Key Topics in Landscape Ecology

Jianguo (Jingle) Wu

Dean’s Distinguished Professor

School of Life Sciences & Global Institute of Sustainability

Arizona State University, Tempe, AZ 85287

LESL

Prof. Jianguo (Jingle) Wu 邬

Landscape Ecology & Sustainability Lab (LESL)

Arizona State University

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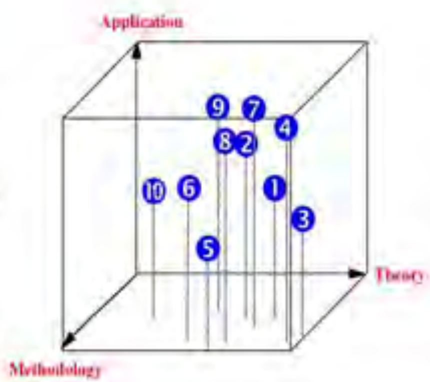
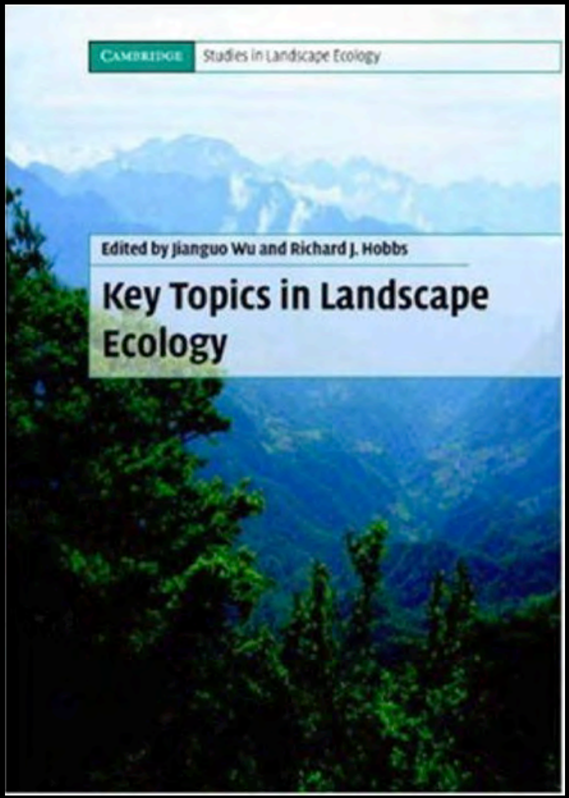
Wu and Hobbs (2002, 2007)

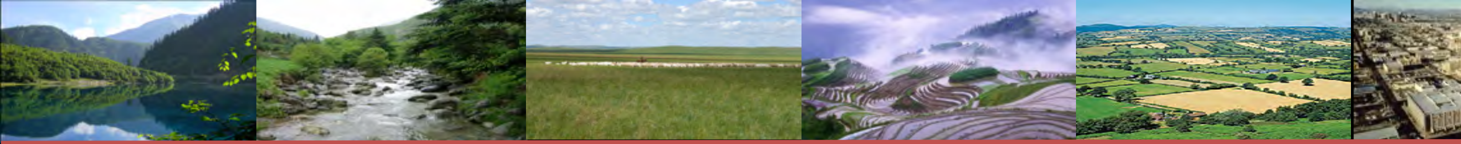
Top 10 Research Topics in Landscape Ecology

Wu, J. & R. Hobbs. 2002. Key issues and research priorities in landscape ecology. Landscape Ecology 17:355-365.

1. Ecological flows in landscape mosaics
2. Causes, processes, and consequences of land use and land cover change
3. Nonlinear dynamics and landscape complexity
4. Scaling
5. Methodological development
6. Relating landscape metrics to ecological processes
7. Integrating humans and their activities into landscape ecology
8. Optimization of landscape pattern
9. Landscape conservation and sustainability
10. Data acquisition and accuracy assessment







Top 10 List

❖ Special Session at US-IALE 2001: Top 10 List for Landscape Ecology in the 21st Century

1	Jack Ahern	9	Tony King
2	Marc Antrop (Belgium)	10	Simon Levin
3	Bill Baker	11	Arthur Lieberman
4	Gary Barrett	12	David Mladenoff
5	Virginia Dale	13	Zev Naveh (Israel)
6	Almo Farina (Italy)	14	Bob O'Neill
7	Richard Forman	15	Monica G. Turner
8	Richard Hobbs (Australia)	16	John Wiens

Landscape Ecology **17:** 355–365, 2002.

