НОВЫЕ МЕТОДЫ И РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЙ ЛАНДШАФТОВ В ЕВРОПЕ, ЦЕНТРАЛЬНОЙ АЗИИ И СИБИРИ

Монография в 5 томах

Том I  Ландшафты в XXI веке: анализ состояния, основные процессы и концепции исследований

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NOVEL METHODS AND RESULTS OF LANDSCAPE RESEARCH IN EUROPE, CENTRAL ASIA AND SIBERIA

Monograph in 5 Volumes

Vol. I Landscapes in the 21th Century: Status Analyses, Basic Processes and Research Concepts

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This monograph shall inform you about up to date methodologies and recent results in landscape research. It is intended as a guide for researchers, teachers, students, decision makers, stakeholders interested in the topic of landscape science and related disciplines. It provides information basis for decision makers at various levels, from local up to international decision bodies, representing the top level of landscape science in a very short form.

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Chapter I/9: CITIZEN AND BIODIVERSITY GOVERNANCE

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ABSTRACT. Biodiversity governance requires relevant biodiversity data and interpretation, policy proposals. Essential Biodiversity Variables are a major concept to identify priorities in regards to these data, how to organize and relate the different kind of biodiversity data. A major type of biodiversity variables to develop to examine and improve human-biodiversity relationships concern ecosystems, where their diversity ought to be related to human livelihoods diversity. In this regard, beyond ‘historical’ and ‘post-modern’ landscapes, ‘ecological’ and ‘post-modern’ landscapes ought to be characterized and promoted, a way to improve biodiversity-society relationships. Finally, the quality of democratic procedures ought to be improved, in regards to i) debates and choices among different biodiversity-society models, landscapes, ii) diversity of options, iii) the number of biological, social and cultural dimensions explored.
INTRODUCTION
Associated to its wide diversity of values, from intrinsic to different types of instrumental values, biodiversity dynamics, hence governance, concerns every citizen, social group. We will consider here two major roles for citizen, in, i) documenting biodiversity state and dynamics, monitoring and averting major biophysical, social and cultural biodiversity dimensions, ii) elaborating new social options where every biodiversity dimension is considered, beyond its immediate uses, like in agriculture or fisheries.

MONITORING BIODIVERSITY
Biodiversity data are especially necessary to relate biological diversity and ecological functions, hence ecosystem services, to document the effect of different human pressures, public policies, on biodiversity. Assessing biodiversity adaptive potential to global change is a growing challenge. It concerns threatened species as well as pests and pathogens, whose adaptation is costly to humans, and also ‘ordinary’ biodiversity whose adaptation is necessary to biodiversity and ecological functions to adapt to global change, avoiding ecosystem disruption. Adaptive management should integrate such adaptation, requiring closer time-scales in regards to observations, to know how biodiversity reacts on short time-scales, to be able to modify management in consequence.
Such needs have to be confronted with observational possibilities, focusing on techniques and human abilities available, including social and environmental costs. To develop monitoring, Biodiversity Observation Networks (BON) build capacities, investigating what should be monitored, identifying observation methods, managing and interpreting data. Observation methods include extensive and intensive monitoring, ecological field studies, and remote sensing [1]. Some methods require rather professionals, whereas other are better performed by citizens, especially extensive monitoring [1,2].

Essential Biodiversity Variables (EBV)
To inventory the biodiversity variables that should be monitored, the concept of EBV considers the different levels of biological organization, scientific disciplines concerned, from the gene to the ecosystem ([3], table 1). EBV classes help to identify entities which are not but should be monitored [1]; the hierarchy between EBV classes, in case of limiting possibilities to monitor biodiversity, being a lagging question. In particular, the species concept is a major tool for biodiversity public policies, represented by the first three EBV classes. However, the higher biological organization levels, communities, ecosystems and landscapes, represented by the following three EBV classes, are also most relevant; ecosystem diversity being an objective in itself in biodiversity preservation, necessary to preserve species diversity, and also ecosystem services (and see below). To hierarchize biodiversity variables to monitor, another difficulty is that many variables can exist for each class. For example, community composition can be described through the number of species, species diversity, weighted by their phylogenetic proximity, and also community abundance, e.g. number of birds [2, 4].
Citizen, as para-taxonomists or para-ecologists, play an important role in BON, documenting especially species-traits and community composition. Monitoring citizens demonstrated major variations of farmland and butterflies communities, in terms of abundance and composition, relative abundance of
specialist species [5]. At the opposite, more classical observations, on species number and diversity, made by professionals, failed to detect changes [6], both results being compatible [4]. Indeed, relating different biodiversity classes dynamics is a major scientific task, to assess contradiction, to get a better image of biodiversity dynamics [4].

