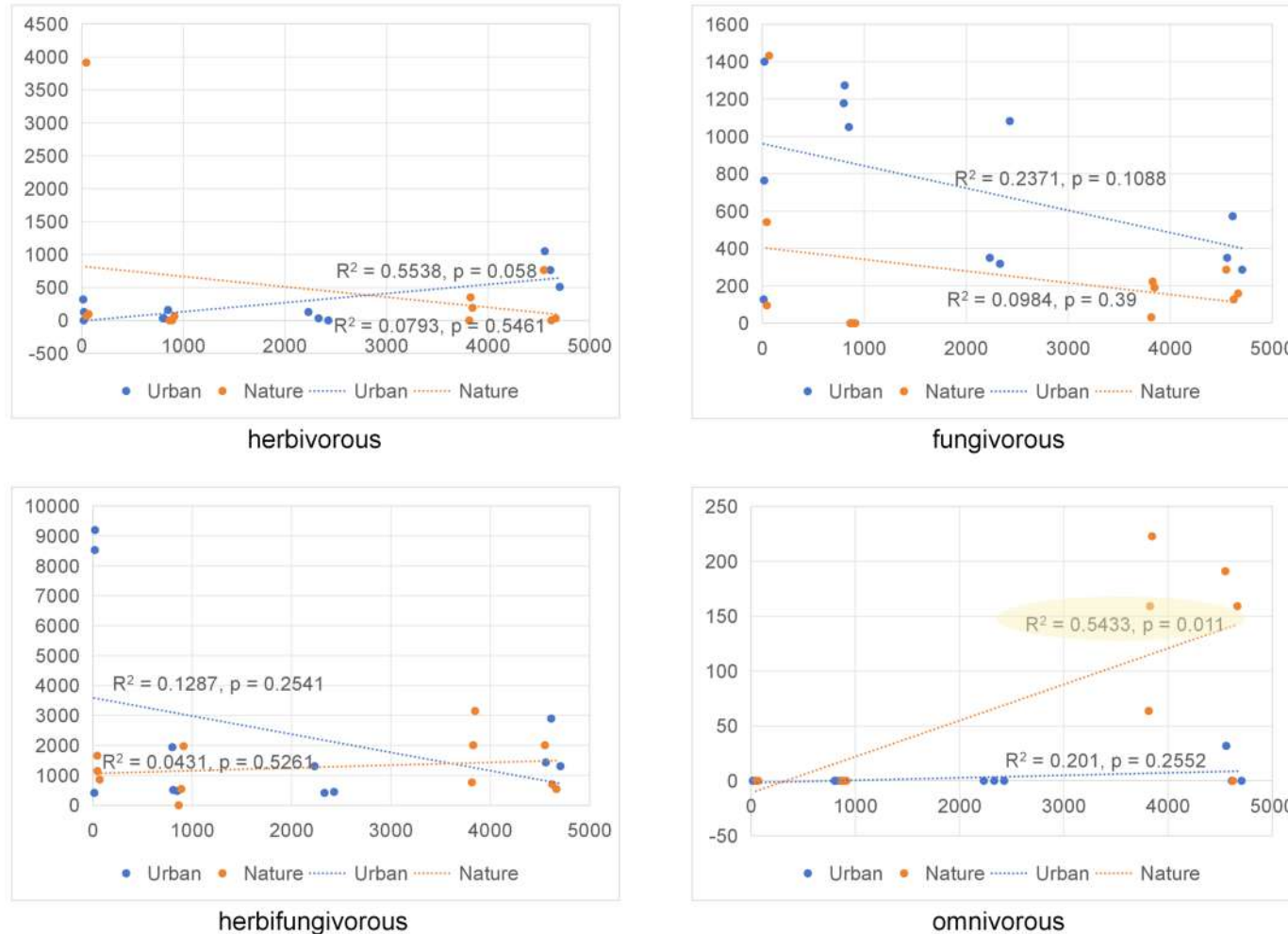


Fig. 2. Abundance of functional level oribatid mites per urbanization class along the distance from the sea by feeding preference traits. X axion as the distance from the sea, Y axion as the density per square meter.

- Omnivorous mites showed a significant positive trend in the natural area along the distance from the sea, while no such significance was detected in urban habitats.

