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Man and Nature: Making the Relationship Last.

Réserve de biosphère - Notes techniques

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Entre l'Homme et la nature,

une démarche pour des relations durables.

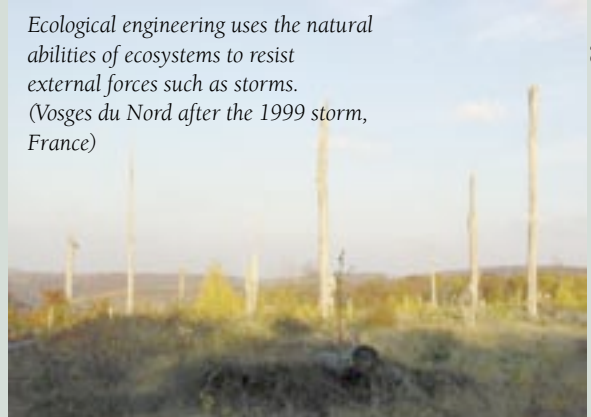
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Ecological engineering and the sustainable redesign imperative

Designing and implementing sustainable environmental management is a major science and engineering challenge for the 21st century. Maintaining human well-being amidst population growth and a demand for improved living standards in the developing world will require a major shift in human attitudes towards the value

Ecological engineering uses the natural abilities of ecosystems to resist external forces such as storms. (Vosges du Nord after the 1999 storm, France)



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of nature and profound changes in how humans conduct many activities. It will require rethinking the design of industries, cities, agriculture, forestry, transportation, and energy use; how best to restore degraded ecosystems; and how to protect remaining wild areas.

Ecological engineering is central to this sustainable redesign imperative. It has the general strategic goal of maintaining or increasing natural processes, and hence the goods and services they provide to humans and other species, with minimal human intervention and minimal adverse collateral impact. This strategic goal reflects the original 1962 definition of ecological engineering by H. T Odum as "those cases in which the energy supplied by man is small relative to the natural sources, but sufficient to produce large effects in the resulting patterns and processes".

Ecological engineering uniquely combines ecological understanding of the functioning of nature with engineering – using science, mathematics and experience for solving problems within constraints – to design ecosystem management practices that are environmentally, socially and economically viable, and that sustain both humans and nature. Ecological engineering uses the natural tendencies of ecosystems to self-organize, to resist external forcing, to be resilient (e.g.,

to recover from disturbance), to adapt to change, to be multifunctional, and to be self-sufficient because they use solar energy and recycle materials.

Prior to industrialization and globalization, ecological engineering was widely used by humanity, even if it did not go under that name. It is still used today by many indigenous populations. Ecological engineering can be used to restore ecosystems; for example, replanting hedgerows into intensive agricultural landscapes, or restoring wetlands, following gravel mining. It can also be used to substitute for technologies that use non-renewable fossil fuels. For example, “green roofs” provide insulation for buildings, purify rainwater and provide habitat for species that use the native plants on the roofs. In another well-known example, New York City chose to maintain forests in the city watershed rather than constructing a vast new water purification plant. Acting as a natural purifier, the forest filters the water supply for the whole city, while also providing other goods and services. Forest protection was the cheaper option.

While there many examples of ecological engineering already in use, there are many opportunities for further use of the approach and much remains to be done in developing the underlying science. For example, how did human techniques used for millennia but now becoming lost in modern culture, effectively use natural processes? A central challenge is how to put our current ecological understanding into practice and to develop ecological engineering best suited to today’s world.

Particularly well developed in the USA (e.g., the *American Ecological Engineering Society*), the discipline has now spread to many parts of the world (e.g., the *International Ecological Engineering Society*). In France, the *Institut Supérieur d’Ingénierie et de Gestion de l’Environnement* (Higher Institute for Environmental Engineering and Management) has been teaching ecological engineering since 2005, and a new ecological engineering program has just been developed by the national research agency (CNRS). Our Ile de France group, GAIE (*Groupe d’Application de l’Ingénierie des Ecosystèmes*) helps develop and promote ecological engineering and was created in 2006.

As Peter Vitousek and colleagues pointed out, sustaining human/natural coexistence means “we cannot escape responsibility for managing

“Green roofs” provide insulation for buildings, purify rainwater and participate in the conservation of species.



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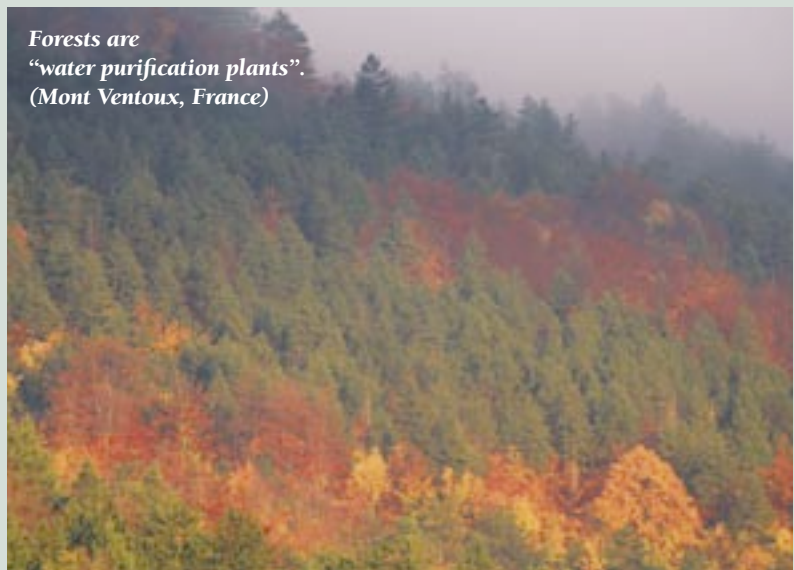
the planet”, and this will require “active management for the foreseeable future”. Ecological engineering will play a major role in this future.

CLIVE G. JONES, ISABELLE DAJOZ AND LUC ABBADIE

Further reading

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Forests are “water purification plants”. (Mont Ventoux, France)



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