Key issues and research priorities in landscape ecology: An idiosyncratic synthesis

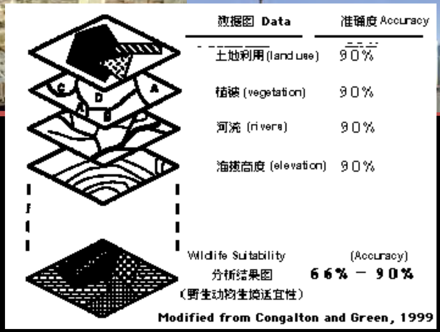
Jianguo Wu[1,*] and Richard Hobbs[2]
*[1]Department of Plant Biology, Arizona State University, Tempe, AZ 85287-1601, USA; [2]School of Environmental Science, Murdoch University, Murdoch, 6150, WA, Australia; *Author for correspondence (e-mail: Jingle.Wu@asu.edu)*

Received 15 November 2001; accepted in revised form 8 February 2002

Key words: Key issues, Landscape ecology, Research priorities and challenges

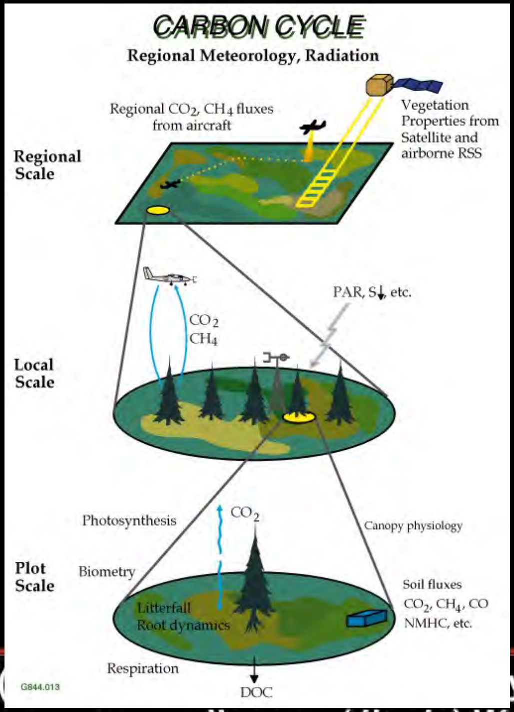
Abstract

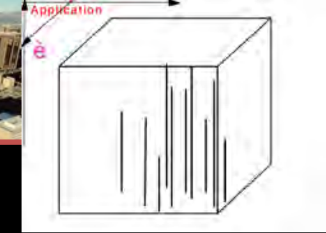
Landscape ecology has made tremendous progress in recent decades, but as a rapidly developing discipline it is faced with new problems and challenges. To identify the key issues and research priorities in landscape ecology, a special session entitled "Top 10 List for Landscape Ecology in the 21st Century" was organized at the 16th Annual Symposium of the US Regional Association of International Association of Landscape Ecology, held at Arizona State University (Tempe, Arizona, USA) during April 25–29, 2001. A group of leading landscape ecologists were invited to present their views. This paper is intended to be a synthesis, but not necessarily a consensus, of the special session. We have organized the diverse and wide-ranging perspectives into six general key issues and 10 priority research topics. The key issues are: (1) interdisciplinarity or transdisciplinarity, (2) inte-



10. Data acquisition and accuracy assessment

- Collection of basic biological data on organisms and species
- Multiple-scale, integrative landscape monitoring programs
- Innovative sampling/statistical methods to avoid problems such as pseudoreplication and spatial autocorrelation
- Metadata, error/uncertainty analysis, and accuracy assessment



