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Foreword

This special issue is based on the conference "Biodiversity facing human activities" organised at the Academy of Sciences, Paris, in February 2010[1]. The impact of Human activities on biodiversity and the many services it provides to human societies are now widely recognized, and such a conference during the "International year of Biodiversity" seemed timely.

The special issue provides a deeper and more permanent review of the subject, based on contributions from the conference speakers and further selected contributors. It contains sixteen articles from which two key ideas emerge: first, the diversity of life is a dynamic process, and we need to better understand the mechanisms that create and maintain biodiversity; second, a diversity of approaches is necessary to understand these mechanisms and, in turn, to help alleviate the impacts of human activities on biodiversity. These two key ideas appear in the introductory and concluding papers [1,2] as well as in the other papers addressing biodiversity in the contexts of populations [3], dynamics of communities, i.e. local assemblages of different biological species [4–7], ecosystem function [8,9], conservation and restoration [10–12], and ecosystem services [13–15].

In an introduction, Robert M. May sets the stage for the other articles, discussing how little we know about the number of distinct eukaryotic species alive on the earth today, and outlining practical and ethical reasons to be concerned about current rates of extinction [1].

Gilles Escarguel, Emmanuel Fara, Arnaud Brayard and Serge Legendre [16] appeal for a spatially integrated study of biodiversity dynamics at an evolutionary timescale. They remind us that in a physically heterogeneous and ever changing world, fluctuation in biodiversity is the rule–not the exception. Change in patterns and processes of diversity varies among spatial integration levels, with new and unpredictable effects arising at each level, thereby making direct extrapolation from one level to another irrelevant and indeed impossible.

Jean-Dominique Lebreton [3] reviews the impact of human activities on terrestrial vertebrates. The current general decrease of many vertebrate populations, together with the spread of habitat loss and fragmentation, and the explosion of local extinctions are obvious signs of an already ongoing vertebrate crisis. Accepting vertebrates as sentinels of Man's impact on the biosphere should encourage a focus on their protection, even if their role is sometimes judged secondary in ecological mechanisms and ecosystem services.

Denis Couvet, Vincent Devictor, Frédéric Jiguet and Romain Julliard [4] examine the advantages of extensively monitoring fine-grained spatial variations of biodiversity. This is accomplished by programmes in which the prominent traits of many species within a community are regularly recorded at numerous sites over a large territory. Major scientific achievements have taken place as a result of extensive monitoring programmes, from documenting species and community patterns to testing hypotheses on the effects of global change. Coordinating observations and modelling should induce significant progress in biodiversity forecasting based on an understanding of the relationship between biological diversity, ecosystem properties and human pressures and thereby aid in developing adequate scenarios.

Yvon Le Maho, Claire Saraux, Joël M. Durant, Vincent A. Viblanc, Michel Gauthier-Clerc, Nigel G. Yoccoz, Nils C. Stenseth, and Céline Le Bohec [5] recall that animals can be tracked by a variety of ecological, behavioural and physiological techniques. However, these authors provide detailed evidence of the detrimental impact of flipper banding on penguins, resulting in prolonged foraging trips, in a lower survival, and a lower breeding success. This detrimental impact induces scientific biases and has obvious ethical implications. The authors suggest to reanalyse data on the breeding success and survival of penguins based on banded birds and to develop technical innovations for using radiofrequency identification.

[1] With the support of the CNRS (Centre National de la Recherche Scientifique) and the FRB (Fondation pour la Recherche sur la Biodiversité). See http://www.academie-sciences.fr/video/v090210.htm.

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Benjamin Roche and Jean-François Guégan [6] review zoonotic infections with vector-borne transmission. They then discuss the effects exerted by host and vector species richness and composition on pathogen prevalence. They emphasize that different epidemiological and ecological outcomes for a same disease can occur in different places, the role of biological diversity and its heterogeneity in space and time being an important and probably missing ingredient in understanding emerging infectious diseases.

The contributions by Le Maho et al. and Roche and Guégan are among those that provide examples of complex interactions that have to be accounted for in the development of scenarios for biodiversity: biological interactions such as those between multiple pathogens and complex host systems, as well as interactions of the biological systems under study with the observer or experimenter, as in the case of penguins.