Key Results

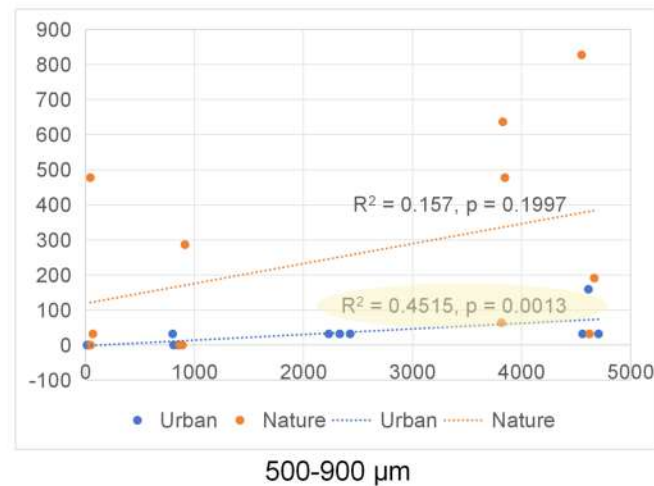
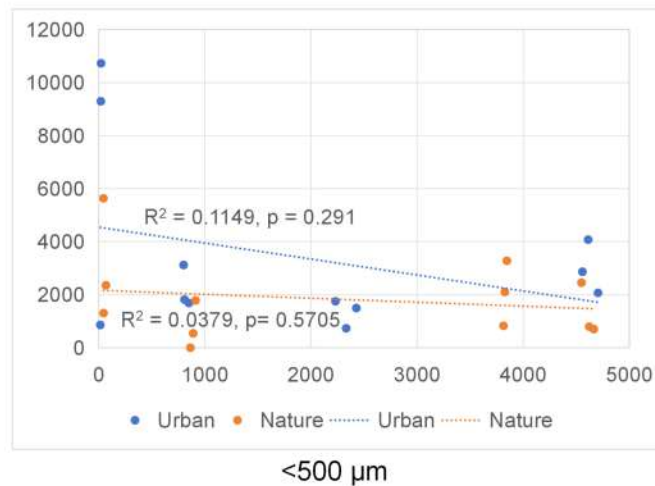


Fig. 3. Abundance of functional level oribatid mites per urbanization class along the distance from the sea by body size traits. X axion as the distance from the sea, Y axion as the density per square meter.

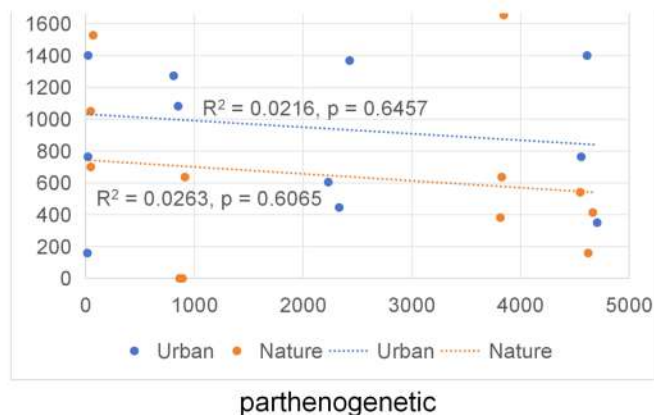
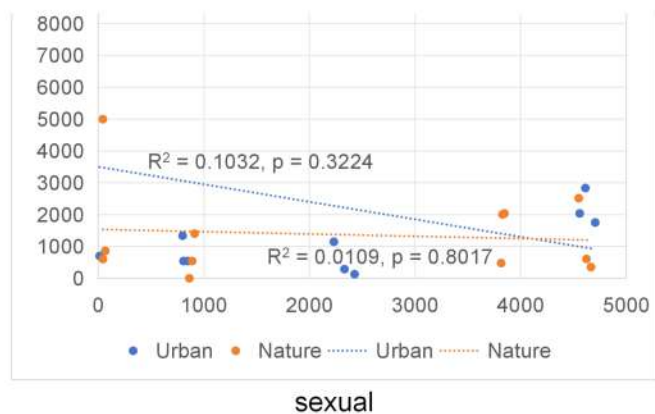


Fig. 4. Abundance of functional level oribatid mites per urbanization class along the distance from the sea by reproduction mode traits. X axion as the distance from the sea, Y axion as the density per square meter.

