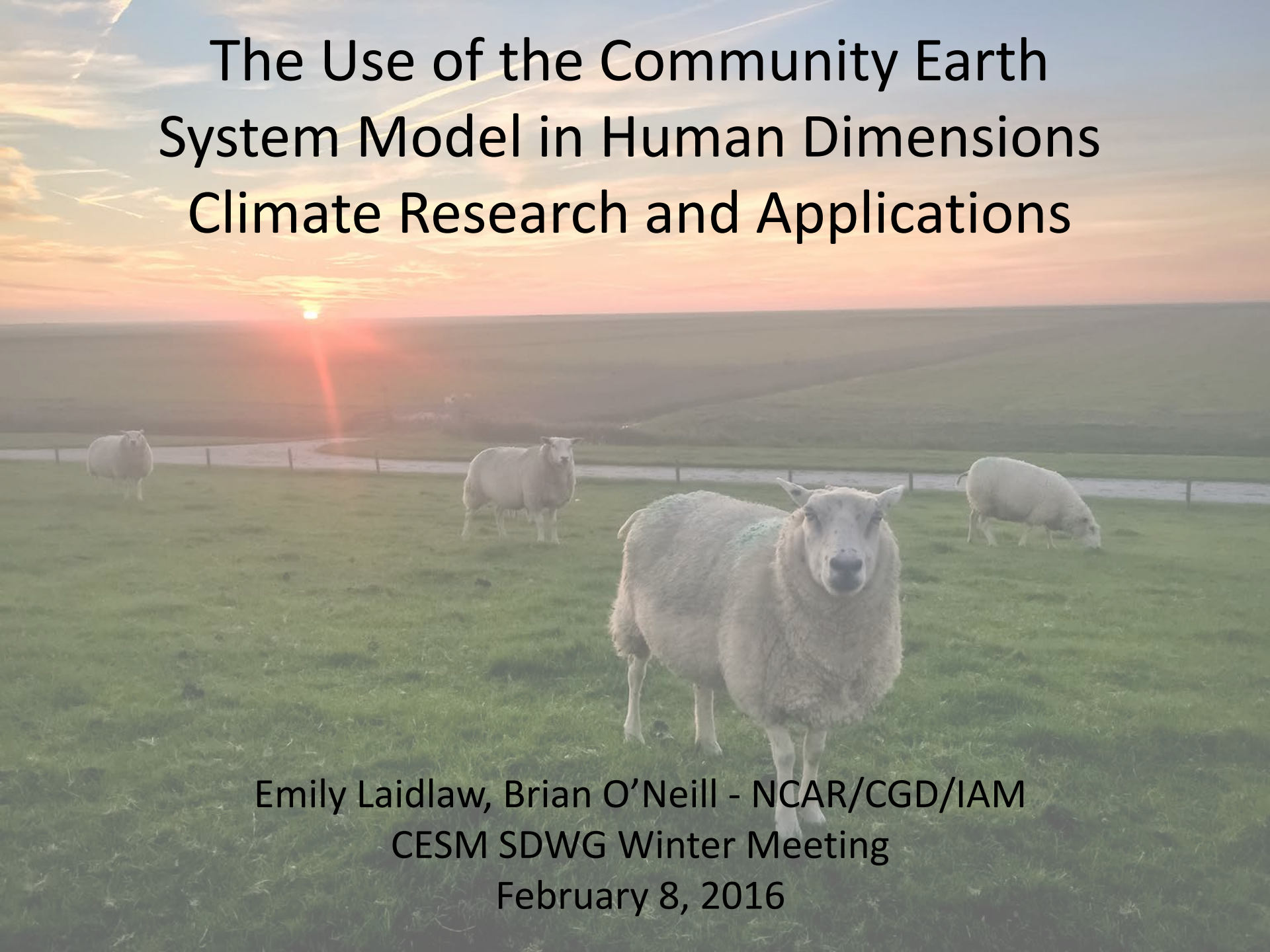
# The Use of the Community Earth System Model in Human Dimensions Climate Research and Applications