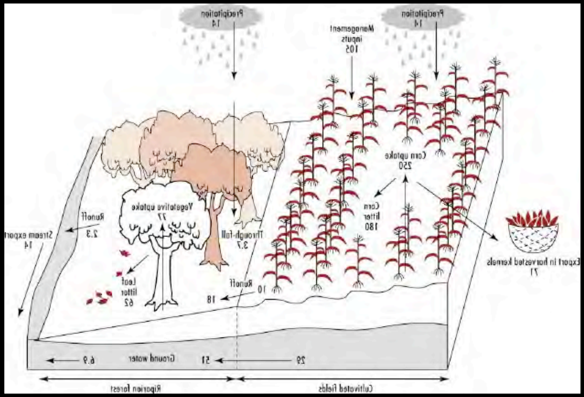


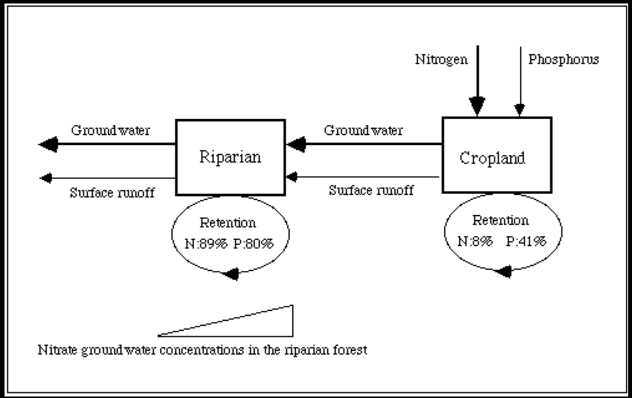
9. Landscape conservation and sustainability

- Specific landscape ecological guidelines for biodiversity conservation
- Comprehensive and operational definition of landscape sustainability, incorporating physical, ecological, socioeconomic, cultural, and political components of the landscape, with explicit expression of scale
- Develop a scientific basis and pragmatic guidelines for valuing ecosystem services of landscapes

8. Optimization of landscape pattern

- Optimization of land use pattern
- Optimal landscape pattern for biodiversity conservation
- Optimal landscape pattern for ecosystem functioning
- Optimal landscape management, and optimal landscape design and planning
- Require theories and methods more than those in traditional operations research (e.g., mathematical programming), as well as interdisciplinary participation





7. Integrating humans and their activities into landscape ecology

- Humans and their activities need to be considered as an integral part of the ecology of landscapes
- A more humanistic perspective
- “Holistic landscape ecology” – a systems view that links natural and human systems

6. Relating landscape metrics to ecological processes

- Behavior of landscape metrics in response to changes in landscape pattern and scale
- Empirical relationships between pattern and process
- Standards for metrics selection and change detection?
- “Vital landscape attributes” for monitoring and predicting landscape changes?
- Holistic metrics that reflect social, cultural, and ecological diversity and heterogeneity?

Landscape Ecology **19:** 389–399, 2004.

Research article

Use and misuse of landscape indices

Harbin Li[1,*] and Jianguo Wu[2]
*[1]USDA Forest Service Southern Research Station, Center for Forested Wetlands Research, 2730 Savannah Highway, Charleston, SC 29414, USA; [2]Faculty of Ecology, Evolution, and Environmental Science, School of Life Sciences, Arizona State University, Tempe, AZ 85287-4501, USA; *Author for correspondence (e-mail: hli@fs.fed.us)*

Received 29 May 2001; accepted in revised form 18 August 2003

Key words: Conceptual flaws, GIS and map data, Landscap

Abstract

Landscape ecology has generated much excitement in the p
tial analysis and modeling to the forefront of ecological r
analysis to improve our understanding and prediction of ec
identified three kinds of critical issues: conceptual flaws i
landscape indices, and improper use of pattern indices. For
description of spatial pattern as an end itself and fail to expl

Landscape Ecology **19:** 125–138, 2004.

Research article

Effects of changing scale on landscape pattern analysis: scaling relations

Jianguo Wu
Landscape Ecology and Modeling Laboratory (LEML), Faculty of Ecology, Evolution, and Environmental Science, School of Life Sciences, Arizona State University, Tempe, AZ 85287-1601, USA; (e-mail: Jingle.Wu@asu.edu)

