Analysis, Integration and Modeling of the Earth System - AIMES

AIMES is an international network of **Earth system scientists and scholars** that seek to develop innovative, interdisciplinary ways to understand the complexity of the natural world and its **interactions** with human activities.

STEERING COMMITTEE

MEMBER NETWORK & OUTREACH

- Initiated a member database in 2022
- https://aimesproject.org/member-database/
- Monthly newsletter
  - Includes a section to feature key activities from other GRNs!
- Annual magazine
- Best strategies for engaging your network? ECRs?

WORKING GROUPS & ACTIVITIES

Joint AIMES/GLP Working Group: Behavioural Models of Land Systems (BeModels)

Goal: Support the development of next generation land systems models that represent human behaviour, agency, decision-making and institutional processes.

The Land System Modular Model (LandSyMM) is an example of a model relevant to this WG. LandSyMM is a sub-national to global scale model of the land system that couples modules of land use decision making, macro-economics & global trade, ecosystem processes, biodiversity and the climate system.
http://www.landsymm.earth/
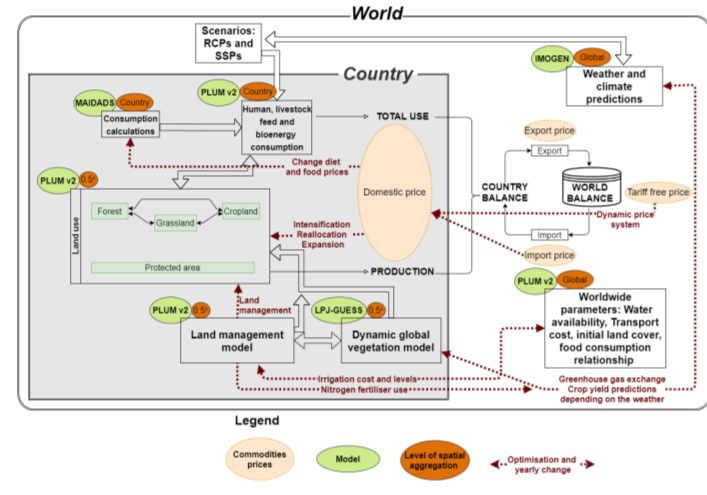
Activities:
- Open Membership
- Land Use and Ecosystem Summer School
- Workshops/Symposia
- Webinars
- Newsletter

https://aimesproject.org/bemodels/
glp.earth/how-we-work/working-groups/bemodels-behavioural-models-land-systems

Land Data Assimilation Community

Goal: Bring together DA scientists working with land surface models to share the latest tools and techniques to better quantify and constrain uncertainty and promote the use of these methods to the wider modeling community.

This figure illustrates a vision for next generation land data assimilation systems, with closer developmental coordination with the LSM and observation communities, adoption of technological enhancements in machine learning and cloud computing, and advancement in the use of metrics and evaluation strategies to realize the potential of land surface observations.
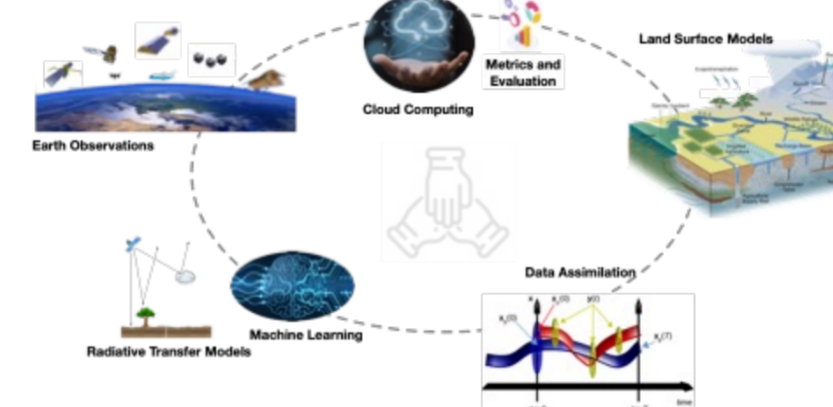
Kumar et al., in review

Activities:
- Open Membership
- Annual Meeting
- Townhalls
- Listserv: land-da-community.github.io/listserv/
- Agenda setting/Review Papers

https://land-da-community.github.io/

Modeling Earth System and Human interactions (MESH)

