The Next Generation Dynamic Vegetation Models

Our goal: better theory and better models by using natural selection and other organizing principles

The hypothesis
While the versatility of dynamic vegetation models (DVMs) continuously increases, their accuracy suffers from accumulating uncertainty as new processes and parameters are added. We propose that the key to solving this problem lies in a ‘missing law’ – adaptation and optimization principles rooted in natural selection.

Challenges at multiple scales

Can we make a universal model of leaf function and structure (photosynthesis, stomatal conductance, chemical composition, and leaf life-span)?

Which minimum set of traits do we need to model a plant in a DVM?

How can we operationalize optimal carbon allocation in a DVM?

How can we model water and nutrient uptake, and the role of plant–soil interactions, such as mycorrhizal and priming strategies?

What is the most efficient way to model plant competition in different ecosystems?

How can we model functional diversity in traits and species, its ecological dynamics and evolution?

What are the most efficient ways to model fire, herbivory, insect outbreaks, and forest management?

The working group

- We aim to develop foundations of a new generation of vegetation models centered on adaptation and optimization principles rooted in natural selection, and other organizing principles.
- We strive to reduce complexity and number of parameters: Models should be as simple as possible, but not simpler.
- To facilitate cross-fertilization among disciplines, the group includes modelers and empirical researchers with expertise in: ecophysiology, ecology and evolution, soil processes, mathematics, human impacts, management, and disturbances.
- The project is centered around a series of workshops at IIASA to discuss the science and initiate collaborative research.
- We will produce perspective papers and road maps for model development as well as components for next generation vegetation models.

The organizers

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- Stephan Pietsch (IIASA)
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