Table 1. The 6 different EBV classes, from [3]

<table>
<thead>
<tr>
<th>EBV Class</th>
<th>Major observation techniques</th>
<th>Type of biodiversity assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic variability</td>
<td>Genomics</td>
<td>Adaptation potential of species</td>
</tr>
<tr>
<td>Populations, Species</td>
<td>Citizen extensive monitoring</td>
<td>Species conservation Status</td>
</tr>
<tr>
<td>Species characters</td>
<td>Museum Collections</td>
<td>Ecological functions</td>
</tr>
<tr>
<td>Community Composition</td>
<td>Citizen extensive monitoring</td>
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<tr>
<td>Ecosystem Functions</td>
<td>Intensive monitoring, remote sensing</td>
<td>Ecosystem Services</td>
</tr>
<tr>
<td>Ecosystems Structure</td>
<td>Remote sensing</td>
<td>Landscape quality</td>
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</table>

The case of micro-organisms.
Recent progresses in the characterization of micro-organisms communities are deeply affecting our biodiversity representations. Defined as bacteria, fungi, a large part of the protists, micro-organisms are the majority of living individuals, in terms of number of individuals and probably as number of species [7], thus in terms of diversity, moreover in terms of phylogenetic differences, a trivial result when one considers that micro-organisms diversity is a lot older than plants and animals diversity. Micro-organisms dynamics has been neglected because they were not readily accessible through human senses, visions., although their human importance in terms of diseases, allergies, human uses (making of wine and cheese for example), is fundamental.

The conservation status of most micro-organisms is not available; for the ones which are obligatory host of threatened macro species, the future could be very bleak. At the opposite, some phyla, like toxic cyanobacteria, benefit from human disturbance, proliferating in overexploited and polluted waters. Climate change could also lead to noticeable changes in their relative proportion, for example between diatoms and foraminifers.

Much of their importance for humans could go through the holobiont, the way they interact with macro-organisms, humans and mammals for example being inhabited by several very large communities of micro-organisms, necessary for many physiological functions, our health, accounting for the effect of plant diversity on minimization of allergies, or the beneficial effects of organic agriculture on plant composition [8]. Microorganisms are probably most important for several ecosystems services, an important issue being how to monitor such communities, to make sense of their variation, and moreover how ecosystem management affect microorganisms fate.

Finally, micro-organisms help to mind the gap between the scientific representation of biodiversity and its biological reality, most scientific biodiversity representations barely integrating micro-organisms, although they are the majority, in terms of number of individuals and probably number of species.

DIFFERENT BIODIVERSITY GOVERNANCES, DEPENDING ON HUMAN WORLD-VIEWS
EBV should also be chosen on their ability to represent different human effects on biodiversity, related to livelihood differences.

The relevance of landscapes diversity
In this regard, ecosystems, or anthropo-ecosystems are the most obvious EBV class humans relate with, varying with human practices, independently of any biodiversity preservation conservation programs. In regards to agriculture, the most important human pressure on biodiversity, different agriculture, from ‘intensive’ to ‘organics’, correspond to different ecosystems, associated to different pressures on biodiversity, livelihoods. Being urban or rural also corresponds to different ecosystems, in different dimensions. At the opposite, even when humans have strong ties with certain species –charismatic, domesticated, exploited, noxious…-ecosystem management is always a necessary step to improve relationship with these species. In other terms, direct relations between humans and genes or species are difficult to conceptualize, manage, depending widely on other biodiversity variables, associated to
ecosystems. Moreover, landscapes should be the related unit to consider, human groups interacting with a set of ecosystems, or a landscape, rather than with ONE ecosystem. An additional importance of ecosystems is that they are a level of biological organization to preserve, according to CBD; although a major difficulty has been identifying and recognizing a ‘threatened ecosystem’, a long-standing question for scientific ecology. Besides species red-list, UICN is now developing a ecosystems red-list, criteria for identification and threat level assessment [9].