Stephan Hättenschwiler, Nathalie Fromin and Sandra Barantal [7] argue that one of the biggest challenges for functional approaches to microbial diversity is how to define the functional diversity of microbes. Recent developments in microarray and metagenomics technology offer promising possibilities to assess the functional structure of microbial communities. If successful, these developments may allow significant progress and ultimately improve our ability to predict the consequences of biodiversity loss in fundamentally important microbial (e.g., decomposer) systems.

Pierre-Alain Maron, Christophe Mougel and Lionel Ranjard [8] survey the development of molecular tools, which makes it possible to investigate the diversity of soil microorganisms. They emphasize the need for integrating spatial upscaling into studies of soil microbial ecology to improve our knowledge of the large-scale determinism of microbial community assembly, and describe a methodological strategy linking soil biodiversity with ecosystem services. An ultimate objective would be to produce large-scale maps (territory, region, landscape...) of the capacity of soils to perform ecosystem processes/services as a function of microbial diversity.

Concerning the latter two papers, it is clear that soil microbial functional biodiversity is of key relevance for forests and agrosystems, as well as for all terrestrial and semi-aquatic parts of the earth, of which major functions such as decomposition and nutrient recycling are under the control of soil microorganisms.

The next two articles consider an even higher spatial level of integration of ecological mechanisms, at the landscape and regional scales where specific interactions with human activities must be considered.

John D. Thompson, Raphaël Mathevet, Olivia Delanoë, Chantal Gil-Fourrier, Marie Bonnin and Marc Cheylan [9] propose "ecological solidarity" as a conceptual tool for rethinking ecological and social interdependence in conservation policy for protected areas and their surrounding landscape. A key issue underlying ecological solidarity is the reciprocal interdependence of ecological interactions – including human activities–and the social and institutional dimensions associated with a willingness to preserve and respect nature. The authors argue that this concept provides an imaginative step toward consolidating ecological and social interdependence in biodiversity policy that goes beyond statutory park boundaries.

Henri Décamps [10] considers river networks as "hot lines" for sharing water between ecological and societal systems, as well as for preserving both systems in the face of global change. Due to their linear structure, river networks require specific strategies for preservation of their biodiversity, which is illustrated by issues such as risks of species extinction, barriers to migration, hybridization, and biotic homogenization of rivers, as well as the future of river networks in a changing climate and the ability to maintain human security along rivers.

Gilles Boeuf [11] reminds us that life emerged in the ancestral ocean, and that the present time ocean shelters many ancient *phyla*, but not many species, and a huge biomass. Specific diversity, associated with original anatomical and biochemical organizations and behaviours, have made marine organisms excellent reservoirs for identifying and extracting molecules for pharmacological or cosmetic use (currently over 15,000) and/or to build especially relevant models for both fundamental and applied research.

Pénélope Lamarque, Fabien Quétier and Sandra Lavorel [12] highlight the implication of terminological diversity around the ecosystem services concept. They review the general terminology that has gained acceptance in the environmental literature, with a specific focus on the diversity of meanings and approaches that have been applied for the use of the ecosystem services concept in the recent literature. They illustrate the implications of such definition choices for a case study aimed at quantifying ecosystem services provided by mountain grasslands. They discuss the implications of using of such diverse definitions for scientific and operational purposes within the ecosystem services concept.

Yves Vigouroux, Adeline Barnaud, Nora Scarcelli and Anne-Céline Thuillet [13] analyze how the diversity found in a cultivated crop is continuously shaped by demographic and selection processes. They illustrate the process of shaping crop biodiversity by Man with a detailed analysis of the domestication and early diffusion of maize. They also review some examples on how humans still largely impact crop diversity today, particularly in smallholder agricultural systems, and show that selection is also acting today, with the example of an adaptive response of pearl millet to climate variation in western Africa.

Jérome Enjalbert, Julie C. Dawson, Sophie Paillard, Bénédicte Rhoné, Yves Rousselle, MathieuThomas and Isabelle Goldringer [14] analyse two examples of dynamic biodiversity management in agricultural settings. One is a strategy for *in situ* conservation of reservoirs of genetic variability in order to maintain the context in which evolutionary forces can act on genetically diverse cultivated populations. Another example is dynamic management of genetic resources which gives farmers a role in the evolution of the cultivated species and deserves a better integration in the formal seed production system.

