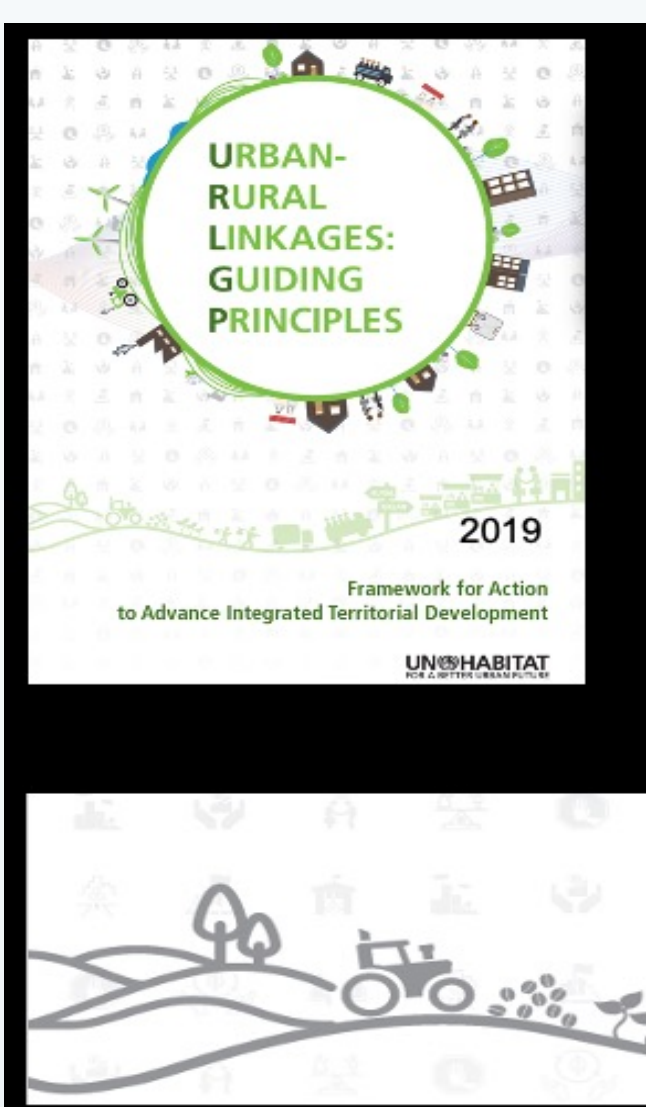# Landscape Sustainability Science: A Transdisciplinary Framework for Studying and Improving the Urban-Rural Regional System

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THE PROBLEM

Two observations motivate me to give this presentation:

1. First, achieving urban sustainability should be the ultimate goal of all urban studies. But this has never been the case and still is not. Without a common goal, multidisciplinary and interdisciplinary studies of cities cannot necessarily – usually do not really – contribute to the understanding, much less improvement, of urban sustainability. Urban and rural areas are often treated as different types of ecosystems or landscapes, but in reality they depend on each other for survival and prosperity.

2. Second, it is easy to imagine that cities cannot be possibly sustainable without the sustainability of their neighboring rural areas, and vice versa. Yet, ecological and sustainability studies have rarely considered urban and rural areas together as an integrated regional (landscape) system. Although studies focusing on either urban or rural areas only are needed, their contributions to regional and global sustainability are limited.

URBAN-RURAL LINKAGES: GUIDING PRINCIPLES 2019
Framework for Action to Advance Integrated Territorial Development
UN-HABITAT

Urban and rural communities do not live in isolation from one another. The flow of people, goods, services and transport, for example, does not go in one direction only.

