Revista Chilena de Historia Natural
61: 155-158, 1988

COMMENTARY

On the theory and practice of Conservation Biology: a comment on Marone's paper

Sobre la teoría y la práctica de la biología de la conservación: un comentario sobre el artículo de Marone

JAVIER A. SIMONETTI

Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile,
Casilla 653, Santiago, Chile

ABSTRACT

The presumed reliance of modern conservation biology on equilibrium and deterministic models is criticized. Ecology has contributed with both equilibrium and nonequilibrium theories and approaches to conservation biology. Conservation biology does not pursue the restoration or maintenance of ecological equilibria. The use of equilibrium models is related to the nature of the decision-making process in disciplines that deal with human issues, not to the uncritical acceptance of deterministic dictums.

Key words: Conservation, equilibrium, decision-making.

RESUMEN

Este trabajo critica la supuesta dependencia de la biología de la conservación moderna, de modelos deterministas y de equilibrio. La ecología ha contribuido con teorías y enfoques basados tanto en sistemas en equilibrio como sin equilibrio. La conservación biológica, de hecho no persigue restaurar ni mantener equilibrios ecológicos. El uso de modelos deterministas se interpreta como resultado de la naturaleza del proceso de toma de decisiones en disciplinas donde el bienestar de las poblaciones humanas está involucrado, y no como aceptación ciega de dichos modelos.

Palabras clave: Conservación, equilibrio, toma de decisiones.

INTRODUCTION

Recently, Marone (1988) has characterized conservation biology as applied biology, relying blindly on ecological concepts of equilibrium, and focusing on the restoration and preservation of such equilibrium. In my opinion, that view is narrow when compared to the actual status of conservation biology as a discipline and as an endeavor.

Conservation biology is an emerging, synthetic and crisis-oriented discipline, aimed toward the development of "principles and tools for preserving biological diversity" (Soulé 1985: 727). The conservation of living resources has, by itself, three goals, namely "to maintain essential ecological processes and life-support systems, to preserve genetic diversity [and], to ensure the sustainable utilization of species and ecosystems" (IUCN *et al.* 1980: vi). Therefore, the discipline of conservation biology does not focus on the maintenance or restoration of ecological equilibria. Further, the conservation of living resources is related to social issues to a higher degree than Marone (1988) has recently pointed out. Conservation is regarded as a tool for development, by ensuring sustainable benefits for human populations through the use of wild species (IUCN *et al.* 1980).

The review of conservation biology by Marone (1988) includes at least two misconceptions regarding the nature and status of the discipline. The first one refers to the assumed reliance on equilibrium models. The second misconception refers to the origin of the discrepancies between the theory and practice of conservation biology. According to Marone (1988), while theoretical ecology accepts a nonequilibrum view

(Received 20 October 1988. Accepted 5 December 1988).

of ecological systems, practitioners of conservation biology are still attached to old views regarding a perfectly ordered, equilibrium world. Here, I put forth that modern conservation biology is on better grounds than Marone (1988) suggests.

Dogmas in the theory of conservation

Conservation biology, according to Marone (1988), is tied to deterministic models borrowed from ecology, irresponsive to the debate regarding the equilibrium-nonequilibrium nature of ecological systems. Marone (1988) neglects the point that the equilibrium versus nonequilibrium debate is not the right issue in contemporary ecology (Berryman 1987). Such a dichotomy is false in ecology and, by extension, in conservation biology. Single, multiple and non-equilibrium points should be viewed as a property emerging under a given set of conditions, not as a unique and intrinsic property of ecological systems (*e.g.*, May 1977, Wiens 1984, De Angelis & Waterhouse 1987). Similarly, rather than debating the role of a given biotic interaction in shaping ecological communities, the "one or the other" approach has been superseded by the analysis of the conditions under which a given interaction or set of interactions has relatively higher importance (*e.g.*, Lubchenco 1986). Therefore, the theoretical scenario is not as chaotic as Marone (1988) depicts.