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CESM SDWG Winter Meeting

February 8, 2016

# BACKGROUND

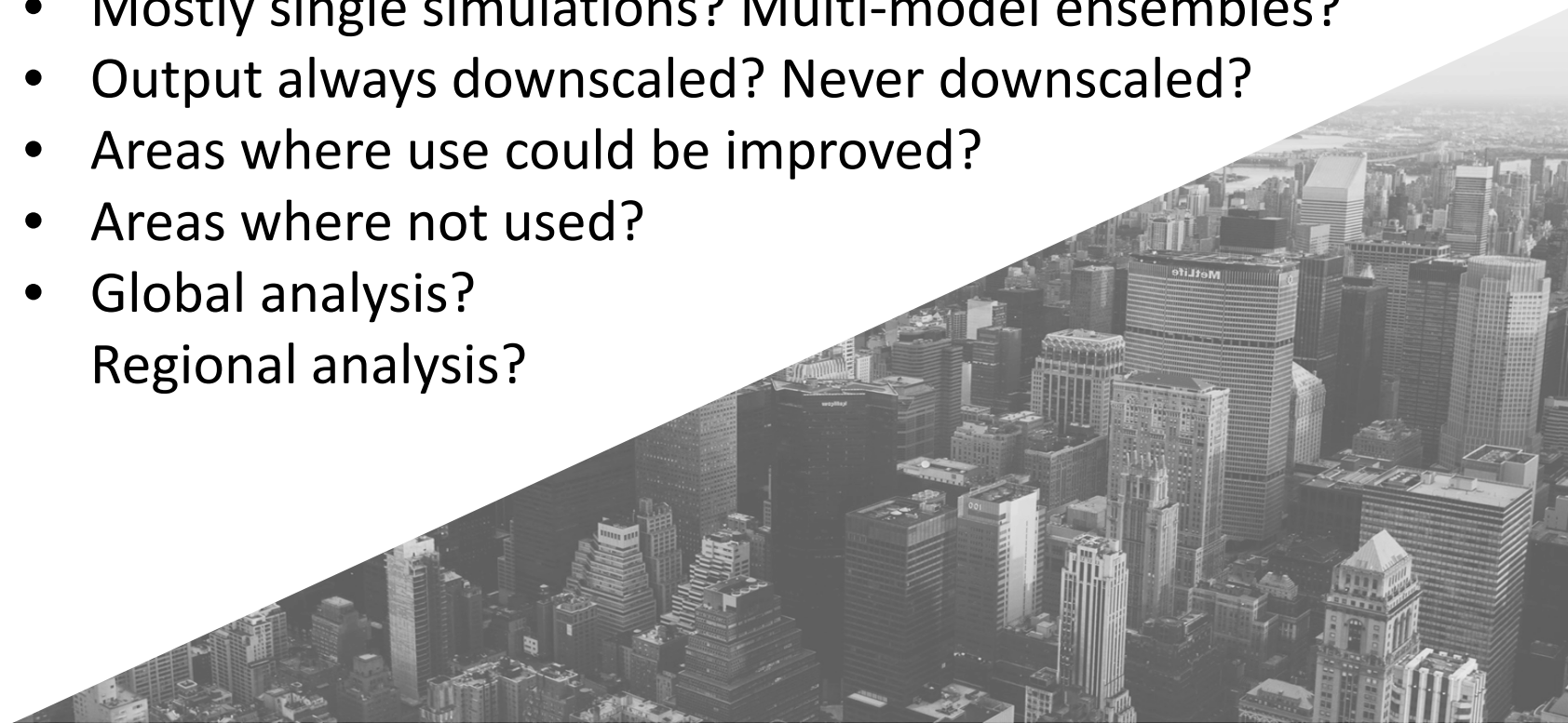
SDWG Mission:
Improve understanding of the interactions between human and earth systems by enhancing CESM and its application through studies of climate change impacts, adaptation, and mitigation that use CESM output in their analyses.

