



LSMS 2022
LAND SURFACE MODELLING SUMMIT

Eleanor Blyth and David Lawrence

***Steering Committee: Aaron Boone, Simon Dadson, Rosie Fisher,
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Administrative Support: Victoria Barlow, Marcia Spencer





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Land and Earth System models are increasingly being asked to provide information on societally-relevant impacts and adaptation associated with climate and environmental change

- Ecosystem vulnerability and impacts on carbon cycle and ecosystem services
- Water and food security in context of climate variability, change, and extreme weather
- Land-based mitigation solutions (net-zero targets); Impacts of land use and land-use change on climate, carbon, water, and extremes
- Hazard prediction (drought, floods, fire, heat waves, etc) under a changing climate
- *Understand and exploit sources of predictability from land processes, Earth System prediction*



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EDITORIAL | 16 August 2022

We must get a grip on forest science — before it's too late

Trees are one of our biggest carbon hopes. Supporting the scientists studying them should be a much higher priority.

Perspectives on the Future of Land Surface Models and the Challenges of Representing Complex Terrestrial Systems

Rosie A. Fisher, Charles D. Koven 

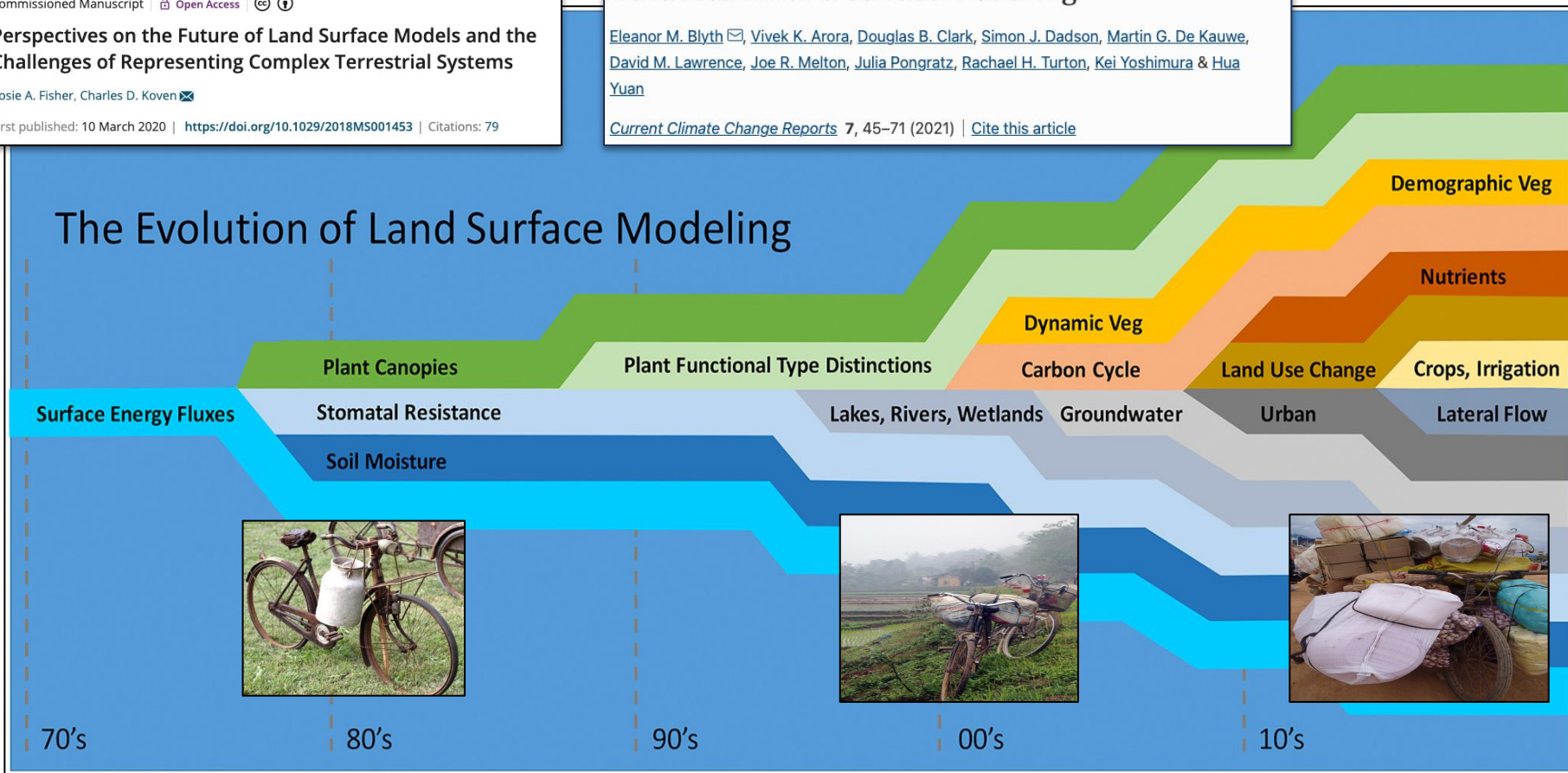
First published: 10 March 2020 | <https://doi.org/10.1029/2018MS001453> | Citations: 79