Goal: Bring together diverse communities engaged with integrated and Earth System modeling, foster advances in coupling methods, and stimulate improved use of coupled approaches in analyses.
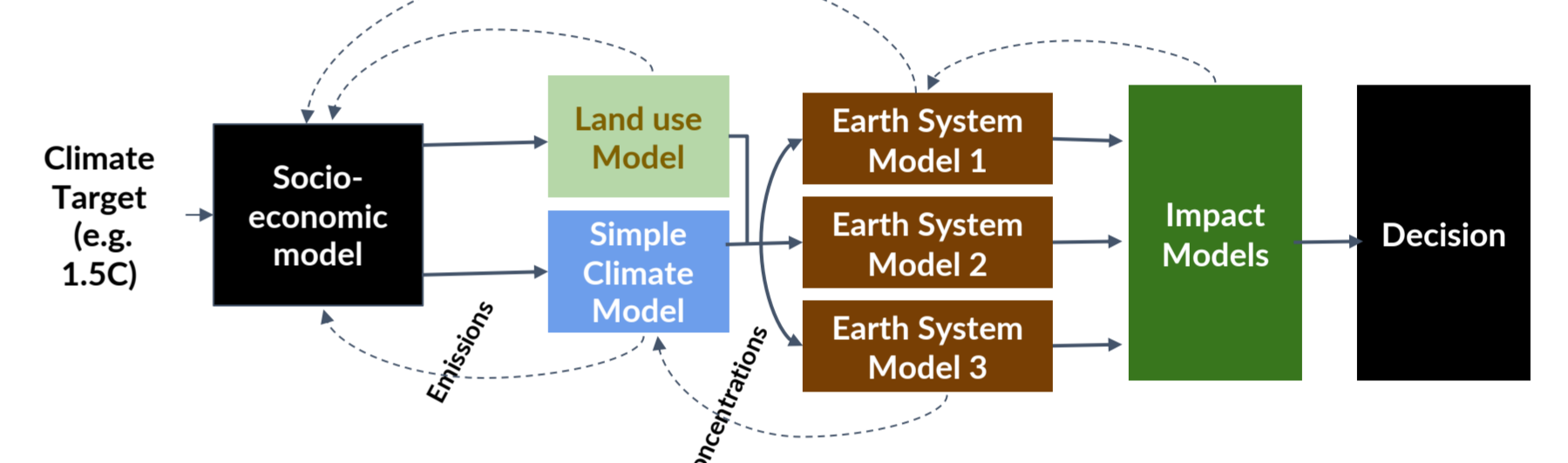

Figure credit: Ben Sanderson

This working group explores the limitations associated with the linear exchange of information inherent to the current approach of the IPCC assessment process, which may limit the understanding of feedbacks between emissions, impacts, and global climate change and uncertainty in climate change projections.
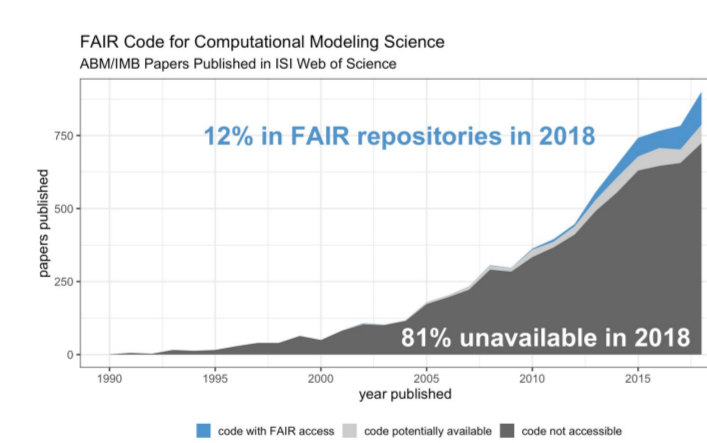
Activities:
- Open Membership
- Workshops
- Conference sessions (Scenarios Forum)

https://aimesproject.org/mesh/

Open Modeling Foundation

Goal: Create an alliance of modeling organizations to coordinate and administer common, community-developed standards that promote "FAIR" [Findability, Accessibility, Interoperability, and Reusability] principles and open science practices.

In a recent ISI Web of Science search, more than 80% of model code (ABM/IBM) was not made accessible. While funding agencies are increasingly requiring data management plans, there remains a need to provide guidelines for managing model code to align with FAIR principles. These guidelines are being developed by OMF through an open process in collaboration with modeling organizations (participate through the OMF website below).