‘Productionist’ governance: ‘historical’ and ‘modern’ landscapes
In regards to ecosystem diversity, related to human uses, a typology was recently proposed, distinguishing ‘modern’ and ‘historical’ landscapes [10]. That corresponds to the ‘productionist’ perspective [11], human livelihoods being considered only from the ‘production modes’ perspective. ‘Historical’ landscapes are associated to historical low human impact. They are rather populated with anthropophobic species, like large carnivores, having difficulties to coexist with humans. Such species are often threatened, and as a matter of fact need protection. Such objective is usually considered as independent of any utilitarian perspective, of any necessity for humans, except for cultural and ethical needs, although preservation of ecosystem services has been recently proposed as a motive of advocacy for such areas.

‘Modern’ landscapes are the ones heavily used by humans. Production is most important, hence the preservation of ecological functions involved, like soil fertility. The objective is to optimize goods and services production, to decrease their environmental impact. Ecological engineering is a proposed method to improve ecological functioning, exotic and synthetic biodiversity being a possible component, depending on their performances in regards to ecosystem functioning [10]. A technical tool to assess efficiency is attributional –or retrospective- life-cycle analyses (ALCA). Hence, companies goals is to minimize products ALCA. Relevant EBV classes differ for these two ecosystems (Table 2).

<table>
<thead>
<tr>
<th>Landscapes</th>
<th>EBV privileged</th>
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<tbody>
<tr>
<td>Historical</td>
<td>Threatened biological diversity, especially at the species level</td>
</tr>
<tr>
<td>Modern</td>
<td>Ecosystem services (community composition, ecosystem functions and structure), possibly associated to synthetic organisms (GMOS, gene editing…), to maximization of labor productivity, related to landscape uniformity</td>
</tr>
<tr>
<td>Ecological</td>
<td>Biodiversity variables associated to ecosystem resilience, hence to biological and social diversity, where the role of local and/or specialist species is important, the role of micro-organisms (holobionts) is considered. Landscape structural heterogeneity (associated in particular to agro-ecology) Ecological functions (community composition, ecosystem functions and structure), their adaptability (functional and phylogenetic diversity)</td>
</tr>
<tr>
<td>Post-Modern</td>
<td>Biological diversity relevant for social minorities (from cultivated to symbolic species), small farming, peasants</td>
</tr>
</tbody>
</table>

Governing different kind of landscapes
‘Productionist’ governance, minimizing ALCA, has major limits in the absence of any change of lifestyles, due to rebound effects, where products with lower environmental impacts stimulate consumptions, leading to an increase of the overall impact [12]. Consequential LCA (CLCA), or prospective life-cycle analyses, has been proposed to anticipate and reduce possible rebound effects [13]. CLCA require defining the market, how demand and offer are related, and the functional unit, relating production and consumption modes. Indeed, such relationship is strong in the case of food and agriculture, affecting biodiversity [14]. A reason being for example that organic consumers are lower meat consumers; or that production and consumption modes of corn are related [15]. In other words, livelihoods, consumption modes, of citizen, are a critical matter for biodiversity dynamics.