Undoubtedly, some approaches in conservation biology have relied on equilibrium models, such as the pioneering attempts to apply the theory of island biogeography to the design of nature reserves (*e.g.*, Terborgh 1975, Wilson & Willis 1975, Diamond & May 1976). Single large reserves were recommended as optimal over several small ones, in order to maximize species diversity within reserves. The immediate debate that sprung around this suggestion contradicts Marone's (1988) claim regarding the uncritical acceptance of deterministic dictums in conservation biology. Criticisms indicated that the equilibrium theory of island biogeography was neutral regarding the diversity accomplished with reserves of different sizes (see Simberloff & Abele 1982, Soulé & Simberloff 1986, for a summary of the debate). Further, even the presumed perfect analogy between nature reserves and islands has been questioned. The nature of "island" depends on the organisms involved (Janzen 1983, 1986a).

Further, and more importantly, several issues related to nonequilibrium communities, such as their spatial and temporal dynamics, have been addressed by ecologists and have direct bearing on conservation biology (*e.g.*, Pickett & Thompson 1978, White & Bratton 1980, Niering 1987). Special attention has been devoted to the role of disturbance in creating and maintaining habitat heterogeneity, and its impact upon population demography and species diversity (*e.g.*, Foster 1980). In fact, the need to conserve changing ecosystems has been recognized as paradoxical (White & Bratton 1980). Practical recommendations have been advanced on these grounds: Reserves should be large enough to encompass a " "minimum dynamic area", the smallest area with a natural disturbance regime which maintains internal recolonization sources and hence minimizes extinction" (Pickett & Thompson 1978: 27).

The role of stochastic events upon the demography and probability of extinction of endangered species has recently received attention, from both theoretical and practical grounds (Leigh 1981, Soulé 1986a, Verner *et al.* 1986 among others). These analyses have aided in the determination of the size of the "minimum viable population", which in turns translates into the amount of area that needs to be preserved in order to ensure the long term survival of a given population (Frankel & Soulé 1981, Soulé & Simberloff 1986, Soulé 1986a for a review). Stochasticity is regarded as a key factor when assessing minimum population size for conservation purposes (*e.g.*, Samson *et al.* 1985, Shaffer & Samson 1985).

Clearly, the two examples cited above demonstrate that modern conservation biology is not relying exclusively on equilibrium models. The use of such models does not owe to the uncritical acceptance of equilibrium theories. It only reflects the framework in which conservation biology is operating. Societal demands for effective managerial plans are pressing. Little time is available for refinement prior to theory application. Action then must be taken based on available theory and data (Diamond & May 1985, Soulé 1986b). Testing and reformulation must be accomplished in parallel to implementation. For example, the equilibrium theory of island biogeography has offered a starting point for challenging views on practical issues such as the conservation of biotic diversity in exploited forests (*e.g.*, Harris 1984, Verner *et al.* 1986; see also Janzen 1988a).

Dogmas in the practice of conservation

The second of Marone's (1988) misconceptions is related to the social nature of conservation biology. According to Marone (1988), the discrepancies between theory and actual practice of conservation biology lie in the dogmatism demonstrated by the administrative personnel, that remain attached to obsolete ideas regarding the prevalence of an equilibrium world. Although the ideas of ecological equilibrium are indeed deeply rooted in western thought (Worster 1977), the eventual discrepancies between theory and practice, in my opinion, may have an additional source: conservation *is* a social issue.

For Marone (1988), the conservation of living resources, although dependent of social and economical issues, is largely applied biology. By definition it is not. To the conservation of living resources, disciplines other than biology concur, such as philosophy, economy, law, and sociology. In this multidisciplinary approach to conservation biology lies its synthetic nature (Soulé 1985). Further, the final goal of the conservation of living resources is human welfare *via* the long term survival of species and functioning of ecological systems (Leopold 1949, Ehrenfeld 1970, McNeely & Miller 1984). Conservation of living resources is regarded as a prerequisite for development, hence as a condition to satisfy human needs and improve human welfare (IUCN *et al.* 1980).