This line of research in the latter two articles obviously raises questions and provides ideas for struggling against the homogenization of biodiversity currently inherent in the most intensive agricultural systems of the western world.

Jean-Michel Salles [15] addresses the issue of the evaluation of ecosystems and biodiversity by revisiting a number of basic biodiversity-related issues. He considers the economic qualification of services that human societies receive from nature, the specificities of their contributions to human well-being, and the consequences of a valuation of biodiversity based on ecosystem services. He discusses whether the purpose of evaluations is improving public policies or creating new markets, and reminds us that valuation is not a solution or an end in itself, but firstly a conceptual and methodological framework for organizing information as a guide for decision-making. Ecosystem services valuation would remain meaningless if it did not help to make better practical choices and actions.

In a concluding paper, Robert Barbault [2] emphasizes the ability of structures and institutions managing the environment and the species to complete the academic research potential. The moment has come for the priority conferred on "biodiversity" to move from the well-meaning *verbal* priority to a *veritable decisive* priority i.e. one with *funding*.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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References

[1] R.M. May, Why should we be concerned about loss of biodiversity? C. R. Biol. 334 (2011) 346–350.
[2] R. Barbault, A new beginning for biodiversity? C. R. Biol. 334 (2011) 483–488.
[3] J.D. Lebreton, The impact of global change on terrestrial vertebrates, C. R. Biol. 334 (2011) 360–369.
[4] D. Couvet, V. Devictor, F. Jiguet, R. Julliard, Extensive monitoring of biodiversity: contributions to macro-ecology and community ecology, C. R. Biol. 334 (2011) 370–377.
[5] Y. Le Maho, C. Saraux, J.M. Durant, V.A. Viblanc, M. Gauthier-Clerc, N.G. Yoccoz, N.C. Stenseth, C. Le Bohec, An ethical issue in biodiversity science: the monitoring of penguins with flipper-bands, C. R. Biol. 334 (2011) 378–384.
[6] B. Roche, J.F. Guégan, Ecosystem dynamics, biological diversity and emerging infectious diseases, C. R. Biol. 334 (2011) 385–392.
[7] S. Hättenschwiler, N. Fromin, S. Barantal, Functional diversity of terrestrial microbial decomposers and their substrates, C. R. Biol. 334 (2011) 393–402.
[8] P.A. Maron, C. Mougel, L. Ranjard, Soil microbial diversity: methodological strategy, spatial overview and functional interest, C. R. Biol. 334 (2011) 403–411.
[9] J.D. Thompson, R. Mathevet, O. Delanoë, C. Gil-Fourrier, M. Bonnin, M. Cheylan, Ecological solidarity as a conceptual tool for rethinking ecological and social interdependence in conservation policy for protected areas and their surrounding landscape, C. R. Biol. 334 (2011) 412–419.
[10] H. Décamps, River system networks as biodiversity hot lines, C. R. Biol. 334 (2011) 420–434.
[11] G. Boeuf, Marine biodiversity characteristics, C. R. Biol. 334 (2011) 435–440.
[12] P. Lamarque, F. Quétier, S. Lavorel, The diversity of the ecosystem services concept and its implications for their assessment and management, C. R. Biol. 334 (2011) 441–449.
[13] Y Vigouroux, A. Barnaud, N. Scarcelli, A.C. Thuillet, Biodiversity, evolution and adaptation of cultivated crops, C. R. Biol. 334 (2011) 450–457.
[14] J. Enjalbert, J.C. Dawson, S. Paillard, B. Rhoné, Y. Rousselle, M. Thomas, I. Goldringer, Dynamic management of crop diversity: from an experimental approach to on-farm conservation, C. R. Biol. 334 (2011) 458–468.
[15] J.M. Salles, Valuing biodiversity and ecosystem services: why put economic values on Nature? C. R. Biol. 334 (2011) 469–482.
[16] G. Escarguel, E. Fara, A. Brayard, S. Legendre, Biodiversity is not (and never has been) a bed of roses! C. R. Biol. 334 (2011) 351–359.

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