Received 2 December 2002; accepted in revised form 20 August 2003

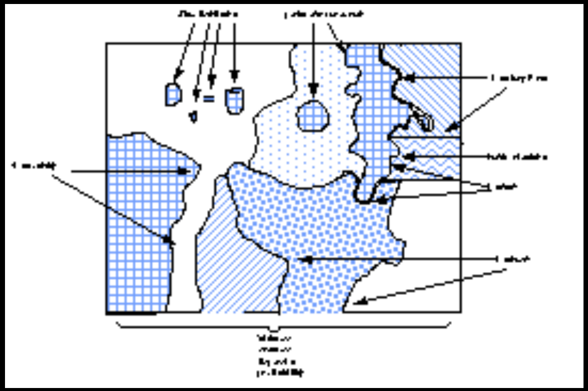
Key words: Landscape metrics, Pattern analysis, Scale effects, Scaling, Scalograms, Grain, Extent

Abstract

Landscape pattern is spatially correlated and scale-dependent. Thus, understanding landscape structure and functioning requires multiscale information, and scaling functions are the most precise and concise way of quantifying multiscale characteristics explicitly. The major objective of this study was to explore if there are any scaling relations for landscape pattern when it is measured over a range of scales (grain size and extent). The results showed that the responses of landscape metrics to changing scale fell into two categories when computed at the

5. Methodological development

- Develop methods that effectively deal with problems of spatial autocorrelation, pseudoreplication, and scale multiplicity in sampling and analysis
- Innovative ways of integrating observation, experimentation, and modeling properly
- Beyond the traditional hypothetico-deductive doctrine

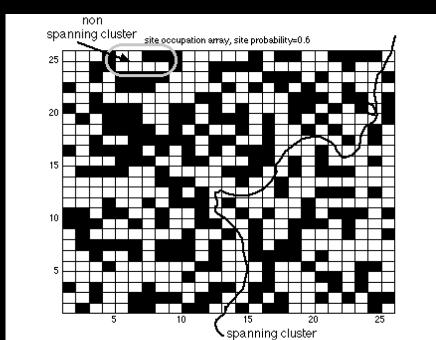


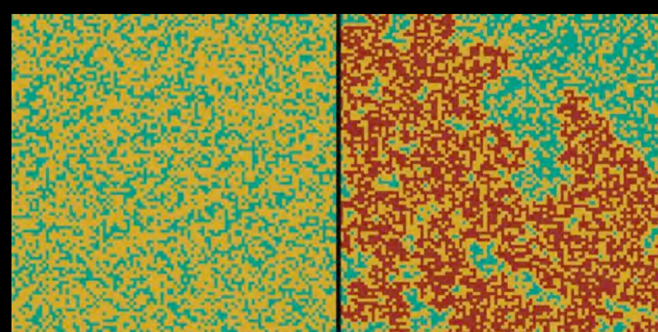
4. Scaling

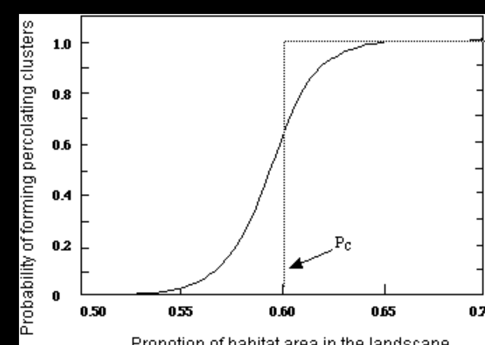
- Scale effects ---> Scaling functions ---> Scaling theory ---> Science of scale
- Develop and test innovative scaling methods
- Integrated approaches combining field measurements, experimental manipulations, remote sensing, GIS, and modeling

3. Nonlinear dynamics and landscape complexity

- **Emphasis on emergent properties, phase transitions, and threshold behavior**
- **Concepts and theories in complexity science, including self-organization, SOC, CAS, nonlinear dynamics, and metastability**

