Erland G. Kolomyts: Experimental Geographical Ecology: Problems and Methods. 705 p. Cambridge Scholars Publishing. Newcastle, 2022. ISBN: 1-5275-8664-2, ISBN 13: 978-1-5275-8664-2. £86.99

Although the polymaths A. v. Humboldt and Ch. Darwin already oftentimes had underlined the interactions between geography and biology, ecology as a discipline, after its introduction by the zoologist E. Haeckel (1866, 1870), and ecology as a term was mainly used by botanists and zoologists, for instance by De Candolle (1855), Grisebach (1872) and Möbius (1877) during the 19th century.

The ecologization of geographical landscape research, called landscape ecology, in the German scientific literature started in the 30s of the 20th century, both with a vertical perspective of site-related biologic-ecological connections and the horizontal perspective of the geographic-ecological order, in combination realised by C. Troll (1939) analysing an air photograph of an East-African savanna landscape. This German landscape ecology was further developed among others by Schmithüsen (1959), Neef (1967), Haase (1967), Leser (1976), Mosimann (1984), Neumeister (1988), Rohdenburg (1991) and others (c.f. Opp 1993, Schreiber & Opp 1999).

Due to limited English and German language skills of the majority of Russian speaking geographers and biologists, these developments of geographical landscape research and landscape ecology took place in the Soviet Union nearly independetly, with exception of a few, but also limited cooperations between Russian and German scientists from the German Democratic Republic.

The effects of limited foreign language knowlege is also still detectable in the reviewed book of Erland Kolomyts. However, because of the English Cambridge publication this „Experimental Geographical Ecology" is a treasure for all physical geographers and landscape ecologists. This is not only, because the reader now has the chance to learn, what and when which progress took place in the experimental geographical ecology research in Russia. Due to the fact that both the former Soviet Union and the today's Russia was and are huge territories, which demand special scientific approaches to combine on-site experiments for the analysis of vertical fluxes between the layers and spheres with the spatial structures and units of zonal up to planetary extentions. For these very complicated tasks Erland Kolomyts has developed tools, empiric-statistical approaches, algorithms and models for the information transfer between different spatial units and an evolutionary model for the paleo and future development of the continental biosphere of Northern Eurasia.

His monograph consists of 17 chapters combined into 7 sections. „The *author's paradigm of experimental geographical ecology* described in these sections is an empirically substantiated, locally ordered, and internally consistent scientific and methodological construction" (from the preface, xxii). The book is a reflection of more than 40 years experimental investigations, discussions and publications of the book author. Erland Kolomytz has put forward and developed the following concepts:

"1) the principles and methodes of discrete empirical-statistical modeling of the spatial organization of different-ordered geo(eco)systems, as well as construction of the predictive models of their climate-genetic transformation;
2) the thesis of geographical ecotones as high priority objects for studying human effects on nature;
3) the numerical methods of regional and local landscape-ecological prediction;
4) the regional paleo-prediction concept (by the example of the Volga River basin) considering the forecast ecological-geographical scenarios and their paleogeographical analoges as a single regional system of global environmental changes; and
5) the topo-ecological prediction concept ‚Global Changes at the Local Level' as a scientific and methodological basis of geosystem monitoring" (from the preface, xxii).

Besides the integration of early Russian approches, given by Dokuchaev (1899), Vysotsky (1909), Berg (1947), Sukachev (1960), Grigorev (1966), Timofeev-Resovsky (1970), Ramenski (1971), Armand (1975), Sochava (1978), Solncev (1981), and Gerasimov (1985) and others, into his own work, Erland Kolomyts always demonstrates theory based and methodology founded approches of a dual landscape organisation with the integration of the different geo-components and the differentiation of the spatial units into their structural levels: local, regional, zonal.

The book author also has included the consideration of kipping points (or points of no return) regarding the global technogenic emissions of greenhouse gases, if the mankind will not follow the Kyoto

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Protocol and the Paris Agreement in his research approach. He compares this situation, in case of not intime following these agreements, with the Great Permian Extinction, when 95% of the living creatures disappeard from the face of the Earth, caused by enormous volcanic outbursts of greenhouse gases to the atmosphere during that late paleozoic period.

Among others, the 17 chapters of the book cover the following key areas:

Chapter 1 describes four stages of landscape-ecologic experiments and the methodology of landscape-ecologic prognosis and paleo-reconstructions.