This urban-rural relationship is increasingly the focus of attention from national, regional and local governments, planners and development agencies.
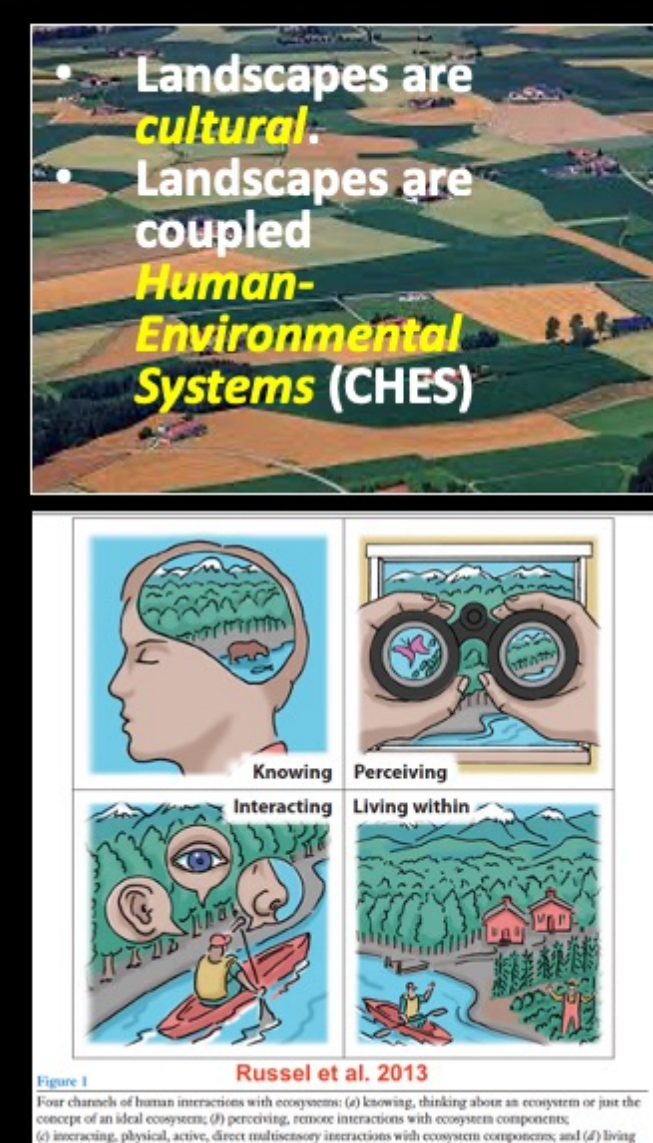
OBJECTIVE

To promote studies that integrate urban and rural areas together for sustainability (not just for biodiversity or ecology), here I introduce a new framework, **Landscape Sustainability Science**.

WHY A LANDSCAPE SUSTAINABILITY APPROACH?

Why landscapes/regions?

