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BOOK REVIEW

F. Kienast, O. Wildi and S. Ghosh. (eds): A changing world, challenges for landscape research

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"A Changing World, Challenges for Landscape Research," edited by Felix Kienast, Otto Wildi, and Sucharita Ghosh, published in Springer's innovative Landscape Series in 2006, includes a collection of contemporary hot topics currently studied by Swiss landscape ecologists. With its long history of human settlement and dense population, European's landscape research includes a strong human component as reflected in this book.

The first section of the book, "Value systems-Major drivers of landscape dynamics," is probably the most interesting and represents a good background on European's perspectives of landscape research. The section includes papers that explore the human dimension in landscape research. Two key ingredients in the quality of life of humans are healthy natural and social environments. The former can be viewed as the ecological fabric of air, water, landforms, fauna and flora that make up the natural setting of people's lives. The latter may be described in terms of attributes of people and the social relationships and processes in which they are involved. From a spatial or geographic perspective, the natural and social environments are united in the concept of landscape—the spatial configuration of abiotic, biotic and anthropogenic elements that materializes as a functional entity serving as humans' environment. While the former has been studied extensively, the latter remains less explored.

The chapters "Value systems: Drivers of human-landscape interactions" and "The role of value systems in biodiversity research" bluntly point out that human value systems are the major drivers of landscape changes. They illustrate that value systems determine "which landscapes are worth preserving and which goods and services of landscapes shall be used or maintained." Value systems are the core components influencing human actions in biodiversity research and conservation. "Space and place" dissects several aspects of the human-landscape relationships. It summarizes theories perceiving landscapes as a physical space, theories perceiving landscapes as a place, and theories that bridges these two aspects together in the context of psychological restoration.

The second section, "Ecological observation and processes," contains a wide range of landscape research, from remote sensing technologies to landscape data sharing, and from dendroclimatology to landscape genetics to landscape permeability. Papers in this section reflect the interdisciplinary nature and wide range of spatial and temporal scales in landscape research. "Modern remote sensing for environmental monitoring of landscape states and trajectories" provides reviews of not only the history and basic principles in remote

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sensing but also discusses contemporary issues such as pattern recognition and the characterization of landscapes as continuous gradients rather than discrete classes that are commonly used. The chapter covers a wide range of topics of applying remote sensing techniques to landscape research and is a good source for someone who needs an overall picture of remote sensing in landscape research.

Modeling and analyzing of temporal and spatial processes in landscapes are based on large amounts of collected data. Landscape researchers face challenges of interoperability, quality, and integration of data from various sources. "A large-scale, long-term view on collecting and sharing landscape data" discusses techniques for efficient and effective data integration, as well as documentation through metadata. The chapter presents an approach for assessing distributed data based on open standards, which is an area that is currently less explored but much needed in landscape research.

"Using the past to understand the present land use and land cover" points out that landscapes are dynamic, time-dependent entities and that current land covers are often legacies of historical land use. The chapter discusses how written and oral information, historical maps and pictures can be used to guide but not dictate future land-use decisions.

"On selected issues and challenges in dendroclimatology" discusses issues in paleoclimatic research. The chapter covers basic theories and techniques of analyzing climatic signals, how to separate temperature and precipitation signals, and how to reconstruct low frequency variations of temperature encapsulated in tree-ring measurements. The chapter shows that proxy data from tree rings are important information for revealing historical climate variation over long temporal and spatial scales.

The core issue of landscape ecology is to understand the relationships of ecological processes and the underlying spatial pattern at various spatial and temporal scales. This issue can be approached from several different angles. "Integrating population genetics with landscape ecology to infer spatio-temporal processes" describes an emerging field that applies molecular techniques to landscape ecological studies. This chapter shows that results from molecular studies at landscape scales may provide insights into the patterns of species migration, dispersal, and gene flow. The field may lead to significant contributions to basic and applied topics such as fragmentation and management of natural ecosystems. "Landscape permeability: from individual dispersal to population persistence" discusses the relationships of landscape connectivity with habitat fragmentation and metapopulation dynamics, two basic paradigms. The chapter uses the example of capercaillie (Tetrao urogallus; Aves; Tetraonidae) to show that the static approach of relating spatial population patterns to landscape structures is limited by the lack of empirical data of dispersal and that the problem can be mitigated by studying dispersal using genetic methods.

Section 3 contains papers of spatial pattern recognition, time series analysis and dynamic modeling. "Identifying and quantifying landscape patterns in space and time" provides an overview of indicators that may be used to quantify landscape patterns. The paper groups landscape indicators into temporally static and dynamic, and spatially discrete and continuous. "Essay on the study of vegetation process" argues that the ultimate goal in vegetation science is a universal prediction theory of vegetation dynamics. The chapter discusses the reoccurring theory of vegetation succession emerging from Clements and individualistic theory of plant association starting from Gleason. The chapter also discusses the methodological developments in analyzing vegetation data over the last half century. The chapter argues that sampling, apart from statistical analysis, is often a question of choice of variables, along with their spatial and temporal scales. To solve this problem, methods accounting for both determinism and randomness are preferred. An emerging conclusion of these two papers is that statistical methods may present a solution to analysis of complex landscapes.

The following two chapters present statistical approaches in landscape research. "Statistical analysis of landscape data: space-for-time, probability surfaces and discovering species" considers a landscape in as a realization of stochastic space–time process, and analysis of landscape data will thus involve statistical techniques for space–time data. The chapter discusses the statistical approaches and their applications for space-for-time substitution, probability and quantile surfaces, self-similarity, and species area curves. "Memory, non-stationarity and trend: analysis of environmental time series" uses observed environmental data to describe statistical approaches that can

be used to analyze trends in seasonal variations in time series, systematic versus random development, long-range dependence, and nonstationarity. The chapter also describes two other statistical approaches, namely wavelets and smoothing quantiles, in great depth. Descriptions of these approaches could have been more beneficial if explanations of the processing results from the sample data were provided.

Extrapolating results from measurements taken at fine, site scales to broad, landscape or even global scales has been an important theme for landscape ecological studies. "Model up-scale landscape research" discusses techniques of up-scale modeling under the framework of hierarchy theory, which leads to formulation of the up-scaling processes containing aggregating source scale variables to target scale variables and deriving the associated target scale model functions. The chapter uses real-world data for examples to illustrate the applicability of the proposed up-scaling techniques. The last chapter of the book, "Dynamic spatio-temporal landscape models" identifies five types of landscape models: static models, dynamic (non-spatial) models, dynamic area models, dynamic regionalized models, and "dynamic regionalized and spatially linked spatio-temporal (SLST)" models. The chapter focuses on the SLST models and uses case studies to illustrate five aspects of applications of the SLST models. They are (1) developing theories, (2) generating and testing hypotheses, (3) scenario analysis, (4) future status projections, and (5) optimization and decision support.

The book contains papers that address frontier research issues as well as reviews of basic concepts and theories of landscape ecology. In general, the papers are of very good quality and the topics are worthy of publication. Section 1 is perhaps the most impressive as it has a rare collection of papers that address how human value systems may affect landscape conservation and research. Section 2 has the most diverse topics that may not be necessarily cohesive, but may be interesting to an individual researcher who needs to fill in the knowledge of a given topic. Section 3 contains the most technical papers that deal with highly advanced issues such as "space-for-time." Examples are plentiful in Sect. 3, but explanations are less than clear. I can recommend this book to both researchers and students in landscape ecology.

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