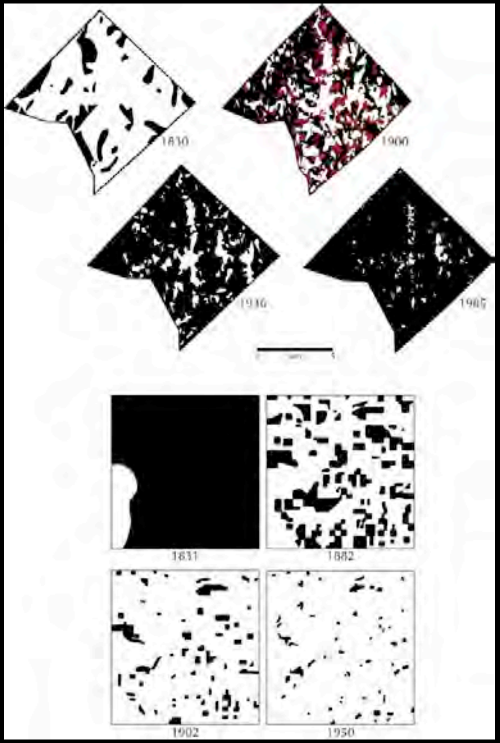






2. Causes, processes, and consequences of land use and land cover change

- Insights from economic geography (how economic activity is spatially distributed) and resource economics (how land is used)
- Long-term changes imposed by economies and climate change, as well as “land use legacies"
- Highly dynamic or chaotic landscapes - unique opportunities?



1. Ecological flows in landscape mosaics

- Develop a better understanding, and a theory, of how organisms, materials, and energy interact with landscape pattern
- Integrating biophysical and socioeconomic processes
- Integrating population, community, and ecosystem ecology into landscape ecology

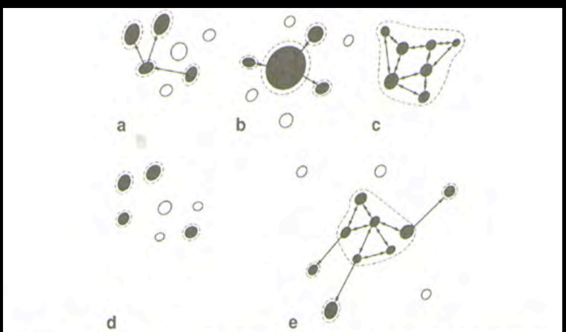
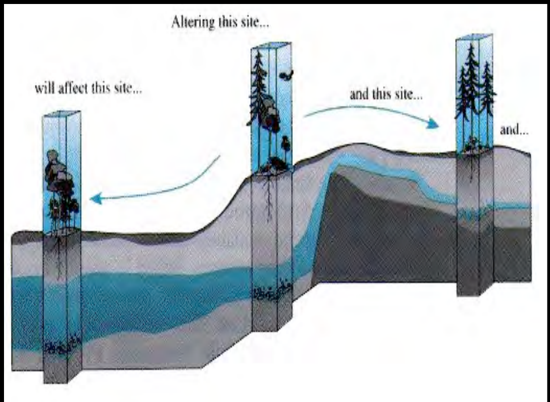


FIGURE 1 Different types of metapopulation. Filled circles, occupied habitat patches; empty circles, vacant habitat patches; dotted lines, boundaries of local populations; arrows, dispersal. (a) Classic (Levins); (b) mainland–island; (c) patchy population; (d) nonequilibrium metapopulation; (e) intermediate case combining features of (a), (b), (c), and (d).



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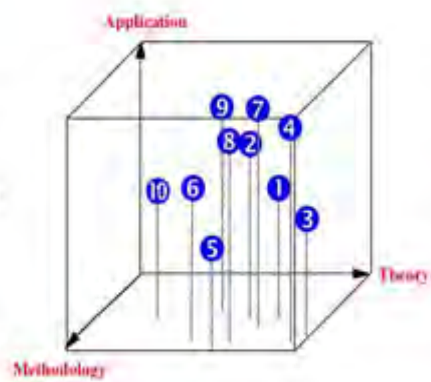
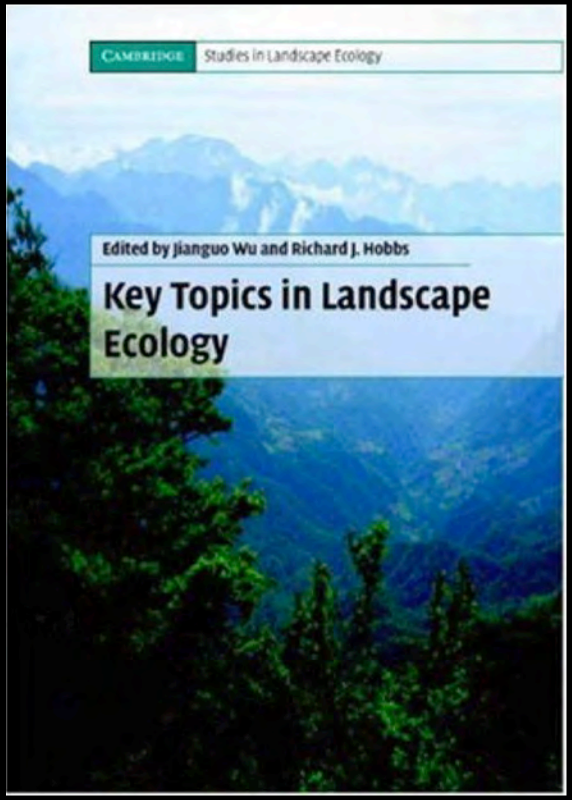