In social sciences, or in any discipline where human issues are at stake, the decision-making process differs profoundly from that in the natural sciences. Decisions are based on the best guess that is backed by available information. Due to the provisional validity of the scientific and technical knowledge available, the consequences are not always predictable. However, no action at all may be worse than an action based on questionable theories (Hayek 1979, Weber 1980). This is certainly the case of conservation biology, where decisions must be made regardless of how confident scientists are about their current theories (Soulé 1986b). As such, the adoption of the theory of island biogeography in the World Conservation Strategy (UICN *et al.* 1980) does not imply the acceptance of the theory and underlying assumptions, but simply the need to use the available theoretical framework in order to prevent the dismal extinction of species that hampers the survival of the human species itself.

Further, in the practice of conservation, decisions are not only based on scientific knowledge. Ecological theory and experience is necessary but not sufficient to determine the rationale for species conservation (*e.g.*, Middleton & Merriam 1985). In fact, trade-offs are to be expected between scientifically sound (read provisionally valid) and socially acceptable practices. The joint contributions of natural and social sciences are required to launch and carry on conservation programs if both species are to be saved from extinction, and human needs satisfied. In fact, cultural and social perceptions are key factors in conservation, and should be considered in any managerial attempt (*e.g.*, Ehrenfeld 1981, McNeely & Miller 1984, Kellert 1985, Janzen 1986b, 1988b).

A final remark

Conservation of living resources, as an idea and an endeavor largely antedates the writings of Robert T. Malthus in 1789. The conservation of Nature has been for millenia an overt or tacit activity with different objectives in mind (Glacken 1967, Passmore 1978). It is the formalization of this activity as a scientific discipline that is a recent event (Soulé & Wilcox 1980). As any human endeavor, it can be improved. Let's work on it.

ACKNOWLEDGMENTS

Fabián Jaksić somehow challenged me to write this commentary, Juan Armesto and F. Jaksić himself suffered the result by reviewing it. Thanks are due to both of them. This manuscript was written under the sponsorship of a grant by Universidad de Chile, DTI 2596-8824.

LITERATURE CITED

BERRYMAN AA (1987) Equilibrium or nonequilibrium: is that the question? Bulletin of the Ecological Society of America 68: 500-502.

DEANGELIS DL & JC WATERHOUSE (1987) Equilibrium and nonequilibrium concepts in ecological models. Ecological Monographs 57: 1-21.

DIAMOND JM & RM MAY (1976) Island biogeography and the design of natural reserves. In: May RM (ed) Theoretical ecology: principles and applications: 163-186. Blackwell, Oxford.

DIAMOND JM & RM MAY (1985) Conservation biology: a discipline with a time limit. Nature 317: 111-112.

EHRENFELD DW (1970) Biological conservation. Holt, Rinehart & Winston, Incorporated, New York. New York.

EHRENFELD D (1981) The arrogance of Humanism. Oxford University Press, New York. New York.

FOSTER RB (1980) Heterogeneity and disturbance in tropical vegetation. In: Soulé ME & BA Wilcox (eds) Conservation biology: an evolutionary-ecological perspective: 75-92. Sinauer Associates, Sunderland, Massachusetts.

FRANKEL OH & ME SOULE (1981) Conservation and evolution. Cambridge University Press, Cambridge, England.

GLACKEN CJ (1967) Traces on the Rhodian shore: Nature and culture in western thought from ancient times to the end of the eighteenth century. University of California Press, Berkeley, California.

HARRIS LD (1984) The fragmented forest: island biogeography theory and the preservation of biotic diversity. University of Chicago Press, Chicago, Illinois.

HAYEK FA (1979) The counter-revolution of science: studies on the abuse of reason. Indianapolis Liberty Press, Indianapolis, Indiana.

IUCN, UNEP & WWF (1980) World conservation strategy. Living resource conservation for sustainable development. IUCN, Gland, Switzerland.

JANZEN DH (1983) No park is an island: increase in interference from outside as park size decreases. Oikos 41: 402-410.

JANZEN DH (1986a) The eternal external threat. In: Soulé ME (ed) Conservation biology: the science of scarcity and diversity: 286-303. Sinauer Associates, Sunderland, Massachusetts.

JANZEN DH (1986b) Guanacaste National Park: tropical ecological and cultural restoration. Editorial Universidad Estatal a Distancia, San José, Costa Rica.

JANZEN DH (1988a) Management of habitat fragments in a tropical dry forest: growth. Annals of the Missouri Botanical Garden 75: 105-116.