- Large enough to include key eco-socio-economic processes and small enough for detailed research and design implementation.
- Ordinary, familiar, tangible, sensible, actionable, and resonant with people – commensurate with human "perceptible realm"
- Common operational scale for ecologists, geographers, social scientists, land designers and planners, and decision makers
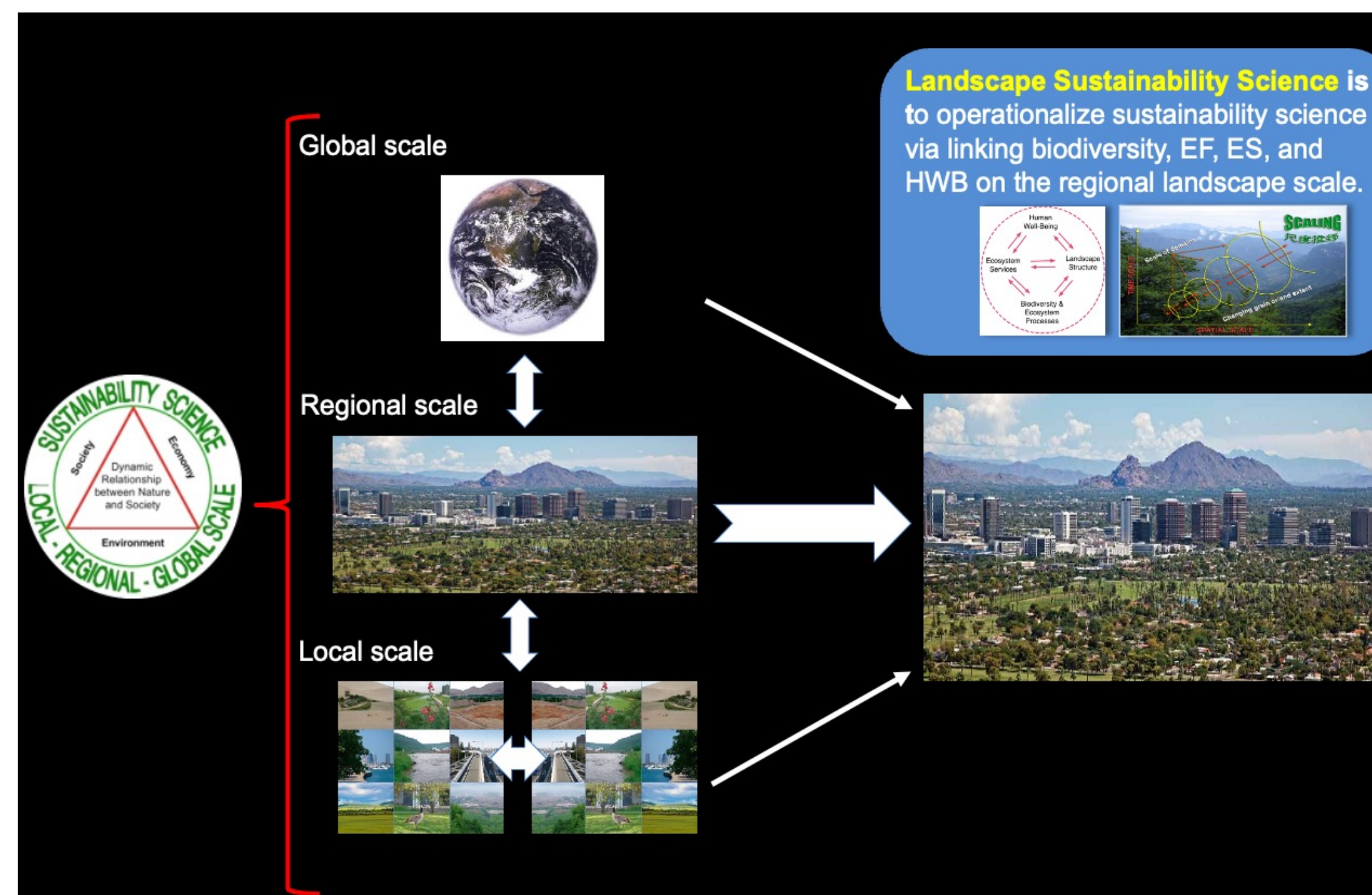- Arguably the most pivotal scale for sustainability research and practice

Landscapes are *cultural*. Landscapes are coupled *Human-Environmental Systems* (CHES)

