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Application of ecological models for assessment of sustainability

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There has lately been an increased interest in sustainability assessment and models have been developed to assess the sustainability of ecosystems, a natural area for instance a landscape and of a well defined area that includes not only ecological processes but also socio-economic activities. Our experiences with sustainability assessment projects are still very limited but from many sides it has been proposed which key variables to include in such an analysis. The use of work energy as a sustainability indicator that includes expressions of natural and socio-economic activities has been proposed and also tested with a reasonable success. The efficiency of the use of work energy in general and the amount of work energy needed to maintain the various sub-systems and their capacity of work energy were included in this analysis. It is however clear that one indicator is insufficient to assess a sustainability of a very complex system. It has therefore been proposed to supplement the use of work energy as indicator with development of models of the most important cycles for natural and socio-economic systems namely the cycles of carbon, nitrogen and water. Two ecological factors are in focus when it is discussed what are important to include in a sustainability analysis namely the services offered by the ecosystems and the biodiversity, that is important for the spectrum of resistances to possible impacts on the systems. It is probably important to include these two ecological factors as direct indicators in the sustainability analysis, although they are both to a certain extent covered by the work energy analysis. Socio-economic indicators are of course also needed but it is beyond the scope of this presentation. The result of use of models for the assessment of the global sustainability by use of a "limits to growth" like model will be presented. The model has been used to assess the global development in the case of more support to the developing countries by the industrialized countries; more green tax to reduce depletion of resources; more investment in pollution control including the emission reduction of the green house gases and more investment in education and research to develop new solutions of the global problems. It can be shown that these investments and changes lead to a win-win situation. The model has also been used to calculate the ecological footprint by various scenarios.

Biography

Sven Erik Jørgensen is a Professor Emeritus in Environmental Chemistry at the University of Copenhagen. He has received a master of science in chemical engineering from the Danish Technical University (1958), a doctor of environmental engineering (Karlsruhe University) and a doctor of science in ecological modelling (Copenhagen University). He is honourable doctor at Coimbra University, Portugal and at Dar es Salaam University (Tanzania). He has received the Einstein Professorship of the Chinese Academy of Science. He has in 1975 founded the journal Ecological Modelling and in 1978 ISEM (International Society of Ecological Modelling). He has received several awards, The Ruder Boskovic Medal, The Prigogine Prize, The Pascal Medal, The Einstein professorship at the Chinese Academy of Sciences, The Santa Chiara Prize for multidisciplinary teaching and the very prestigious Stockholm Water Prize. The Encyclopedia of Environmental Management, edited by Sven Erik Jørgensen, received in 2013 the outstanding publishing achievement, "this year's Outstanding Academic Title". He has published 370 papers of which 256 were published in peer-reviewed international journals and he has edited or authored 79 books, of which several have been translated to other languages (Chinese, Russian, Spanish and Portuguese). He has authored a successful textbook in ecological modelling "Fundamentals of Ecological Modelling", which was published as a fourth edition together with Brian Fath in 2011. He is the president of ISEM and he has been elected member of the European Academy of Science's, for which he is the chairman of the Section for Environmental Sciences.

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