Advances in Land Surface Modelling

[Eleanor M. Blyth](#) , [Vivek K. Arora](#), [Douglas B. Clark](#), [Simon J. Dadson](#), [Martin G. De Kauwe](#),
[David M. Lawrence](#), [Joe R. Melton](#), [Julia Pongratz](#), [Rachael H. Turton](#), [Kei Yoshimura](#) & [Hua
Yuan](#)

Current Climate Change Reports **7**, 45–71 (2021) | [Cite this article](#)

The Evolution of Land Surface Modeling

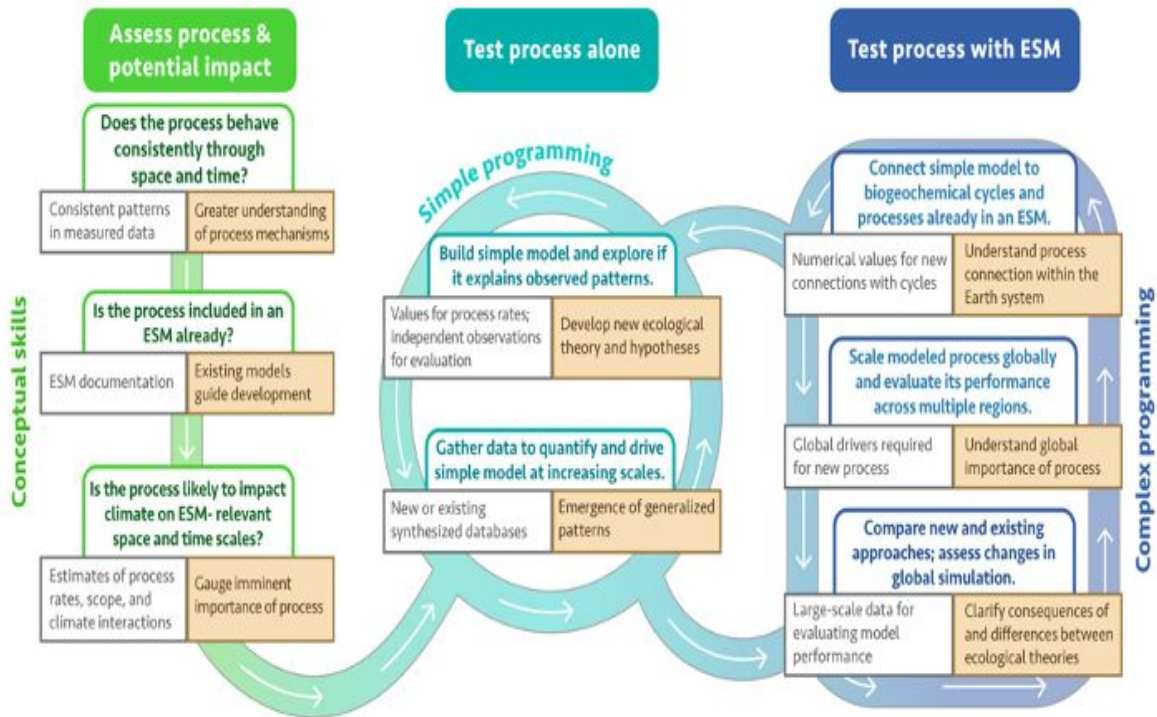




The Illusion:



The Reality:



Global Change Biology

REPORT | Open Access

Increasing the spatial and temporal impact of ecological research: A roadmap for integrating a novel terrestrial process into an Earth system model

Correction(s) for this article

Emily Kyker-Snowman Danica L. Lombardozzi, Gordon B. Bonan, Susan J. Cheng, Jeffrey S. Dukes, Serita D. Frey, Elin M. Jacobs, Risa McNellis, Joshua M. Rady, Nicholas G. Smith ... See all authors

First published: 20 September 2021 | <https://doi.org/10.1111/gcb.15894> | Citations: 2

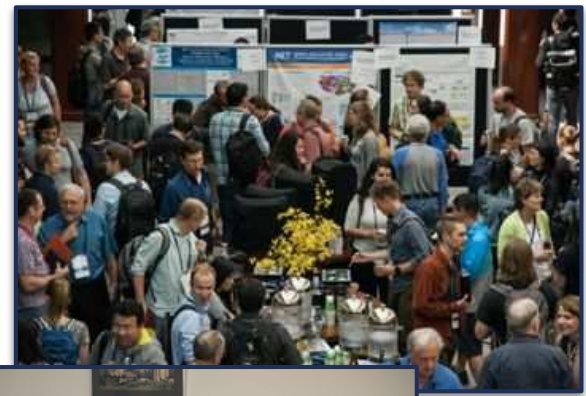
GH



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- Growing partnerships between modeling centers and academic and stakeholder communities are proving fruitful
- At same time, these partnerships put strains on modeling centers and expose limitations of current modeling systems



