Intergenerational Equality: Quantitatively Analyzing Ethical Philosophy With Integrated Assessment Modeling

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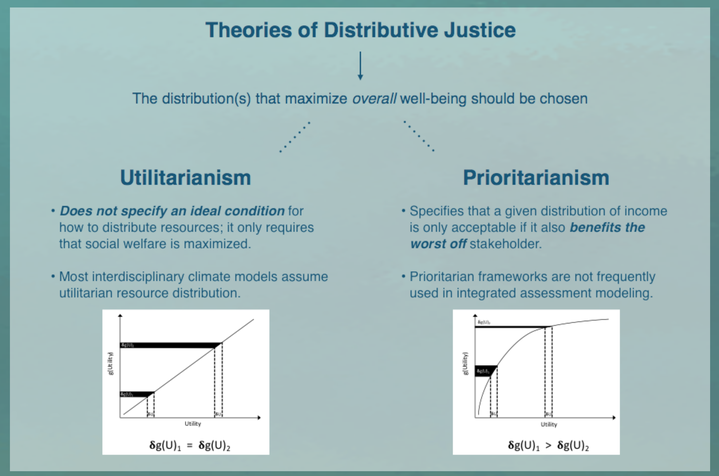
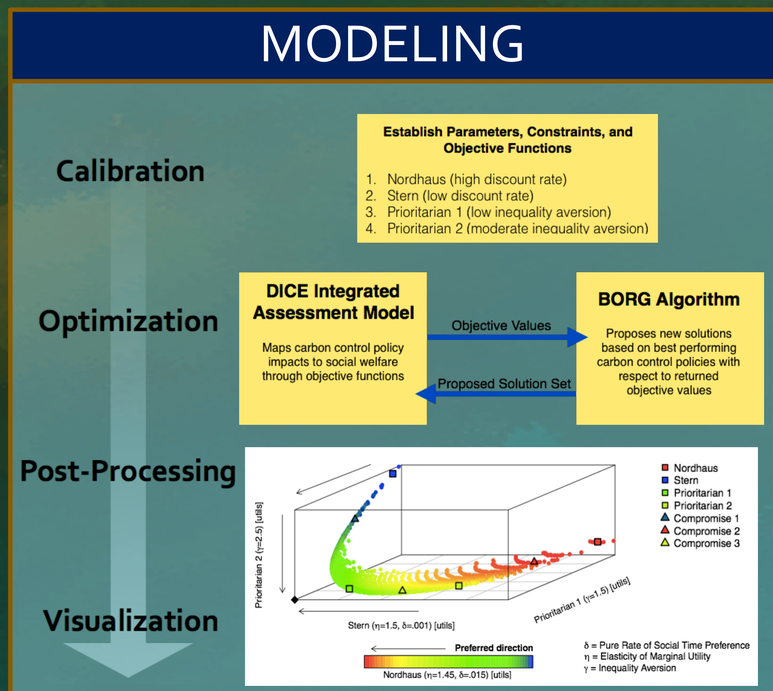
INTRODUCTION



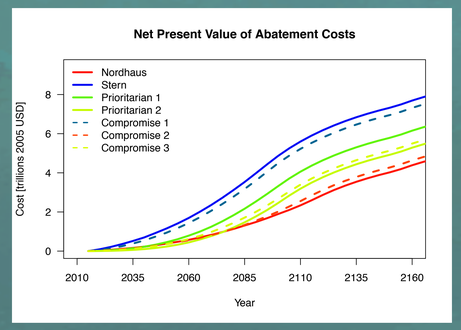
Integrated Assessment Modeling combines and evaluates economic and ecological parameters to inform climate policy decisions. Among these parameters are discount rates, which serve as intertemporal weightings between generations and often carry underlying utilitarian assumptions. This study aims to:

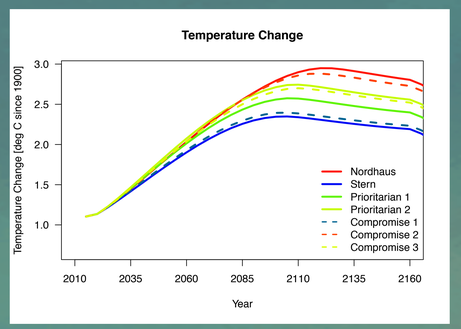
1. **Determine the complexities and tradeoffs introduced in modeling between ideologies and opinions.**
2. **Evaluate the implications and outcomes of diverse stakeholder preferences.**