*To improve model development and application, we need to know who uses CESM in human dimensions work and for what purpose.*

# MOTIVATION

What do we know about use of CESM in human dimensions work? No synthesis exists.

- In what research areas is CESM used?
- How often used for physical  vs societal assessments?
- Mostly single simulations? Multi-model ensembles?
- Output always downscaled? Never downscaled?
- Areas where use could be improved?
- Areas where not used?
- Global analysis?
  Regional analysis?

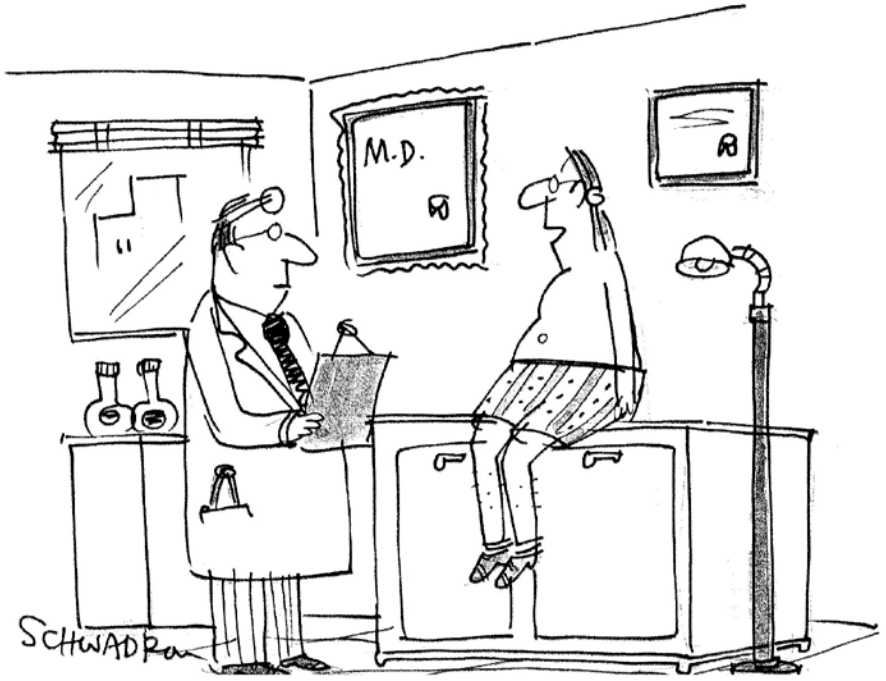


# GOALS FOR THIS REVIEW

- ✓ Develop framework to quantify use of CESM
- ✓ Answer questions relevant to the SDWG
- ✓ Present a synthesis on the use of CESM output
- ✓ Provide recommendations to SDWG and CESM community on facilitating, improving, and increasing the use of CESM

# A FEW CHALLENGES & CAVEATS

- ✓ Broad topic
- ✓ Still in early stages
- ✓ CESM history
  - Names
  - Components
- ✓ Papers not written with review in mind
- ✓ Overlap/gray areas
- ✓ Not exhaustive
- ✓ Not a modeler




"No, I don't take any drugs, but I do have a $50 a day latte habit."

Truth in advertising

# AN IMPORTANT DEFINITION

What do we mean by “human dimensions climate research and applications”?