Knowing, Intersecting, Perceiving, Living within
Russel et al. 2013
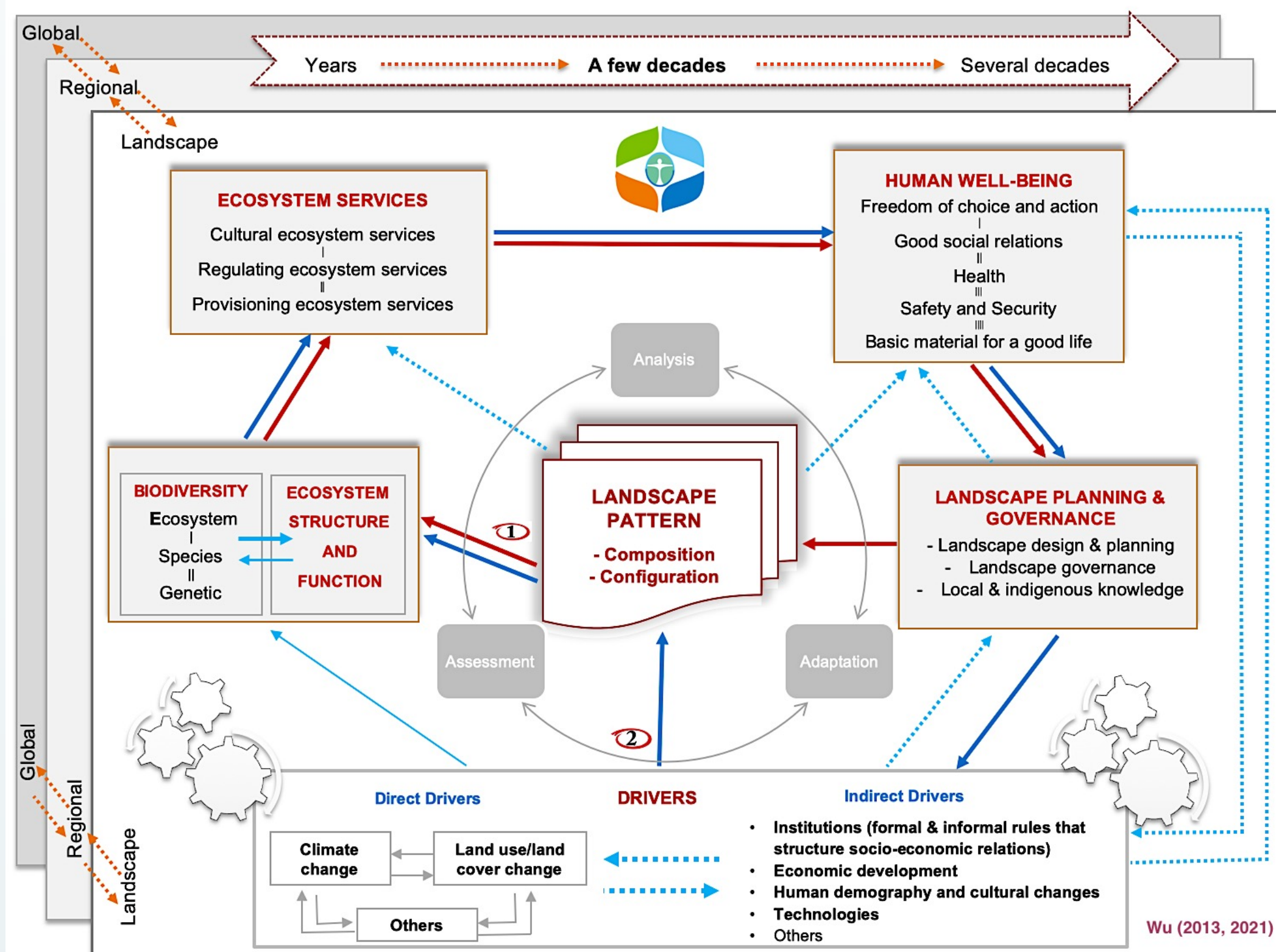
WHAT IS LANDSCAPE SUSTAINABILITY SCIENCE?

Landscape Sustainability Science

- **Landscape Sustainability:**
  - The capacity of a landscape/region to consistently provide long-term, landscape-specific ecosystem services essential for maintaining and improving human well-being in a regional context under environmental and sociocultural changes.
- **Landscape sustainability science (LSS):**
  - a place-based, use-inspired science of understanding and improving the dynamic relationship between ecosystem services and human well-being in changing landscapes with spatially explicit methods and outcomes.

Wu, J. (2013). Landscape sustainability science: Ecosystem services and human well-being in changing landscapes. Landscape Ecology 28: 999–1023.