Barton et al., 2022; Janssen et al., 2020

Activities:
- Membership for modeling organizations in the social, ecological, and geophysical sciences
- Open working groups for individual participation
- Workshops

Publications:
Barton et al., **How to make models more useful**. Proceedings of the National Academy of Sciences 119.35 (2022)
Barton, et al., **Making modeling and software FAIR**. Environmental Modelling & Software 156. 105496. (2022)

https://openmodelingfoundation.github.io/

Tipping Elements in the Earth System w/the Earth Commission and WCRP

Goal: Increase the consistency in the treatment of tipping elements in the scientific community, develop a research agenda, and design joint experiments for a Tipping Point Model Intercomparison Project (TIPMIP)

TIPMIP's goal is to systematically advance our understanding of tipping dynamics in various Earth system components and assess the associated uncertainties. Initially, TIPMIP will conduct three major experiments (1) a baseline experiment to analyze the historical and projected response of selected tipping elements to different climate and land-use change scenarios, (2) a commitment experiment to assess the long-term consequences of surpassing different temperature and CO2 levels, (3) a reversibility experiment to probe the reversibility of impacts and potential hysteresis behaviour.
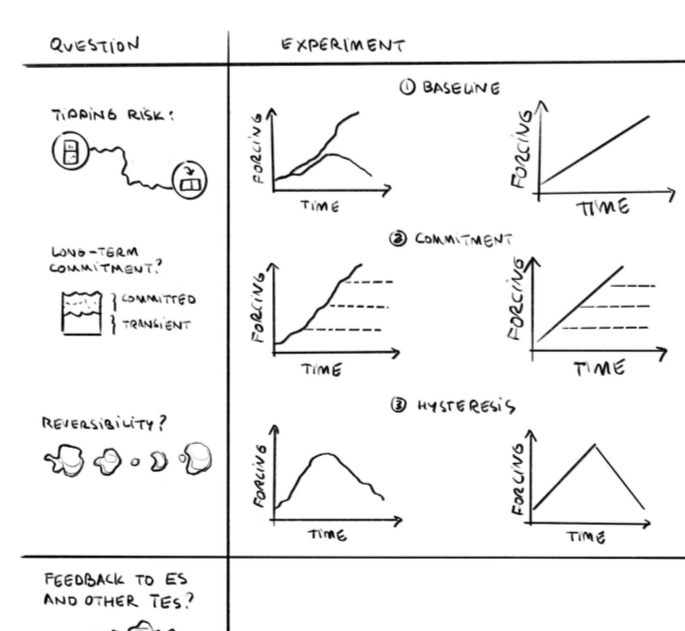
Winkelmann et al., *in prep*

Activities:
- Webinar series "Tipping Elements, Irreversibility, and Abrupt Change in the Earth System"
- Workshops
- Expression of interest for TIPMIP participation (online form)

https://aimesproject.org/tipping-elements-working-group/

Amazon Forest Degradation Activity

Goal: This activity brought together ecologist, social scientists, and Earth system modelers to develop an integrated understanding of degradation processes and impacts in the Amazon forest.

