

TOWARDS AN INTEGRATED MODEL FOR THE MEDITERRANEAN SOCIAL-ECOLOGICAL SYSTEM

Wolfgang Cramer

(using input from many people...)

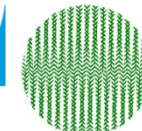
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Background

Human civilization has had its cradle in the broader Mediterranean area – for several millennia, ecosystems have co-evolved with human society in the region. As a consequence, ecosystem services from land and ocean are now crucial for the economy and human well-being in the Mediterranean.

Decision-makers, at the regional and international level, require credible information and scenarios about changes in ecosystem function, biodiversity and services.

**DO WE ACTUALLY DELIVER
ANY SUCH INFORMATION?**



Numerical tools, based on process-based simulation models and spatial data bases, permit the assessment of past, current and future ecosystem service provisioning.

...let me try once more...

Background

Human civilization has had its cradle in the broader Mediterranean area – for several millennia, ecosystems have co-evolved with human society in the region. As a consequence, ecosystem services from land and ocean are now crucial for the economy and human well-being in the Mediterranean.

- Human action affects climate and the ocean...
- Climate change, as well as direct human action, affect biodiversity and ecosystems...
- Ecosystem change affects people and the economy
- People, through institutions, can influence climate (-> Paris Agreement)



Numerical tools, based on process-based simulation models and spatial data bases, permit **NOT ONLY** the assessment of past, current and future ecosystem service provisioning, **BUT ALSO** the scientific study of the various feedbacks in this social-ecological system.

**ISN'T THIS REALLY
INTERESTING - FROM A
SCIENTIFIC PERSPECTIVE?**

The truth is: we mentioned a number of these issues in our very ambitious original OT-Med proposal – hence it is a fair question to ask how much of these objectives can really be achieved by OT-Med so far.

At the global level, the development of tools for such feedback analysis has taken decades, and these models now fall in two broad categories:

- 1) “Earth System Models”, being highly complex descriptions of the physics and biogeochemistry of the atmosphere and the ocean, fitted with some description of ecosystem dynamics and almost no aspect of human society, except for greenhouse gas emissions.
- 2) “Integrated Assessment Models”, being stylized descriptions of components such as climate, land use, energy use and other things – simulating the most important feedbacks in the system, with little to no recognition of physics, ecology or the geography of things.

Both types of models are useful and have delivered important science, e.g. for the Paris Agreement, both have significant shortcomings – and none of them can say very much about people, or ecosystems, in the Mediterranean Basin.

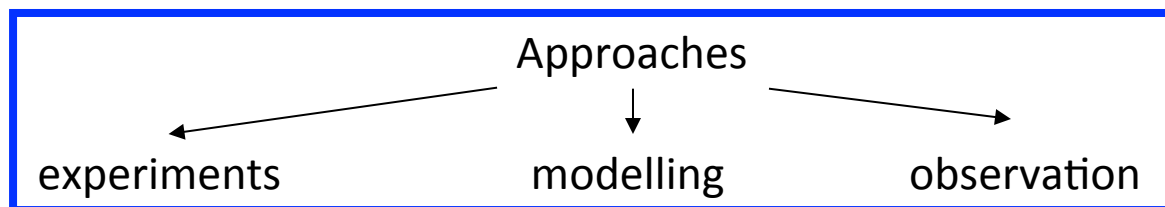
**...we do not have several
decades to build an integrated
model...**

An emerging vision?

We have some essential building blocks already:

- ecosystem models for the land and the ocean,
- access to physical ocean and atmosphere models,
- a lot of intelligent people,
- experimental data, observations...

We even now have a project for new coupling approach between subsystems (LaserMed)!



What are we missing?

One might say: we need more resources (scientists, programmers, computers, time), and this is always true, in any research project.