Landscape Ecology and Sustainability Laboratory (LESL), Arizona State University

Landscape Sustainability Science is to operationalize sustainability science via linking biodiversity, EF, ES, and HWB on the regional landscape scale.
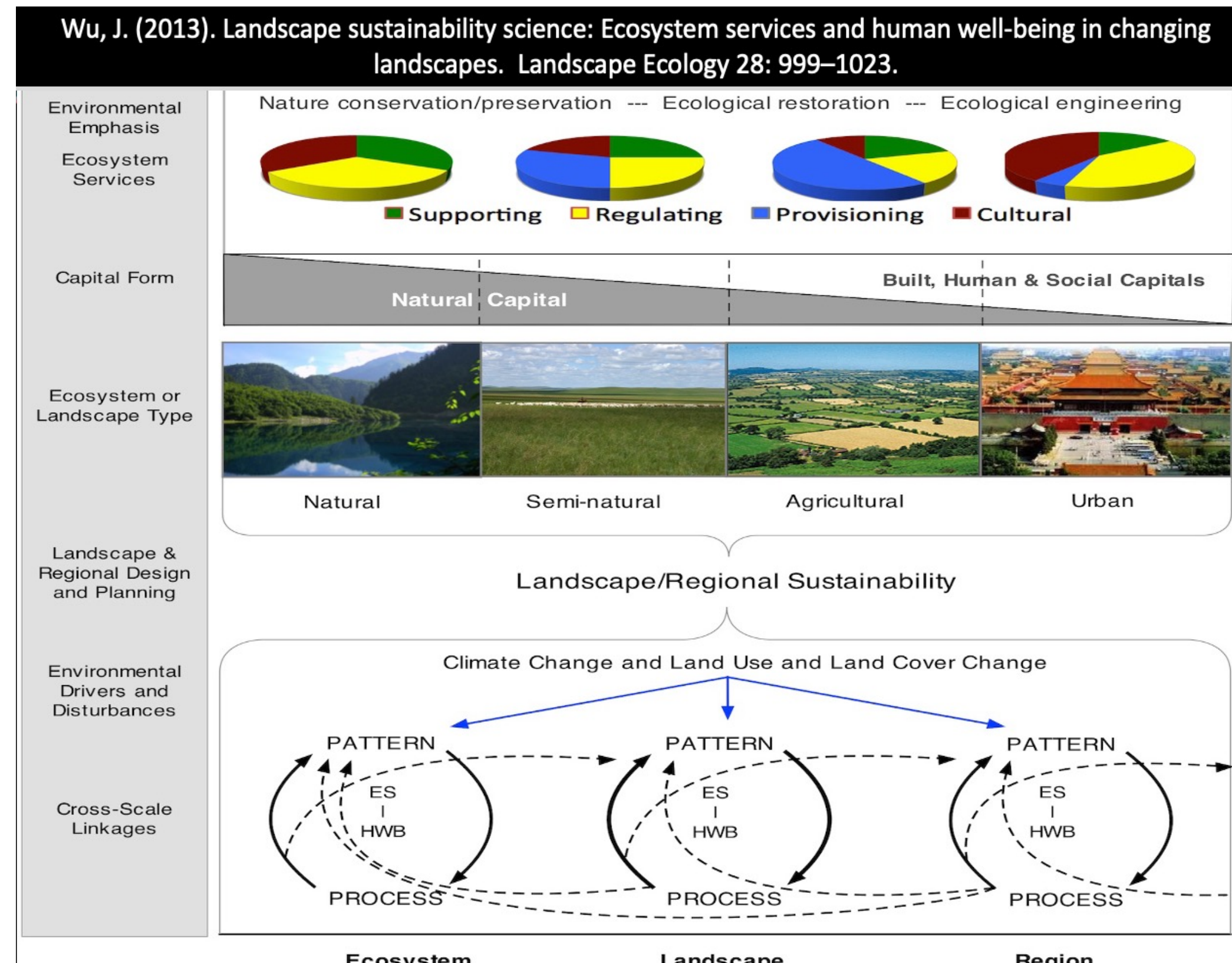