- Research or applications whose results are directly relevant to improving understanding of how society contributes to climate change, is influenced by it, or takes action to respond to it.
- Human dimensions-related goal must be explicitly stated in abstract or title

# BOUNDARIES FOR THIS REVIEW

Timeline: 2004-2016

CESM Versions: CCSM 3, CCSM 4, CESM 1

System categories: Societal systems, managed systems, ecosystems, relevant physical systems

Literature types: Major scientific assessments, research projects, and reports; multi-model ensemble efforts; journal articles

Manageable approach: Informative but not exhaustive

# WHAT INFORMATION AM I COLLECTING?

- Currently in Google sheet
- Possibility of online database

| BASIC INFO | PRIMARY/ SECONDARY SYSTEM | SYSTEM OUTCOME | PRIMARY/ SECONDARY RES. AREA | TYPE OF OUTPUT | MODEL SPECIFICS | STUDY SCOPE |
|---|---|---|---|---|---|---|
| ✓ Title | ✓ Societal system | ✓ Health | ✓ Impacts | ✓ Single simulation | ✓ Model version | ✓ Timeframe |
| ✓ Author | ✓ Managed system | ✓ Economy | ✓ Mitigation | ✓ Initial cond. ensemble | ✓ Resolution | ✓ Global |
| ✓ Affiliation | ✓ Ecosystem | ✓ Crops | ✓ Adaptation | ✓ Small multi-model ensemble | ✓ Offline, component | ✓ Regional |
| ✓ Source | ✓ Relevant physical system | ✓ Managed forests | ✓ Emissions | ✓ Large multi-model ensemble | | ✓ City |
| ✓ Year | | ✓ Biodiversity | | ✓ Downscaled? | | |
| ✓ Summary | | ✓ Species range | | ✓ Bias-corrected? | | |
| | | ✓ Sea level rise | | | | |
| | | ✓ Tropical cyclones | | | | |

# SYSTEM CATEGORIZATION

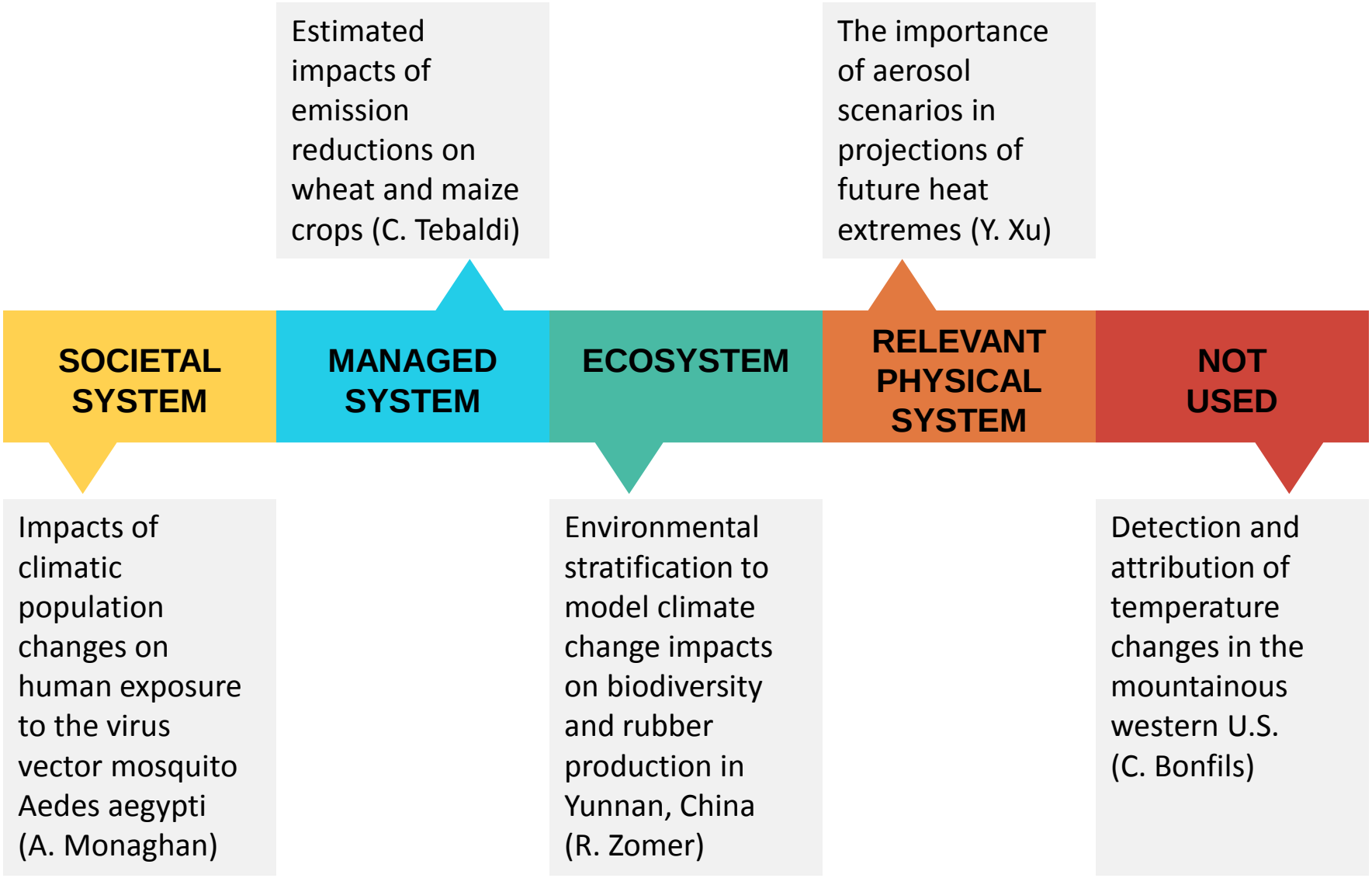
**SOCIETAL SYSTEMS**
Health
Economy
Energy use

