

What climate negotiators can learn from slime moulds

Ecologist Simon Levin discusses his work linking social and natural systems.

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Simon Levin, an ecologist at Princeton University in New Jersey, is the winner of the 2014 Tyler Prize for Environmental Achievement, a US\$200,000 award handed out by a panel of researchers. In his 50-year career, he has worked on mathematical descriptions of ecosystems, and on the commonalities between the network structures of ecological and socioeconomic systems.

What motivated you to take your particular career path?

I went to graduate school in mathematics, but I decided early on that I wanted to apply those skills to addressing the problems of the world. It was a time of increasing awareness of the environmental problems the world was facing, thanks to the work of Rachel Carson [author of *Silent Spring*, the 1962 exposé on the dangers of pesticide overuse] and others. So very early in my career, I began turning my efforts to ecological problems.

What are the common elements in your work over the years?

Many of the systems I have been interested in have similar structure. They are made up of individual agents pursuing their own selfish agendas. There are emergent features that feed back on everybody.

My goal has been to build a deeper understanding of how ecological communities are organized, what benefits we gain from these ecological systems — from direct products such as food and fibre to the aesthetic pleasures we get out of them — as well as the risks these systems face and how we can minimize risks to develop a sustainable future. Ultimately, I am interested in the robustness of ecological systems.

How has your work influenced environmental policy?

I've been involved in some very specific issues, such as the effects of power plants on the Hudson River and my work on the oversight committee on the recovery of Northwest salmon. But more important to me is the fact that there has been a movement towards changing the way forests and fisheries are managed from single-species, fixed-yield approaches. The general trend is that systems should be managed as complex adaptive systems where the maintenance of robustness and resilience are key.

Back in February 2008, with Robert May and George Sugihara, you warned in *Nature*¹ of a possible financial collapse.

How did you know?

By analogy with things we were familiar with in ecological systems, where it was known that overconnected systems are highly prone to collapse. Systems in which there are a huge number of connections among the units are less resilient than those with a more limited distribution of connections. And that's what we saw in the flow of money between banks in 2008, where everything was more or less connected to everything else. So since then I've been doing a lot of consulting, as have Bob and George, regarding how corporations and financial firms might change current practice.

What system are you tackling now?

I think the grandest challenge that is facing us is how to gain cooperation at the international level on problems such as climate change and biodiversity loss, where individual agents have their own selfish agendas. Some of my work has been designed towards understanding how much we can learn from how cooperation is achieved in nature, in the slime moulds and bacterial films and small societies. In terms of climate change, I am currently exploring the polycentric approach of [economists] Elinor and Vincent Ostrom, where we build up from local agreements and modularize the system.



Princeton University

Simon Levin's work on ecological and socioeconomic systems led him and others to warn of a financial collapse in 2008.

What do slime moulds tell us?

Slime moulds are cooperative because individual amoebae at particular stages aggregate into assemblages, which lead to sporulation and the next generation. This involves some individuals giving up their own reproductive fitness to help the collective. Why do they do this? How do they do this? And what can we learn from this process about getting cooperation in our own societies?

Can international agreements ever achieve the level of cooperation of slime moulds?

You have nothing to lose by being optimistic.

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References

1. May, R. M., Levin, S. A. & Sugihara, G. *Nature* **451**, 893–895 (2008).