This figure illustrates a conceptual model of the drivers, impacts and feedbacks of Amazon forest degradation. In this analytical review, the current estimate of degraded Amazon forest by fire, edge effects, timber extraction and/or extreme drought is 0.3-2.5 x10⁶ km², which represents 4%-38% of all remaining forests in the region. Associated C-emissions total 0.05-0.2 PgC yr-1 are comparable to emissions from Amazon deforestation (0.06-0.21 PgC yr-1). Degradation can reduce dry-season evapotranspiration by up to 34% and impacts biodiversity generating uneven socioeconomic burdens. Projections suggest that degradation will remain a dominant source of C emissions to the atmosphere independent of deforestation rates. Therefore, policies should uniquely address degradation.
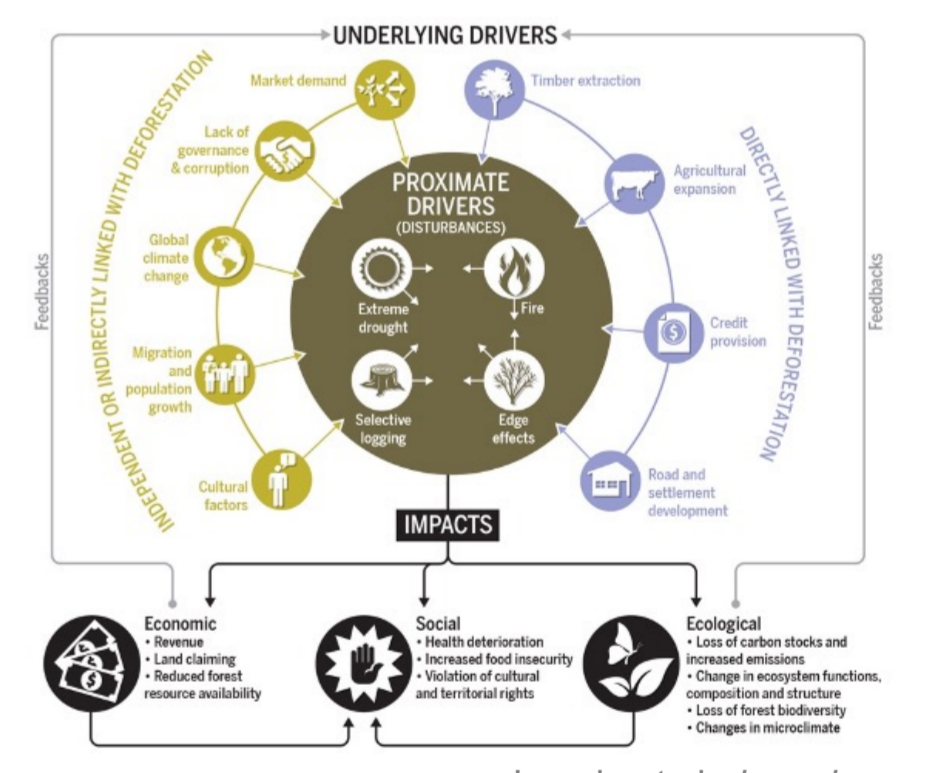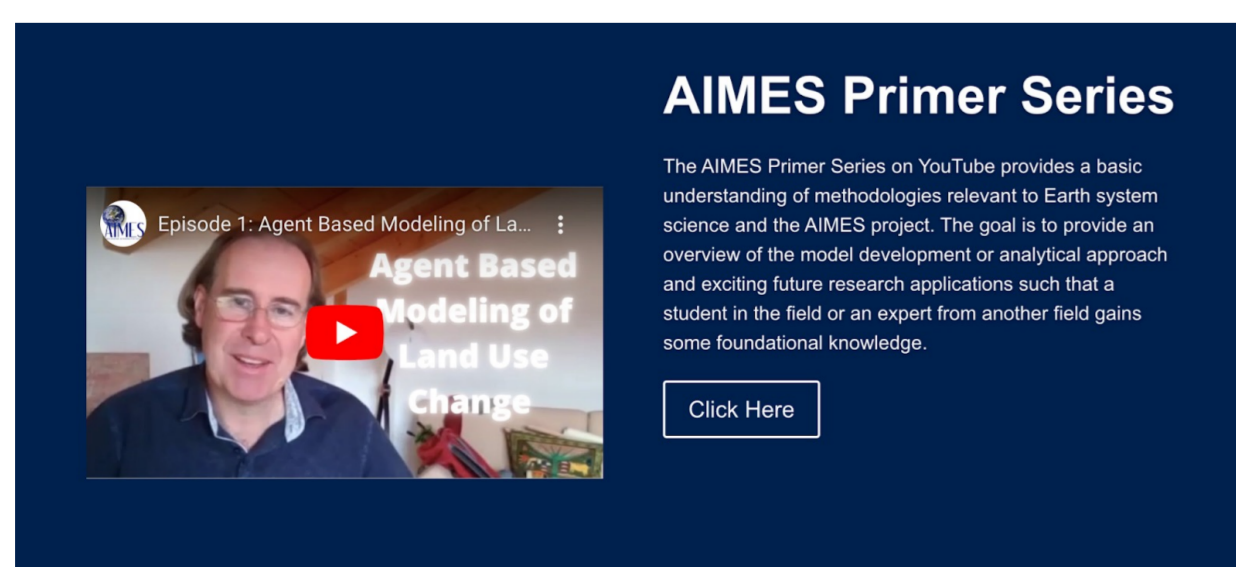
Lapola et al., *in review*

Publications:
Silva Junior CHL, Carvalho NS, Pessôa ACM, Reis JBC, Pontes-Lopes A, Doblas J, et al.: **Amazonian forest degradation must be incorporated into the COP26 agenda**. *Nat Geosci* 2021, **14**:634–635.
Lapola DM, Pinho P, Barlow J, Aragão LEOC, Berenguer et al., **Amazon forest degradation and its main disturbance drivers**. *In review.*

BRIDGING DISCIPLINES

AIMES Primer Series

The AIMES Primer Series on YouTube provides a basic understanding of methodologies relevant to Earth system science and the AIMES project. The goal is to provide an overview of the model development or analytical approach and exciting future research applications such that a student in the field or an expert from another field gains some foundational knowledge.

Click Here

AIMES is seeking to develop a compilation of educational resources that foster interdisciplinary research knowledge in Earth system science. Recent efforts include: an AIMES Primer Series, "Knowledge Exchange" webpages, and educational course development for certain working groups.

AIMES AND THE GRNs

- PAGES/AIMES Tipping Points workshop in Hamburg (2018)
- GLP/AIMES Working Group: Behavioural Models of Land Systems (2019 – present)
- ILEAPS/IGAC/GCP/AIMES SRI Session on Fire (2020)
- ILEAPS/Future Earth Coasts/GCP/AIMES SRI Session on Nature Climate Solutions (2021)

As an Earth system project, AIMES is supportive of deeper collaborations between GRNs to bridge knowledge gaps. How to make this a success?
– Formed through conversations between steering committees
– Target specific strengths of communities
– Other?

CONTACT US

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