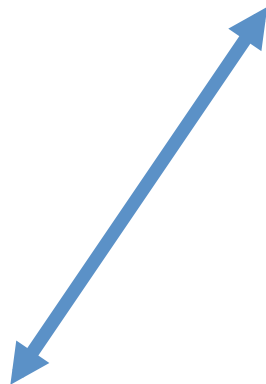
But such resources can be found, and through improved networking, e.g. via MISTRALS, they are easier to be found than we might think.

**...I think we are missing a view
of what the complete system
should look like...**

The Mediterranean Social-Ecological System

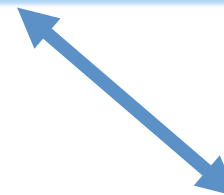
Human society

- uses natural resources (food, fibre, water, minerals, clean air)
- undergoes internal dynamics (demography, social structure, economy)
- transforms its immediate environment (land and sea use, pollution)



The physical environment

- atmosphere changes due to weather patterns and global greenhouse gas emissions (warming, rainfall change, air quality change)
- ocean changes due to circulation patterns and atmospheric and coastal inputs (warming, acidification)



The biological environment

- terrestrial ecosystems change due to climate change (incl. CO₂), land use (including protection) and pollution
- marine ecosystems change due to warming, acidification, fisheries and pollution



Inspiration from outside

A social-ecological model of the Mediterranean could probably be built, as an Earth System Model or as an Integrated Assessment Model - and most needed components are available for it.

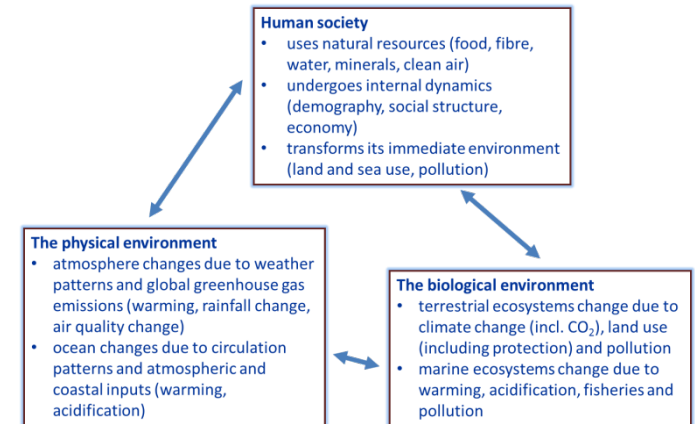
But if we spent some more time thinking about its potential / desired applications, then we could maybe build it sooner, better or both.

Future Earth could provide some help:

- “solution-oriented”
- “co-designed”
- through an ongoing brainstorming activity, led by Sander van der Leeuw

What if we looked directly for transitions, or regime shifts:

- intended shifts (goals, targets) or unintended shifts (catastrophes)
- ecosystem shifts (biodiversity loss) or societal shifts (changed consumer behavior)



**Our current thinking is too much characterized by the idea
“we scientists will tell the policy-maker about some risk, and then
he/she will take better decisions”**

**An alternative approach is to build a tool that allows to explore
options for future development, accounting for essential processes
in both, society and the natural environment.**

Let's think about this together!

Something of this kind could be built, either in the form of a process-based Earth System Model, or more like a stylized Integrated Assessment Model

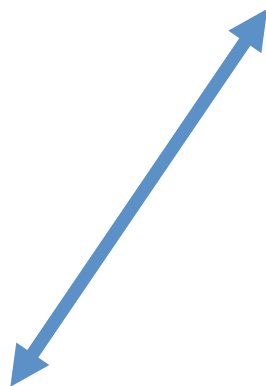
But what we are really missing is a clear narrative, or research question, along which we can arrange the components of our system in a way that we consider BOTH, scientifically interesting and also useful from a policy perspective.

Having this would greatly enhance our capacity to develop something useful.

The Mediterranean Social-Ecological System

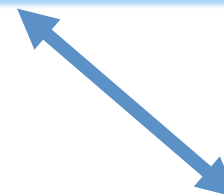
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