4-2022

Cross-Sectoral Climate Change Modeling

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Math in Social Context: Cross-Sectoral Climate Change Modeling

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What's The Problem:

Governments are not responding in a decisive or adequate manner to the results of climate change modeling. Although the climate data originates from various integrated sectors, it continues to be evaluated in isolation. By using cross-sectoral modeling, climate change modeling can more effectively represent data, and the possible consequences of misjudging future models.

Background:

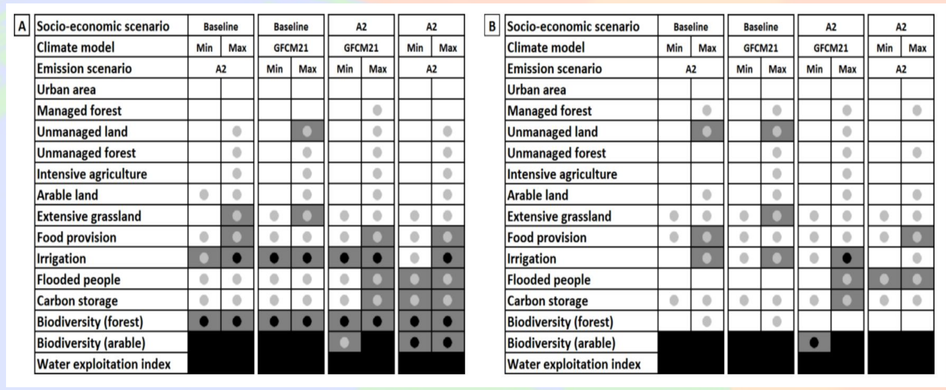
Climate Change remains one of the largest issues plaguing the nations of the world, even after years of detection and reporting by various organizations. One such group, the Intergovernmental Panel on Climate Change (IPCC), called for an "integrated, cross-sectoral assessments of climate change impacts" in 2015 so that they could accurately account for climate change effects. However, such assessments have yet to occur on a larger scale, leading a number of data scientists to take the matter into their own hands.

Math in Social Context:

Single sector studies, which are the norm in climate modeling, represent the impacts of climate change ineffectively or incorrectly. The focus on single sector modelling takes the complicated interrelated human and environmental systems and removes the nuance necessary to accurately represent the data, and by extension the issue at hand.

One Mathematical Aspect:

In addition to the issues stemming from single sector modelling, one result of the cross-sectoral models is the widely varying data (see the graphic below tracking over and under-estimation between models). This is due to the weighing of specific factors above others, which when modelling leads to prioritizing some factors (e.g. Urban Area, Managed Forest) over others (e.g. Water Exploitation Index, Forest and Arable Biodiversity).



Difference due to (A) under-estimation and (B) over-estimation of single sector models compared to integrated models. The values are based on the total of all positive (A) or negative (B) differences summed across all cells and standardised relative to the baseline value.

How Do We Solve It?

The issue can be solved on a large scale by creating cross-sectoral models for data, like the CLimate change Integrated Methodology for cross-Sectoral Adaptation and Vulnerability in Europe, or CLIMESAVE. Calculating the CLIMESAVE in addition to socio-economic factors leads to even more drastic differences in data results. It becomes clear how modelling should shift away from single sector studies in favor of models that combine factors not only for accuracy but to maintain many common causes.

The Big Picture:

By not evaluating the collective data in cross-sectoral models, it seems inevitable for governments to continue improperly planning and responding to the current and future effects of climate change. These poor legislative decisions about climate adaptation lead to possibly disastrous government policies that could have awful effects on the environment and socio-economic communities of the future.

Math/Stats Components:

In order for the CLIMESAVE researchers to simplify the wide arrays of single-sectoral models, they implemented a form of modelling that would effectively and efficiently lead to the same results. Instead of computing fourteen complex models together, the data scientists used a number of meta-models. These simpler models churned out nearly indistinguishable results from their more complex counterparts, using far fewer components due to a combination of optimization and comprehensive sensitivity analysis.

References

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