Key Results

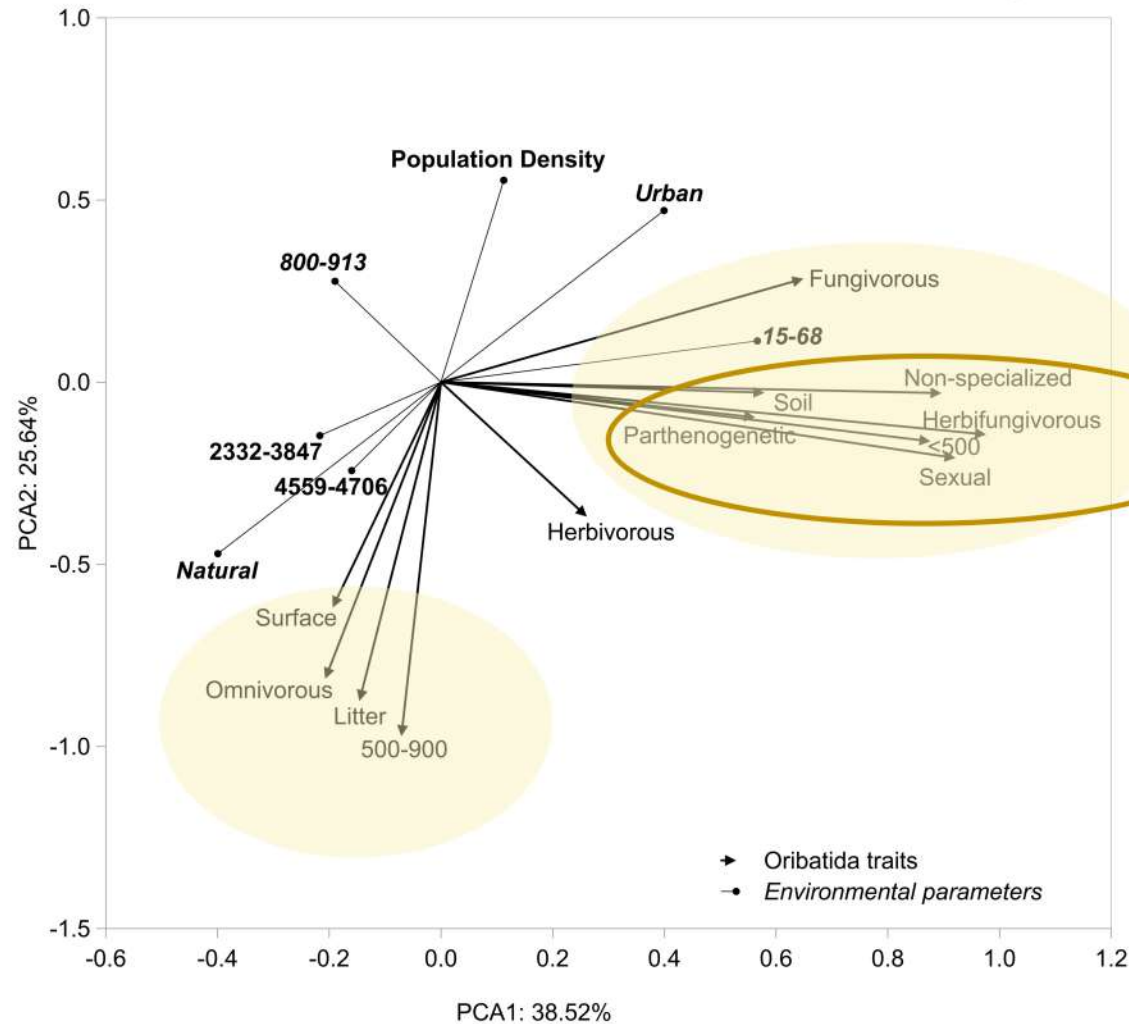


Fig. 1. Principal component analysis results for each trait of oribatid mites after z-score transformation of all data, isolated distance gradients and habitats with population as passive variables.

- Trait-driven partitioning of the community and respective filtering associated with either urbanization or natural gradient
- The factors associated with human population density may identified the trait groups with tolerance



Stage 2 research

**What are the differences between landuse types
within a city (local scale)?**

**How universal are the trends across biomes
(continental scale)?**

Study Area and Sampling



Model cities:

- Moscow
- Kazan
- Yekaterinburg
- Novosibirsk
- Petrozavodsk
- Sochi

In each city:

Roadside greenbelt (5)
Urban park (5)
Residential area (5)
Natural forest (5)

Sampling for two consecutive years using standard methods at the most phenologically optimal time.