GitHub repository page for ESCOMP / CTSM (Public). The page shows a commit by billsacks titled "Merge branch 'fix_perched_water_table'" from 4 days ago with 6,780 commits. The repository structure includes folders like .github, bld, cime_config, and doc. The "About" section describes the Community Terrestrial Systems Model (CESM) and provides a link to the model's website. The "About" section also includes tags for ecosystem, climate, land, hydrology, ncar, clm, cesm, and land-surface-model.

Search or jump to... Pull requests Issues Marketplace Explore

ESCOMP / CTSM Public Edit Pins Unwatch 36 Fork 230

<> Code Issues 511 Pull requests 30 Actions Projects 22 Wiki Security Insights

master 16 branches 851 tags Go to file Add file Code

billsacks Merge branch 'fix_perched_water_table' 19c57a7 4 days ago 6,780 commits

.github	Point to CTSM-specific forums	10 months ago
bld	If fates_sp is turned on, make the default for soil_decomp_method to...	8 days ago
cime_config	Add LILAC test to the expected fails list	4 days ago
doc	Update ChangeLog	4 days ago

About
Community Terrestrial Systems Model
(includes the Community Land Model of CESM)
[www.cesm.ucar.edu/models/cesm2.0/...](http://www.cesm.ucar.edu/models/cesm2.0/)

ecosystem climate land hydrology
ncar clm cesm
land-surface-model



Goals of the Summit

Formal

- Collectively create a Road Map to address the challenges to improve land models so that they are fit for purpose to address scientific and societal needs associated with anthropogenically and naturally-driven environmental change
- Produce overview and technical reports, peer reviewed manuscripts, and/or plans for follow up meetings and working groups, which can be used as basis for modeling groups and collaborative partners to solicit funding to support development activities and to build a community effort to accelerate progress

Informal

- Develop a shared understanding of the ‘pain points’ in modern land model development and application
- Foster collaborative relationships to address these challenges





Goals of the Summit

Modeling groups represented

- JULES
- ORCHIDEE
- JSBACH
- LPJ-GUESS
- TESSEL
- CABLE
- ISBA
- CLM
- ELM
- GFDL-LM
- Matsiro
- GISS-LM
- *CoLM*
- *CLASSIC*





Breakout Sessions

- New approaches for subgrid heterogeneity
- Managing model complexity
- Towards sharing of modules across LSMs
- Input and forcing datasets
- Crop modeling and forestry
- Water and land management
- Coupling external models to LSMs
- Fire and humans
- Land model benchmarking
- Machine learning approaches and LSMs
- Parameter estimation and uncertainty

Goal of breakouts was to identify collaborative steps or activities that could be taken to accelerate progress

Participants asked to break down options according to cost (e.g., no cost, inexpensive (~\$5000), medium cost (~\$100,000), Super League (~\$5m)



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Recordings of presentations available from the conference webpage

<https://hydro-jules.org/land-surface-modelling-summit-conference-2022>



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We propose the formation of an **International Land Modeling Forum (ILMF)** through which the land modeling community can share ideas, promote relevant workshops, and form working groups to advance specific collaborative projects. Initiation of the ILMF is being led by:

- David Lawrence
- Eleanor Blyth
- Rosie Fisher
- Martin de Kauwe
- Sonali McDermid
- Philippe Peylin
- Aaron Boone
- Gab Abramovitz
- Julia Pongratz
- Charlie Koven
- Martyn Clark
- Kei Yoshimura
- Natasha McBean
- Simon Dadson



Near-term ILMF activities

- Create the ILMF! (ASAP)
- High level commentary (e.g., for Nature) that outlines the important societally-relevant needs from advanced land models: *Where are we going to grow our food? Where are we going to get our water? And, where is the carbon going to go?* and the scientific and technical barriers that need to be overcome
- Detailed Road Map manuscript that fleshes out the argument that technical barriers are impeding more rapid progress in land models and provides descriptions of paths forward that would alleviate these roadblocks
- Formation of Working Groups to (initiate in January, 2023):
 - Evaluate and implement shareable modules (focus initially on a few examples across different land model domains) and assess the potential of shared modeling frameworks
 - Develop a database and shared knowledge on input and forcing datasets
 - Determine new data set needs and pathways to better integrate humans into land models including interactions with LUH group and IAMs
 - Develop shared methods for parameter uncertainty assessment and estimation
- Note that other international coordinating bodies such as AIMEs, ILEAPS, and GEWEX/GLASS can provide complimentary expertise and provide a natural extension/links into other interdisciplinary communities.