**MANAGED SYSTEMS**
Crops
Managed water
Managed forests

**ECOSYSTEMS**
Biodiversity
Species range
Ecosystem viability

**RELEVANT PHYSICAL SYSTEMS**
Extreme temp.
Sea level rise
Tropical cyclones

# EXAMPLE CLASSIFICATION BY PRIMARY SYSTEM

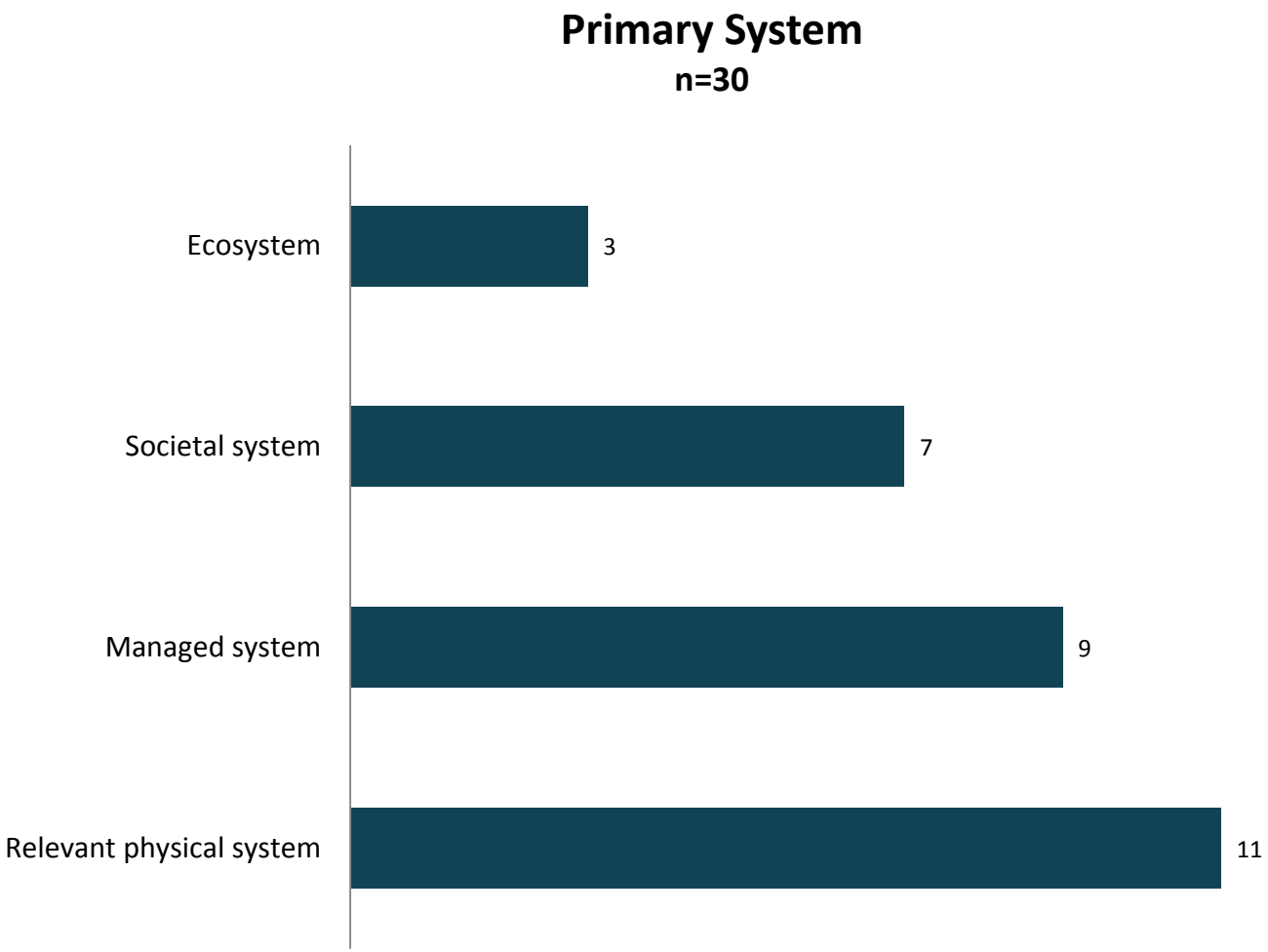


# EXAMPLE PAPER USING FRAMEWORK

| Title | Primary Author | Affiliation | Source | Year | Summary | Primary System | Secondary System | System Outcome | Primary Research Area | Secondary Research Area |
|---|---|---|---|---|---|---|---|---|---|---|
| Projecting trends in high-mortality heatwaves in 82 U.S. communities in 2061-2080 under climate, population, & adaptation | G. B. Anderson | Colorado State University | To be published | To be published | Applies health-based models to project trends in high-mortality heatwaves in 82 US communities in 2061-2080. Results suggest RCP4.5 could substantially decrease exposure to high-mortality heatwaves. | Societal System | N/A | Health | Impacts | Adaptation |

| Model Version | Resolution | Scale of Analysis | Timeframe | Type of output | CESM Component (if offline) | Offline or Coupled | Downscaled | Bias-corrected | Notes |
|---|---|---|---|---|---|---|---|---|---|
| CESM 1.0 | 1 degree | City level | 2061-2080 | Initial condition ensemble | N/A | Coupled | Yes | No | Used gravity-type downscaling model (Jones and O'Neill 2013) to create gridded projections of the US population for two Shared Socioeconomic Pathways (SSP3 and SSP5). |