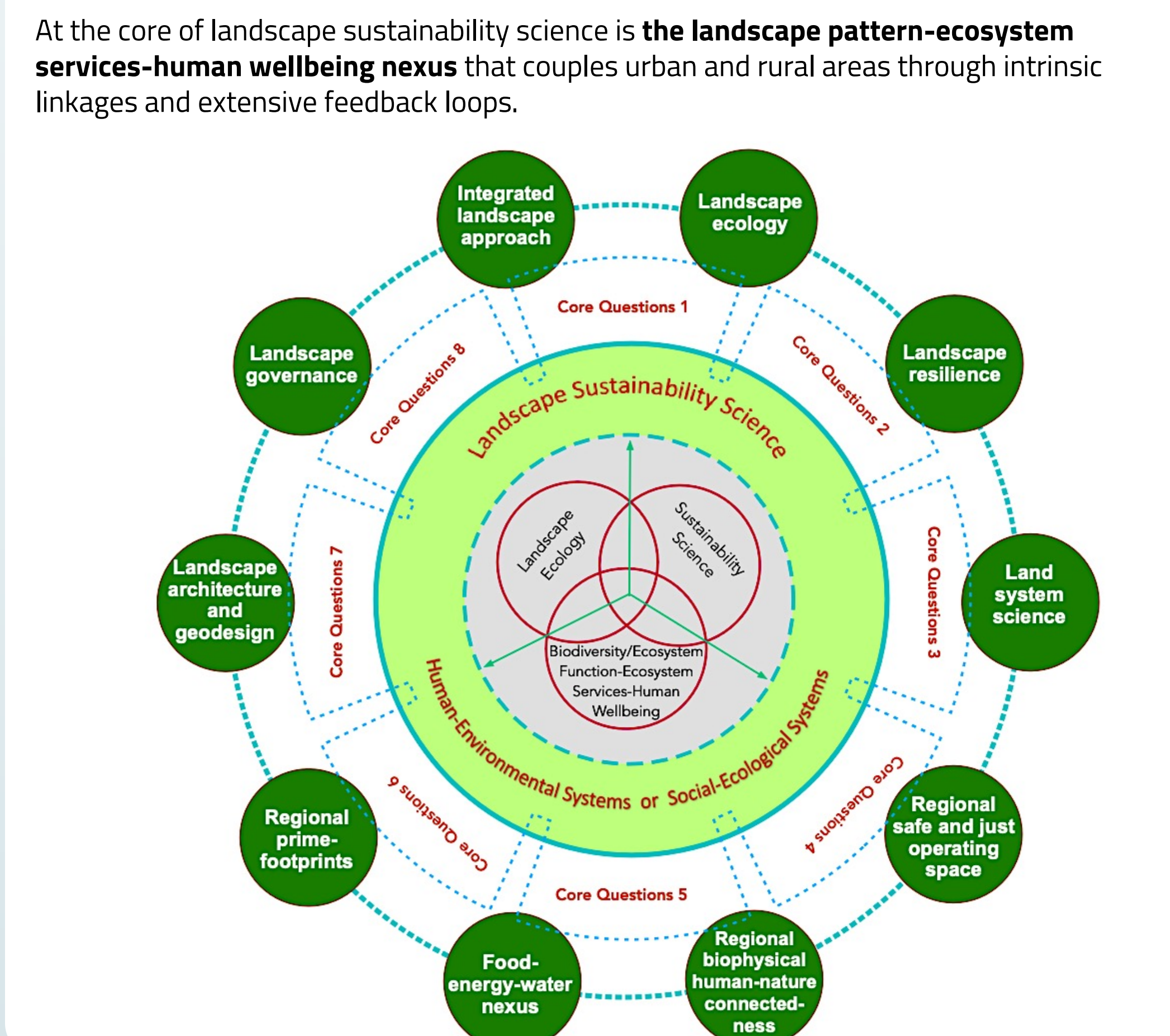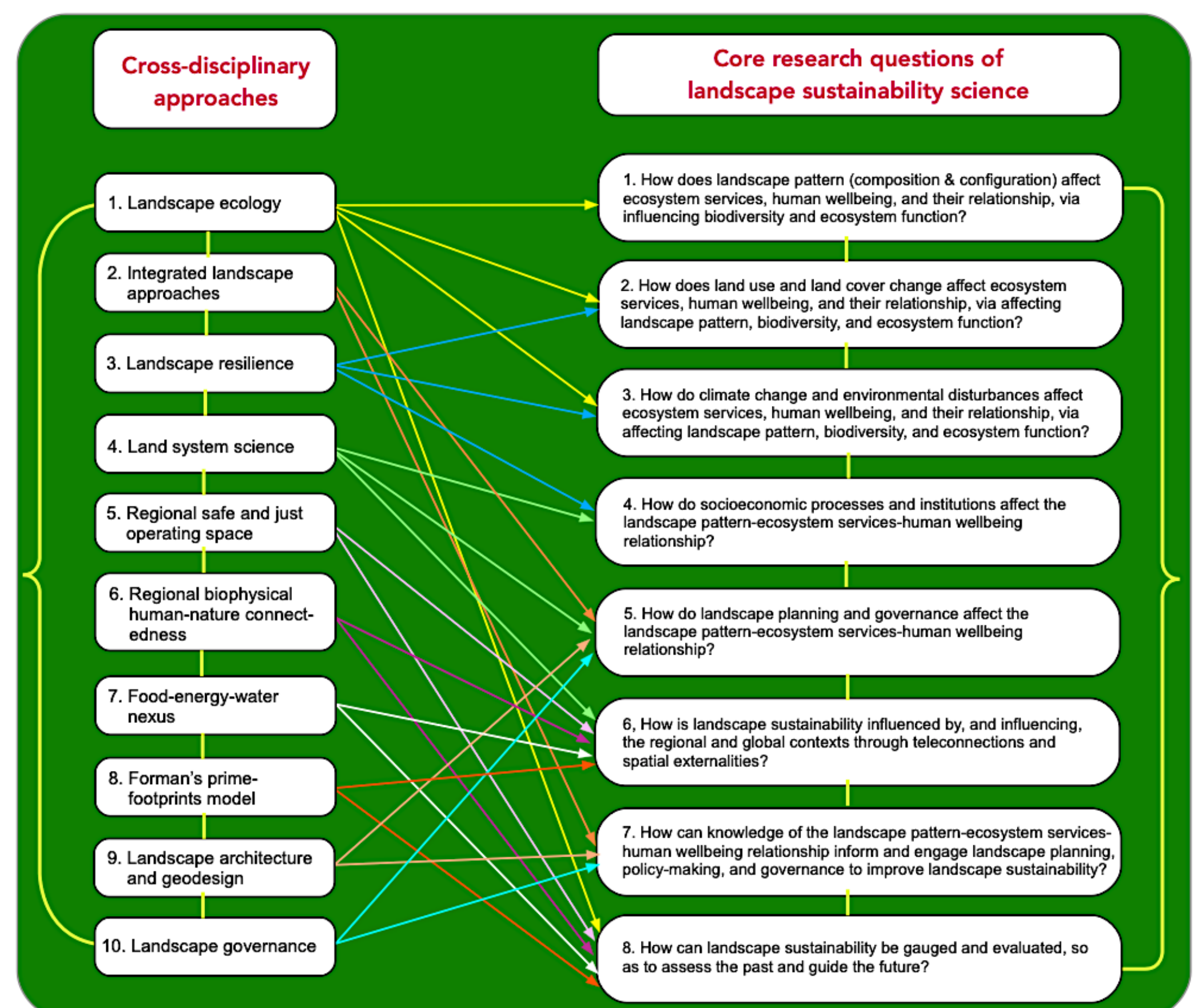
Global scale
Regional scale
Local scale

