The Philosohy of Ecological Engineering

Individuality, Stability & Ethics

CNRS Multidisciplinary project Philosophy & Ecology

Minus van Baalen (minus.van.baalen@ens.fr)

Philippe Huneman (huneman@wanadoo.fr)

Ecological Engineering

Natural phenomenon

Many species manipulate positive feedback loops that exist in ecosystems. Well-known examples include

- worms that collectively create favorable conditions
- cows who manipulate gut flora to suit dietary needs.

These feedback loops that we cannot consider the biology of a species without considering its effect on its environment as well.

Human influence is but a special case

Humans are ecological engineers *par excellence*. Large swathes of the earth are no longer in a pristine state but are strongly affected by human activities in one form or other. Some of these effects are the result of intended behaviour, such agriculture or fisheries, but others are unintended consequences of other activities, such as global warming. In fact, the last example shows that whether the effects are positive or negative is not always clear. Ecological engineering as a scientific discipline can be defined as *in situ* manipulation of ecosystems.

Scientific approach needed

Given the fact that large-scale manipulation (by humans) may have large-scale consequences affecting a multitude of ecological components (humans included), it is necessary to carefully consider the theoretical and ethical issues associated with ecological manipulation.

Philosophical Issues

Theoretical issues: what are we talking about?

When can we talk about individual ecosystems? What is a biological entity if it is not an individual *sensu stricto*? Does our understanding of how evolutionary individuals emerge from collections of lower-level individuals affect our conception of ecosystems as individuals? Interestingly, the discipline of evolutionary ecology has developed the notion of levels of selection to study cases where adaptations benefit larger associations rather than the smallest components. Application of these ideas may be very useful to determine what can be considered an entity and what not.

Ethical issues: what should we aim for?

Ecological engineering projects typically try to neutralise or at least reduce human impact but their precise aims are rarely explicit. Nevertheless, large-scale interference with ecosystems may have a variety of consequences that differentially impact members (or subclasses) of society (in terms of costs and benefits, for example), which raises typical ethical problems. We will discuss the ethical criteria that have to be agreed upon for developing aims of ecosystem-oriented actions.

Multidisciplinary project Ecology and Philosophy

A project at the interface of the disciplines of Ecology and Philosophy (funded by the research program « Ingénierie Ecologique » of the CNRS Institut National Ecologie et Environnement) intends to address these issues in a series of workshops and meetings.

Stability and Individuality

Most interactions in ecosystems are internal but no ecosystem is closed and many interactions are external. This begs the question of how we should draw the boundary. Is it always possible to recognize an ecosystem unit when one sees one? Or is any definition essentially arbitrary, or at least based on epistemic (rather than ontological) features?

Part of the answer may lie in the consideration of the way multi-component 'individuals' may emerge in the course of evolution. Indeed, virtually every individual is in reality an association of more-or-less independent smaller-scale entities. Recent theoretical development has given insight into the conditions that allow such associations to emerge and retain their coherence. The open question is to what extent such approach is applicable to larger-scale levels of organisation such as communities and ecosystems.

Stability is the key concept here. In order to maintain its coherence an 'individual' must be stable with respect to processes that may cause its desintegration. Inversely, these entities should emerge as a persistent outcome of the evolutionary process of apparition and invasion of mutants. However, especially in population and community ecology, many concepts of stability have been forged and used in various modeling frameworks, without any systematic understanding of their relations and of the commitments they entail for the modelers who use them. Such systematic investigation is therefore required to properly tackle issues about individuality.

Stability and Ethics

Science teaches us how we can engineer ecosystems, but we should be explicit about the goals. Many ecological engineering projects in the area of conservation biology aim to 'restore' an ecosystem to its presumed original equilibrium. However, many studies indicate that the so-called Balance of Nature is an idealization and that ecosystems rather tend to be in a state of flux. What state or process can be considered to be the original becomes a non-trivial issue. The stability of an ecosystem can take on many forms, from internal population dynamical equilibrium via non-equilibrium persistence via stability with respect to exotic invaders to stability with respect to evolutionary processes. Which of these aspects should we aim at? What kinds of instability are we prepared to accept? Do we accept the 'perturbation' caused by human activity as an integral part of an ecosystem? In parallel with recent debates in the field of bioethics, should ecological engineering in this field really cure an ecosystem (from human inflicted damage) or merely care for it?

In other areas of ecological engineering, humans do form part and parcel, for instance in public health policies that deal with infectious disease. In these cases, another philosophical chestnut emerges, namely: who should benefit and whom can be made to bear the costs ? If we do not accept plain utilitarianism as a guiding principle, given that we can not take it for granted in the domain of environmental ethics, which guidelines should we adopt? What value should we thereby grant to non-human components such as species or even more abstract quantities like biodiversity?

Actions

Meetings

- Kickoff meeting. Establishment of key issues. March 2009
- Workshop 1. The emergence of evolutionary and ecological individuals. Fall 2009
- Workshop 2. The ethics of ecological engineering. Spring 2009.
- Workshop 3. Organisms as ecosystems, ecosystems as organisms. Fall 2010
- End of the program.: Interdisciplinary summer school.

Deliverables and outcomes

- Special issues of interdisciplinary journals (such as *Environmental ethics*, *Economy and environment*, *Biological theory*, or *Biology and philosophy*) co-written by ecologists, ethicians, philosophers of science.
- Opinion articles in general ecological journals (*Ecology Letters*, *American Naturalist*, …).
- Booklet for teaching in environment-related programs (ethical issues, epistemological dimensions, metaphysical commmitments of ecological modelling and engineering)

People

Responsible

- Minus van Baalen (UMR Ecologie & Evolution, CNRS – UPMC – ENS)
- Philippe Huneman (Philosophy of science, IHPST (CNRS/Paris 1))

Already involved

- Samuel Alizon (Microbiology & Evolution, Zürich)
- Frederic Bouchard (Philosophy of science, Montreal)
- Rachel Bryant (Philosophy & Ethics, Toronto)
- Catherine Dekeuwer (Ethics, Lyon III)
- Julien Delord (Philosophy & ethics, ENS)
- Andy Gardner (Evolution, Edinburgh)
- Clive Jones (Ecology, Cary institute, NY)
- Silvia de Monte (Ecology & Evolution, CNRS – UPMC – ENS)
- Thomas Pradeu (Philosophy of science, Paris 4 – IHPST)

Having expressed an interest

- Luc Doyen (Paris, MNHN)
- Cedric Gaucherel (Montpellier, Cirad)
- Hans Metz (Leiden)
- Gregory Mikkelson (Philosophy of science, Montreal)
- François Munoz (Montpellier, Cirad)