# PRELIMINARY RESULTS



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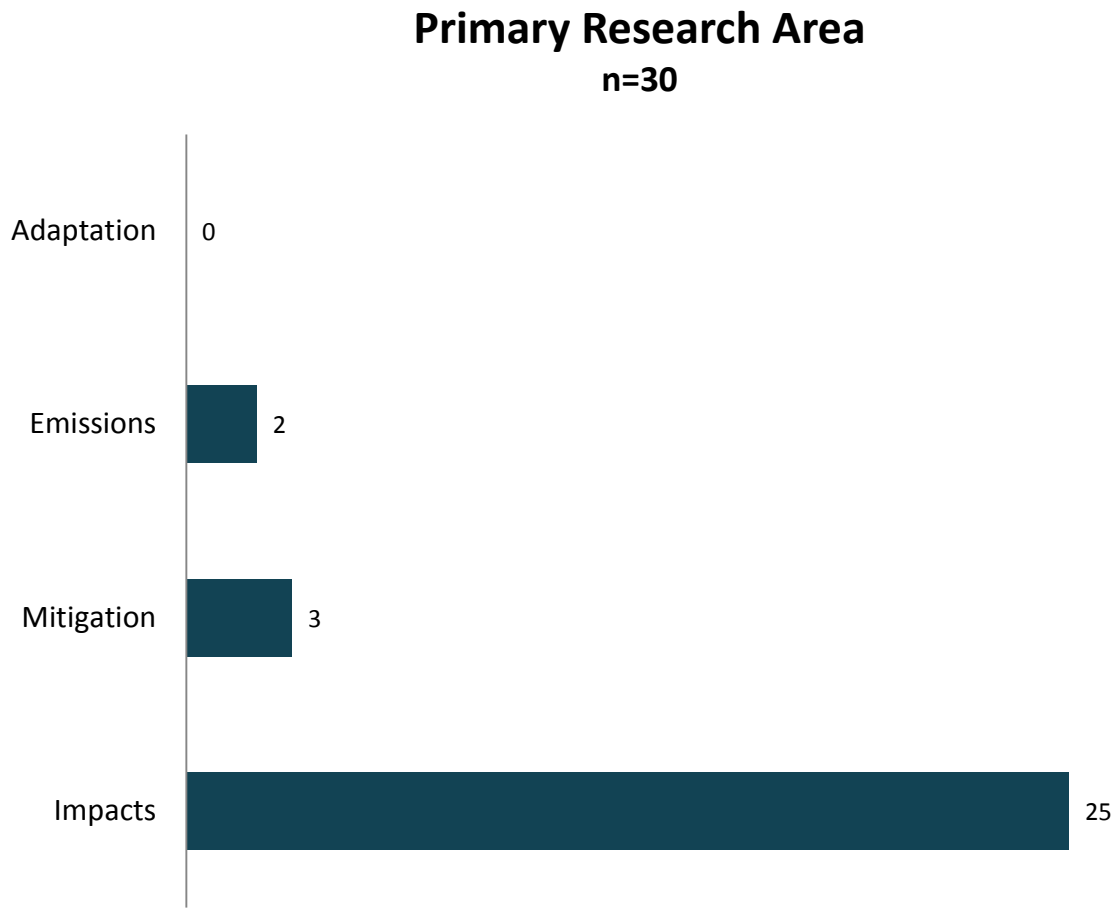