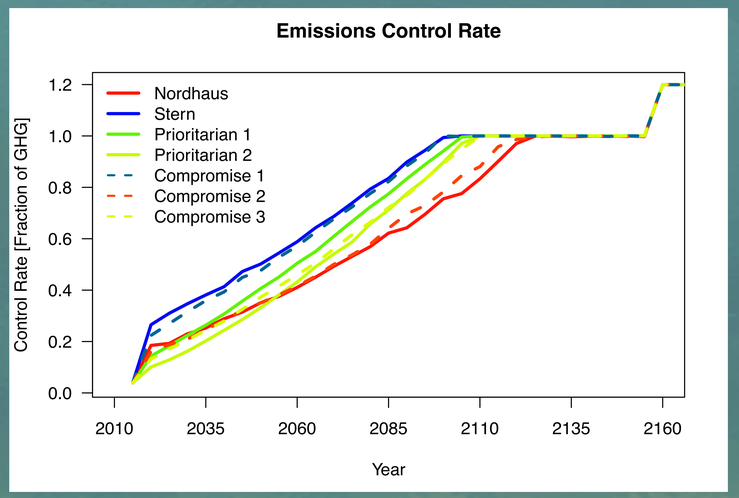
MODELING



MODEL OUTCOMES

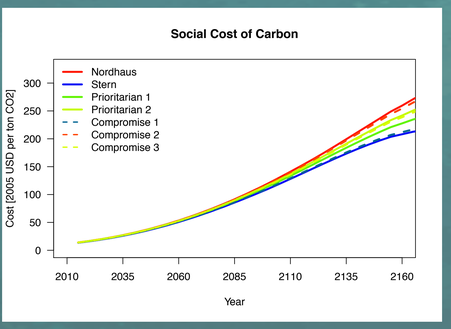


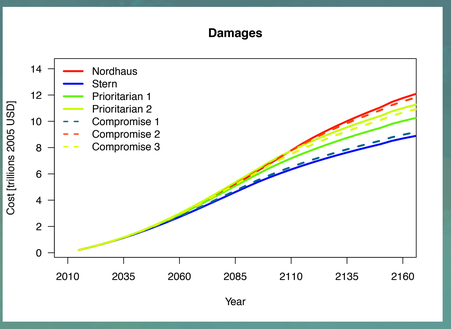




Objectives were projected out to 2160. After analysis, we found:

- Prioritarian outcomes lie between utilitarian outcomes.
- Stern and Nordhaus both prescribe immediate action, whereas prioritarian frameworks prescribe steadier emissions control.
- *All* policy approaches exceed the 2° C limit established by the Paris conference.

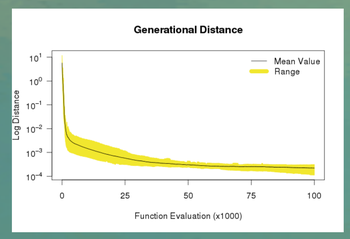


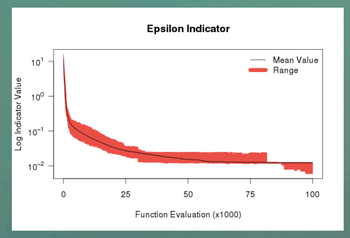


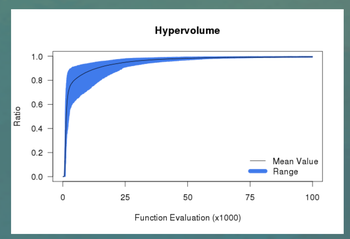
STATISTICAL ANALYSIS

After running the model through the multiple seed experiment, results were evaluated using 3 criteria that describe the optimization process at a given function evaluation.

1. **Fit:**
   - *Generational Distance* is a measure of how well the pareto-front "fits" the reference set by measuring mean squared error. A pareto set with perfect fit would have a generational distance equal to zero.
2. **Continuity:**
   - The *Epsilon Indicator* measures how many gaps there are in a set of solutions. A perfectly continuous pareto-front would have an epsilon indicator value equal to zero.
3. **Convergence:**
   - *Hypervolume* measures the ratio of the volume that a solution set occupies relative to its reference set. Ideally, a pareto-front will achieve a hypervolume of 1, meaning it is identical to its reference set.





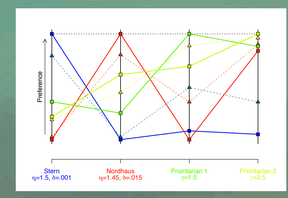


CONCLUSIONS

- Prioritarianism is more ethically and possibly quantitatively defensible. It is also more conducive to capturing threshold climate impacts such as melting of major ice sheets.
- The Stern objective did not perform well relative to any of the others. This is demonstrated by the blue line in the figure below.
- Prioritarianism presents a need for better understanding of future damages as outcomes are heavily reliant on damages.

Future Work:

- Further modeling with prioritarianism
- Statistical analysis of each policy approach
- Experiments across alternative damage functions



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