Theories, Models and Tools in Ecology and Biogeochemistry for Advancing Natural Resources Management

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In 1972 "The Limits to Growth" was published, showing –by presenting a number of model runs— how our current lifestyle and technology would lead to an environmental crisis and the depletion of natural resource. The bookcame in a time with a rising concern about pollution and resource depletion. The impact it had on both the scientific community and the political realm was far-reaching. Although highly criticised by many it marked the beginning of a new era in computer modelling. Around this time there occurred an increased interest in computer modelling. This was not entirely because of "The Limits to Growth". Several other projects and organisations involving computer modelling were under development during this era. This paper mainly deals with the theoretical and technical developments that preceded "The Limits to Growth" and in a way can be said to have set the stage for this and other contemporary modelling projects. The developments that can be said to be the basis for all modeling are the developments in calculus and computer power. Other important developments are the theoretical developments in population and ecosystem ecology, the emergence of weather forecast models and their development into climate models and the group of theories that can be defined as system thinking.

The theoretical and methodological background underpinning "Limits to Growth" has occurred in many fields including:

Mathematics
-One prerequisite for computer modeling is the development of the Calculus that begun in the 17th century.

Physics
-Some of the developments in calculus are based on progress made in varying fields of physics.

Computer Technology
-From mechanic and analogous computers the development in computer power have made more and more advance calculations and long model runs possible.

Population Dynamics
-The early populations developed by e.g. Lotka, Volterra and Gausse have also contributed to the knowledge about the dynamic properties of nature. A further development in the field of population dynamics was the chaotic behavio r shown by e.g. May and Holling.

Systems Ecology
-Early ideas about nature as a system (the ecosystem concept, the biosphere) has contributed to a more holistic view of nature and led to several ecological modeling projects.

Climate Models
-In the sixties, climate models evolved from numerical weather prediction models creating a new form of natural resource management models

Systems Thinking
-Several ideas and theories about systems and their general properties (i.e. Cybernetics, General Systems Theory, Operation Analysis) can be summarized under the term System Thinking.

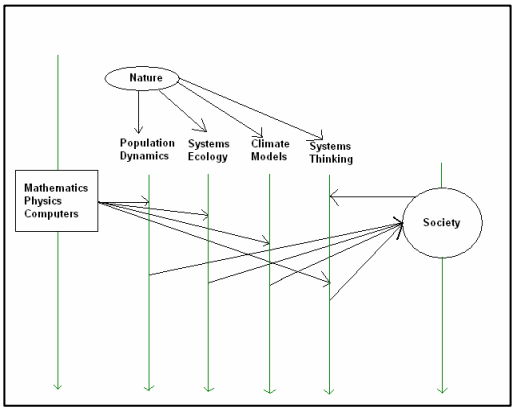

Fig 1. The theoretical and methodological development within different fieldsm, important to the development of the models used today in natural resources management. Green Arrows symbolize development and black arrows: influence.

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