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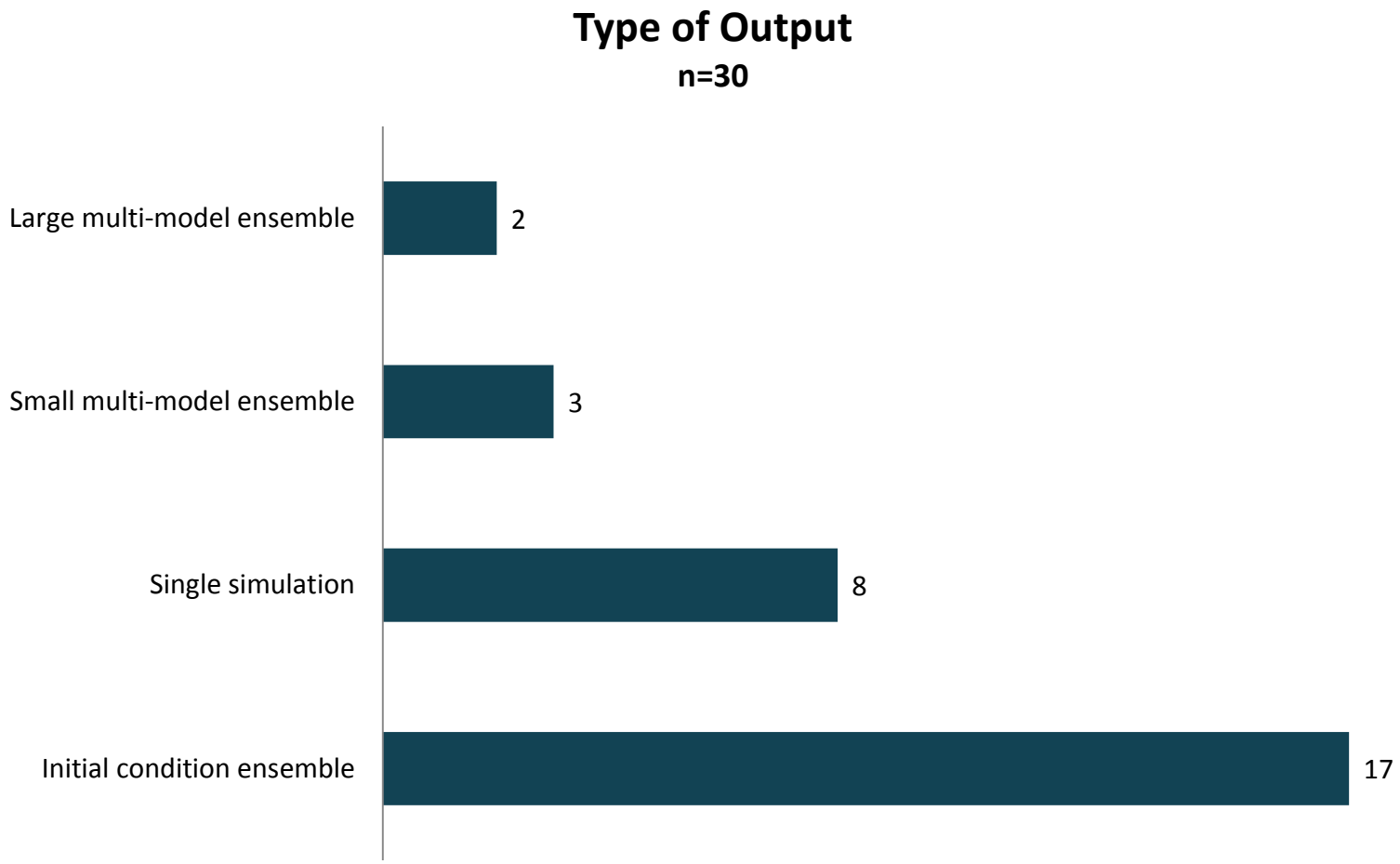

# HOW CAN YOU HELP?

- Your input can help refine this review
- Want to collect right information initially

# FEEDBACK WANTED & APPRECIATED

**Research Questions:**
What would you like to know from this review?
What kind of recommendations would be useful to SDWG/CESM?

**Literature**
Do you have papers that would fit into this review?

**Additional Feedback**
Other suggestions and feedback?

# THANK YOU!

## QUESTIONS? COMMENTS?


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# WHERE AM I FINDING THIS INFORMATION?

## MAJOR SCIENTIFIC ASSESSMENTS

IPCC
Millennium Ecosystem
U.S. National Climate Assessment



## CESM PUBLICATIONS LISTS

CESM journal pubs. list online
CLM journal pubs. list online
Other similar lists

## MAJOR RESEARCH PROJECTS

BRACE
ISI-MIP
AgMIP
EU Projects

## SCHOLARLY LITERATURE REVIEW

Searchable database
Targeted keyword strategy

## MODEL INTERCOMPARISON PROJECTS

CMIP 3
CMIP 5

## NGO REPORTS