Σ – up to 240 samples

Landuse Types:



Urban Park



Roadside
Greenbelt

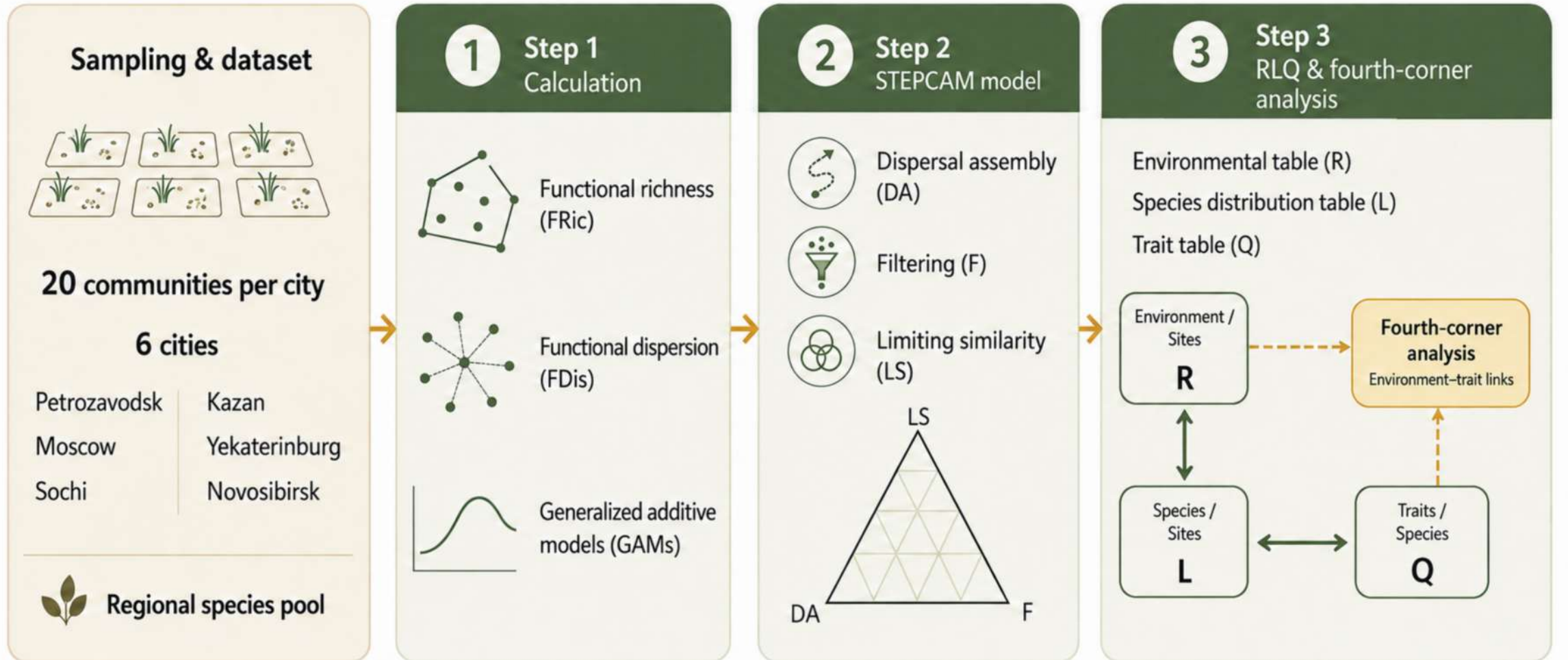


Residential
Area



Natural
Forest

Data Analysis



Complementary data from China

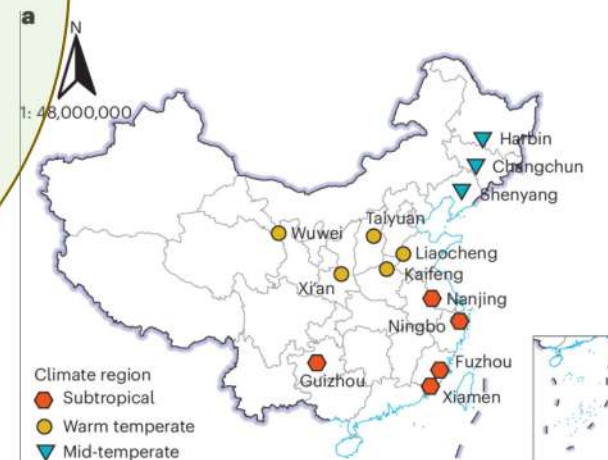


The fourth climate region

- Kazan
- Yekaterinburg
- Novosibirsk

Three landuse types

- Urban park (4)
- Residential area (4)
- Natural forest (4)



Map by: Sun et al., 2026

Anticipated results

- **A unique, process-based framework for urban soil quality assessment**
- **Testing general ecological theory for soil ecosystems**
- **Investigating mechanisms of soil functional stability in urban environments**
- **Addressing the fundamental question of linking soil biodiversity and function in novel ecosystems**

LOOKING FORWARD FOR YOUR FEEDBACKS!

Thank You for Your Attention!

Please feel free to ask any questions