Wu’s Landscape Ecology Top 10 List in 2013

① Pattern-process-scale relationships of landscapes

② Landscape connectivity and fragmentation

③ Scale and scaling

④ Spatial analysis and landscape modeling

⑤ Land use and land cover change

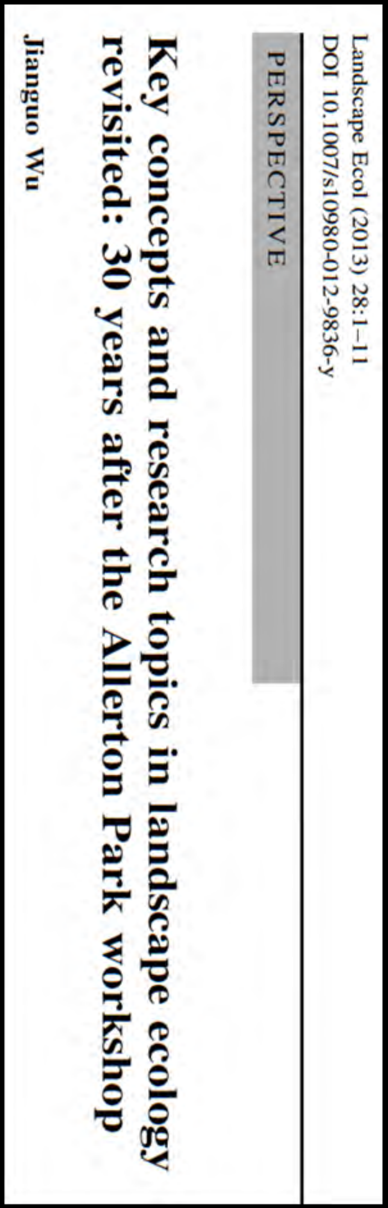
⑥ Landscape history and legacy effects

⑦ Landscape and climate change interactions

⑧ Ecosystem services in changing landscapes

⑨ Landscape sustainability

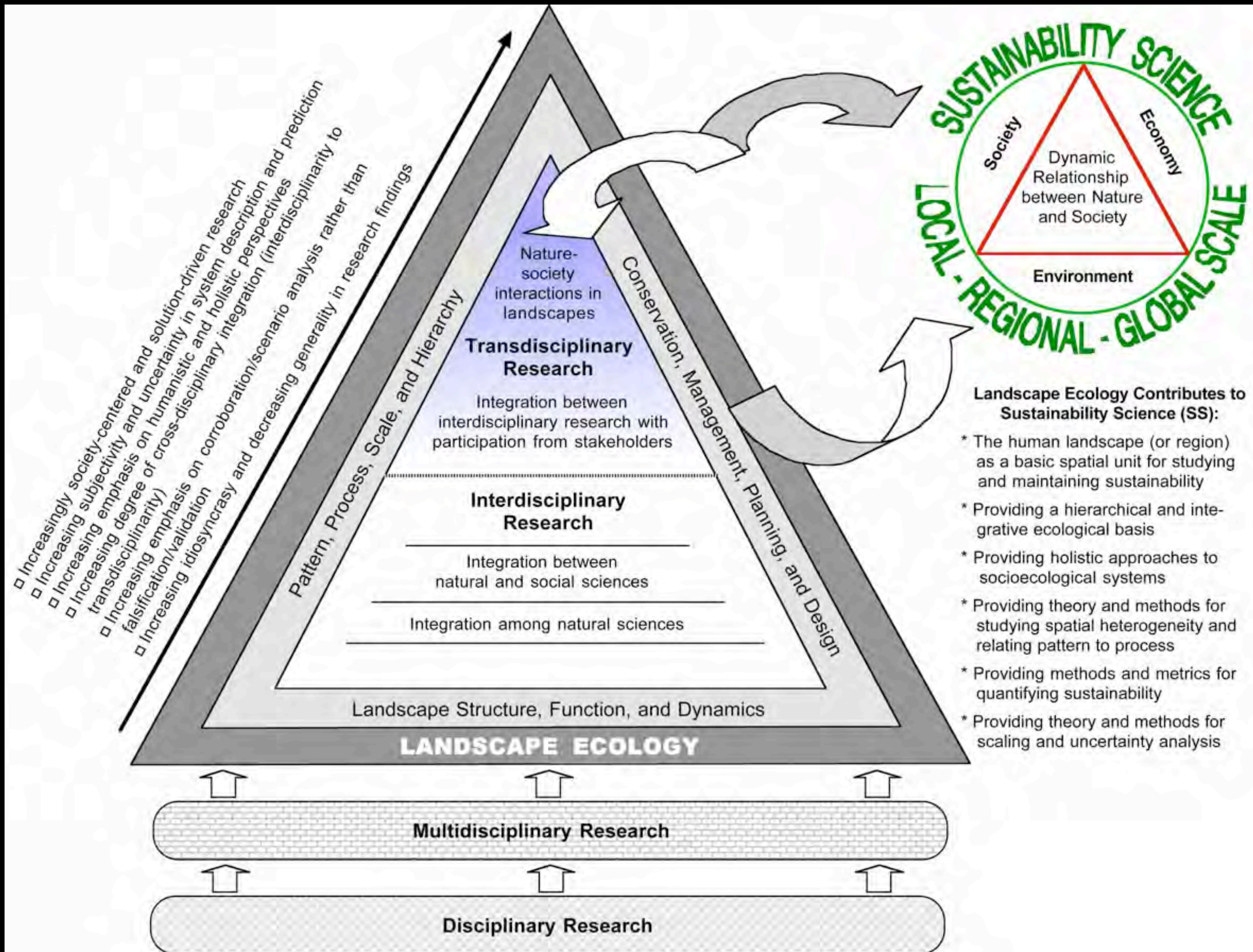
⑩ Accuracy assessment and uncertainty analysis


Landscape Ecol (2013) 28:1–11
DOI 10.1007/s10980-012-9836-y

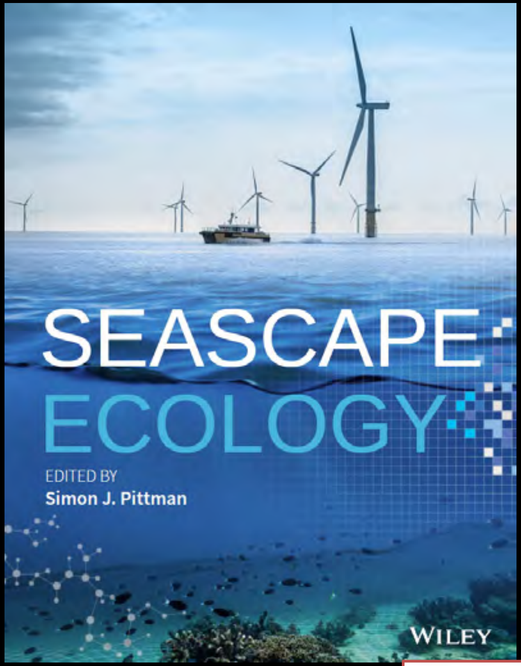
PERSPECTIVE

Key concepts and research topics in landscape ecology revisited: 30 years after the Allerton Park workshop

Jianguo Wu



A Hierarchical Pluralistic Framework for Landscape Ecology and Sustainability (Wu 2006)



16.3 Seascape Ecology and Landscape Ecology: Distinct, Related and Synergistic

By Jianguo Wu

Most ecological theories have been based on terrestrial systems, despite the fact that about 71% of the Earth's surface is covered by water (nearly 96.5% of which is contained in the oceans). With rare exceptions, terrestrial and marine systems were studied separately with little scholarly communication until the 1980s when scientists began to compare and connect them in order to understand the earth as a whole ecosystem (*e.g.*,

Thank You

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