Wu, J. (2013). Landscape sustainability science: Ecosystem services and human well-being in changing landscapes. Landscape Ecology 28: 999–1023.

At the core of landscape sustainability science is **the landscape pattern-ecosystem services-human wellbeing nexus** that couples urban and rural areas through intrinsic linkages and extensive feedback loops.

Landscape Sustainability Science

Integrated landscape approach — Landscape ecology — Landscape resilience — Land system science — Regional safe and just operating space — Regional biophysical human-nature connectedness — Food-energy-water nexus — Regional prime-footprints — Landscape architecture and geodesign — Landscape governance

Human-Environmental Systems or Social-Ecological Systems
Biodiversity/Ecosystem Function-Ecosystem Services-Human Wellbeing

Cross-disciplinary approaches

1. Landscape ecology
2. Integrated landscape approaches
3. Landscape resilience
4. Land system science
5. Regional safe and just operating space
6. Regional biophysical human-nature connectedness
7. Food-energy-water nexus
8. Forman's prime-footprints model
9. Landscape architecture and geodesign
10. Landscape governance

Core research questions of landscape sustainability science

1. How does landscape pattern (composition & configuration) affect ecosystem services, human wellbeing, and their relationship, via influencing biodiversity and ecosystem function?
2. How does land use and land cover change affect ecosystem services, human wellbeing, and their relationship, via affecting landscape pattern, biodiversity, and ecosystem function?
3. How do climate change and environmental disturbances affect ecosystem services, human wellbeing, and their relationship, via affecting landscape pattern, biodiversity, and ecosystem function?
4. How do socioeconomic processes and institutions affect the landscape pattern-ecosystem services-human wellbeing relationship?
5. How do landscape planning and governance affect the landscape pattern-ecosystem services-human wellbeing relationship?
6. How is landscape sustainability influenced by, and influencing, the regional and global contexts through teleconnections and spatial externalities?
7. How can knowledge of the landscape pattern-ecosystem services-human wellbeing relationship inform and engage landscape planning, policy-making, and governance to improve landscape sustainability?
8. How can landscape sustainability be gauged and evaluated, so as to assess the past and guide the future?

KEY RESEARCH QUESTIONS

The Central Question

What are the spatial signatures, environmental and socioeconomic impacts, and sustainability pathways of urban-rural regional system transitions?

Three specific research questions:

How does urban-rural integration affect landscape pattern (composition and configuration), and are there any spatial signatures?

How does urban-rural integration affect ecosystem services and human wellbeing, particularly via landscape pattern? -- The LP-ES-HWB nexus

How can we optimize landscape pattern to make urban-rural integration more sustainable, particularly via changing and improving landscape governance (institutions and decision making)?

CONCLUSIONS

1. Cities depend on rural areas for basic material needs (e.g., food, water, and energy), while rural areas need cities for economic opportunities and education and health services. Thus, they must be studied together.

2. Although urban ecology has been booming in recent decades, focusing on urban areas without explicit consideration of rural areas is not adequate for sustainability purposes.

3. The landscape sustainability science approach make it explicit that urban-rural regional systems are landscape mosaics that consist of cities, towns, rural areas, human-made infrastructures, and natural ecosystems.

4. At the core of landscape sustainability science is the landscape pattern-ecosystem services–human wellbeing nexus that couples urban and rural areas through intrinsic linkages and extensive feedback loops.

5. Landscape sustainability science does not promote "localization" socially or politically, but it emphasizes both reducing ecological footprints and enhancing ecosystem services from the regional landscape.

6. Urban-rural regional landscapes are inevitably connected to the global context; but if global sustainability is to be achieved, our regional landscapes must be sustained first. **It is not the other way around!**

ACKNOWLEDGMENTS

Any questions?
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