‘Citizen’ governance: ‘ecological’ and ‘post-modern’ landscapes
The citizen perspective indeed considers the relationship between production and consumption modes, their diversity, as a way to improve human-biodiversity relationships, for example, with the ‘slow food’ movement [16]. World-views diversity, helpful to understand environmental controversy [17], can help to identify such diversity of humans-biodiversity relationships. That is ‘modern’ and ‘historical’ ecosystems [10], is a typology corresponding to a ‘modern’ world-view, where natural science and associated techniques are the major tool to improve humans-biodiversity relationships. In the ecological world-view,
where human-nature relationships are considered in their different dimensions, rationalities [18], ‘ecological’ and ‘post-modern’ landscapes can be proposed, using the terminology of De Witt [17]. In ‘ecological’ landscapes, ecosystems and societies resilience is a crucially matter. Local biological and social diversity, landscape structural heterogeneity, the diversity of ecological functions, their adaptability, involving functional and phylogenetic species diversity, have to be maintained. That corresponds in particular to agro-ecology in regards to agriculture, where the primary issue is the use of ecological functions involving local and/or specialists species, to minimize agriculture environmental impacts (Table 2). A corollary might be that human productivity is not any more maximized. Minimizing human ecological foot-print might then be considered as a prerequisite to preserve biodiversity. Ecosystems associated to vegans, low-energy life-styles, including ‘transition towns’, might be good examples.

‘Post-modern’ landscapes are seen through the primacy of social issues, especially social minorities. The idea is that social uses of biodiversity, ecosystems, hence environmental questions, priorities and urgencies, vary with social groups. That concerns in particular farmers, leading to proposals to favor small farming, ‘peasant’ agriculture, corresponding to a certain kind of agriculture, based on agro-ecology, organics. Such perspective concerns a large majority of farmers, probably more than 90 % of the farmers in the planet, based primarily in Asia and Africa [19]. The way they manage biodiversity, what matters to them, for example in regards to biological control, becomes a central issue to prioritize EBV to monitor.

Finally, the objective will be to assess ‘real’ ecosystems in regards to these different world-views, their potential to correspond more closely to one of these world-views, more importantly to compare their potential as such to better respond to human aspirations and to preserve biodiversity, to avoid contradictions between these two objectives.

CONCLUSIONS

1. Building citizen capacities in regards to biodiversity, in terms of information and objectives
2. Taking into account the way different citizen, stake-holders relate to biodiversity, citizens having a critical role in terms of expertise capacity, scrutinizing public policies.
3. Improving the quality of democratic procedures in regards to biodiversity policies. Avoiding to develop policies independently of the regard of citizens, being internalized among sectorial actors.
4. Proposing a diversity of options, each taking into account many social and biological dimensions, beyond wealth, health, quality of life, integrating all central capabilities [20].

REFERENCES

Chapter I/10: SOILS AS WITNESSES OF WARS: AN OVERWIEW AND FURTHER RESEARCH NEEDS

Глава I/10: Почвы как свидетели войны: обзор и дальнейшие исследования

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ABSTRACT. Wars and the military use of landscapes have influenced and changed the soils at all times to varying extents. World War I (WWI) at the latest indicates the beginning of the age of „technical warfare“. Technical warfare has led and leads to severe impacts on the landscape and therefore on the soils. For a long time the legacies of these military and warfare activities were primarily a realm of archaeologists and historians. But activities like digging field fortifications, the impact of explosives or chemical and radio-nuclear contamination lead to non-reversible changes of soils. Such war-influenced soils can therefore be classified as archive soils, which can be used to illustrate the catastrophic impact of mankind to human civilisations and to soils. From the authors’ point of view there is a strong need for more research into these often „forgotten“ influence factor on soils, which affected landscapes especially in Europe and Asia at a scale of tens to hundreds, in some places of up to many thousand square kilometers.

Резюме. После войн, а также после использования местности в военных целях, почвы различаются по степени деструкции и изменения почвенных горизонтов. Начиная с Первой мировой войны, хронологически возрастающие «Технические войны» оказали сильное воздействие на ландшафт и, следовательно, на почву. Долгое время наследие всех военных действий было, прежде всего, сферой исследований археологов и историков. Но такие виды деятельности, как строительство полевых укреплений, воздействие взрывчатых веществ или химическое и радиоактивное загрязнение, приводят к необратимым изменениям почв. Поэтому такие почвы, подверженные влиянию войны, могут быть классифицированы как архивные почвы, и которые могут быть использованы для иллюстрации катастрофического воздействия человечества и цивилизации на почвы. С точки зрения авторов, существует настоятельная потребность в более широком изучении этого часто забываемого фактора воздействия на почву, который затрагивает ландшафты, особенно в Европе и Азии, в масштабах от десятков до сотен, в некоторых местах до многих тысяч квадратных километров.