JANZEN DH (1988b) Tropical ecological and biocultural restoration. Science 239: 243-244.

KELLERT SR (1985) Social and perceptual factors in endangered species management. Journal of Wildlife Management 49: 528-536.

LEIGH EG (1981) The average lifetime of a population in a varying environment. Journal of Theoretical Biology 90: 213-239.

LEOPOLD A (1949) A Sand Country almanac and sketches here and there. Oxford University Press, New York. New York.

LUBCHENCO J (1986) Relative importance of competition and predation: early colonization by seaweeds in New England. In: Diamond J & TJ Case (eds) Community ecology: 537-554, Harper & Row Publishers, New York. New York.

MARONE L (1988) Acerca de la conservación de la naturaleza y la teoría ecológico-evolutiva. Revista Chilena de Historia Natural 61: 11-18.

MAY RM (1977) Thresholds and breakpoints in ecosystems with a multiplicity of stable states. Nature 269: 471-477.

McNEELY JA & KR MILLER, eds (1984) National parks, conservation, and development: the role of protected areas in sustaining society. Smithsonian Institution Press, Washington, D.C.

MIDDLETON J & G MERRIAM (1985) The rationale for conservation: problems from a virgin forest. Biological Conservation 33: 133-145.

NIERING WA (1987) Vegetation dynamics (succession and climax) in relation to plant community management. Conservation Biology 1: 287-295.

PASSMORE J (1978) La responsabilidad del hombre frente a la naturaleza: ecología y tradiciones en Occidente. Alianza Editorial, Madrid.

PICKETT STA & JN THOMPSON (1978) Patch dynamics and the design of nature reserves. Biological Conservation 13: 27-37.

SAMSON FB, F PEREZ-TREJO, H SALWASSER, LF RUGGIERO & ML SHAFFER (1985) On determining and managing minimum population size. Wildlife Society Bulletin 13: 425-433.

SHAFFER ML & FB SAMSON (1985) Population size and extinction: a note on determining critical population sizes. American Naturalist 125: 144-153.

SIMBERLOFF DS & LG ABELE (1982) Island biogeography and conservation: effects of fragmentation. American Naturalist 120: 41-50.

SOULE ME (1985) What is conservation biology? BioScience 35: 727-734.

SOULE ME, ed (1986a) Viable populations. Cambridge University Press, Cambridge, England.

SOULE ME (1986b) Conservation biology and the "real world". In: Soulé ME (ed) Conservation biology: the science of scarcity and diversity: 286-303. Sinauer Associates, Sunderland, Massachusetts.

SOULE ME & D SIMBERLOFF (1986) What do genetics and ecology tell us the design of nature reserves? Biological Conservation 35: 19-40.

SOULE ME & BA WILCOX, eds (1980) Conservation biology: an evolutionary-ecological perspective. Sinauer Associates, Sunderland, Massachusetts.

TERBORGH J (1975) Faunal equilibria and the design of wildlife preserves. IN: Golley FB & E Medina (eds) Tropical ecological systems: trends in terrestrial and aquatic research: 369-380. Springer-Verlag, New York, New York.

VERNER J, ML MORRISON & CJ RALPH, eds (1986) Wildilfe 2000: modeling habitat relationships of terrestrial vertebrates. University of Wisconsin Press, Madison, Wisconsin.

WEBER M (1980) El político y el científico. Alianza Editorial, Madrid.

WHITE PS & SP BRATTON (1980) After preservation: philosophical and practical problems of change. Biological Conservation 18: 241-255.

WIENS JA (1984) On understanding a non-equilibrium world: myth and reality in community patterns and processes. In: Strong DR, D Simberloff, LG Abele & AB Thistle (eds) Ecological communities: conceptual issues and the evidence: 439-457. Princeton University Press, Princeton, New Jersey.

WILSON EO & EO WILLIS (1975) Applied biogeography. In: Cody ML & JM Diamond (eds) Ecology and evolution of communities: 522-534. Belknap Press, Cambridge, Massachusetts.

WORSTER D (1977) Nature's economy. A history of ecological ideas. Cambridge University Press, New York. New York.