Chapter 2 demontrates an algorithm of quantitative analysis of mono and polysystem geospace organizations, developed and tested on the regional level using empirical models including complex interconnections.

Chapter 3 discusses geographical zonality as one of the fundamenal principles of Physical Geography and Geoecology, its symmetry analysis of zonal geospace formation and its ecologic principles of geospace formation and its boundaries.

Chaper 4 comprehensively presents the concept of geographical ecotones.

Chapter 5 covers the analysis of small scale natural complexes, so-called „facies", with examples from the Middle Volga ecoregions: the Zhiguli Low Mountain Range and the right bank Sura Region.

Chapter 6 informs about both the use of the factor analysis of forest ecosystems within the boreal ecotone of the Volga River basin, and the polyzonality of local geo(eco)systems as a way of their response to global climate change in dependence on their plain or mountain relief.

Chapter 7 brings into focus landscape-geophysical foundations for geosystem monitoring of the natural environment, such as the edaphic humidty factor and methods of its calculation, and the forest litter factor as an indicator of ecosystem functioning.

Chapter 8 describes biosphere reserves as an object of regional and global geosystem monitoring.

Chapter 9 characterises the organisation of forest ecosystems in the insular volcanic landscapes of the Pacific Northwest.

Chapter 10 introduces the potential of bioproductivity within the system of regional connections, exemplified by the Great Caucasus.

Chapter 11 explains the system of paragenetic sequences of natural complexes, with examples from the orographic ecotone of the Middle Ural Mountains.

Chapter 12 explicates methods of regional geo-ecological prognosis and paleo reconstruction. The author included two stages in the prediction of ecosystem transformations: 1) evaluation of the probabilities of changes in the functional status of the ecosystems; 2) calculations of the rates of ecosystem transformation.

Chapter 13 pinpoints regional prognosis scenarios for mid and end of the 21th century for all natural zones of the Volga River basin, for the landscape structure of the Northern Caucasus mountain and piedmont ecosystems, and for insular-arc volcanic landscapes.

Chapter 14 shows local geo(eco)systems under global climatic change until mid of the 22nd century, with examples from the Volga River basin and the Central Caucasus.

Chapter 15 compares the carbon balance of forest ecosystems under a changing climate using different models for 2075 and 2150 during warming and for 2050 during cooling and 2200 during warming.

Chapter 16 highlights the abilities of ecological resources of boreal forests for mitigating the forthcoming global warming (in accordance with the Paris Agreement on Climate Change), with examples from the Upper and Middle Volga catchment and from Central Caucasus

Chapter 17 illustrates the functional stability of forest ecosystems and its influence on their carbon balance.

The book of Erland Kolomytz is a certain logically ordered ensemble of basic and predictive empiric-statistical models and concepts, such as geoecotone, landscape-zonal polymorphism, paleo reconstruction and forcast, forcast-topological, landscape-evolution, high-mountain geoecological concepts on the basis of experiments within different spatial units. The following methods are described in the book:

- analytic and cartographical methods of empirical-statistical modeling of ecosystems;
- determination of zonal organization of the forest belts of the Russian Plain under a changing climate;
- quantitative methods of regional and local landscape-ecological prognoses and paleo-reconstructions;
- quantitative evaluation methods of functional sustainability of forest ecosystems;
- determinations of the carbon balance in forest ecosystems and biotic regulation of the carbon cycle under global warning.

In the following Russian natural spatial units the verification of the theories and concepts was carried out:

- the Russian Plain
- the biogeographic ecotone of the Volga River basin
- the Oka River Terrace Reserve
- the Great Caucasus
- the Middle Ural Mountains
- the insular-arc volcanic landscape of the Northwest Pacific, including the Southern Kuril Islands and the Lower Amur River catchment.

Those interested in theories, methodologies, and methods of landscape ecological and experimental geographic analyses and the relationships between different spatial units, including the organization of information transfer between these spatial levels, will find interesting research approaches in general and verified results for large-scale examples from Russia.

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Author

Prof. Dr. Christian Opp
ORCHID: 0000-0001-7034-6945
opp@geo.uni-marburg.de
Philipps-Universität Marburg
Department of Geograpy
Deutschhausstr. 10
D-35037 Marburg
Germany