Advancing (cross-sectoral) papers

- **What do we want to contribute to the next IPCC AR7?**

What do we want to contribute to the IPCC-AR7?

- **Present an example of how ISIMIP3 data are used in practice**
- **Discuss emerging paper ideas contributing to the IPCC's AR7**
- **Identify gaps which the ISIMIP community could help to fill**

Funded by the European Union

Aims & Outline

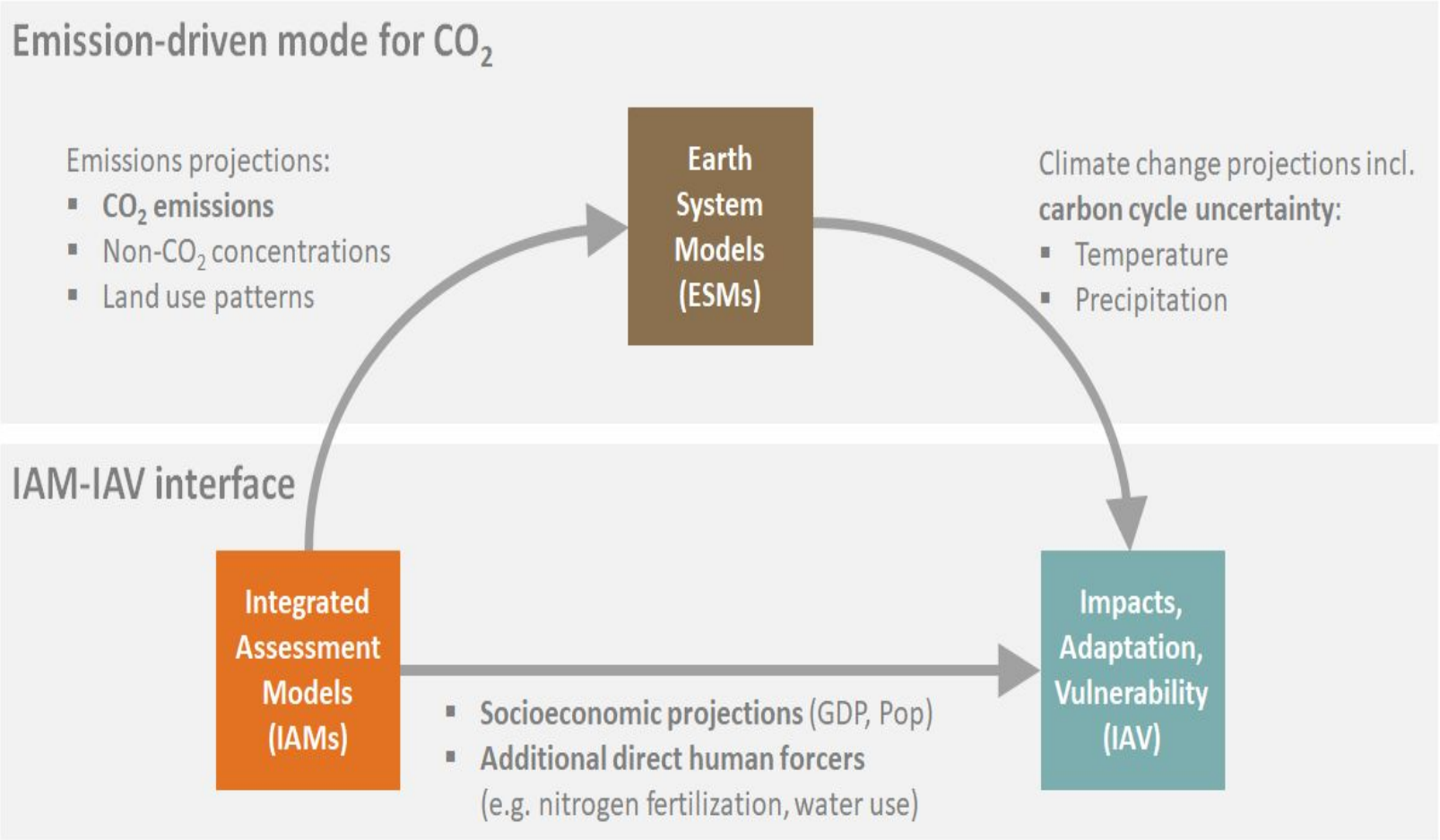
Topic	Time	Presenter
How ISIMIP data are used for physical risk assessments in finance	10 mins	Terrence Thompson
Overview of th		o (PIK)
to AR7		
Presentation a		
Where are the		

Miro-board for paper ideas

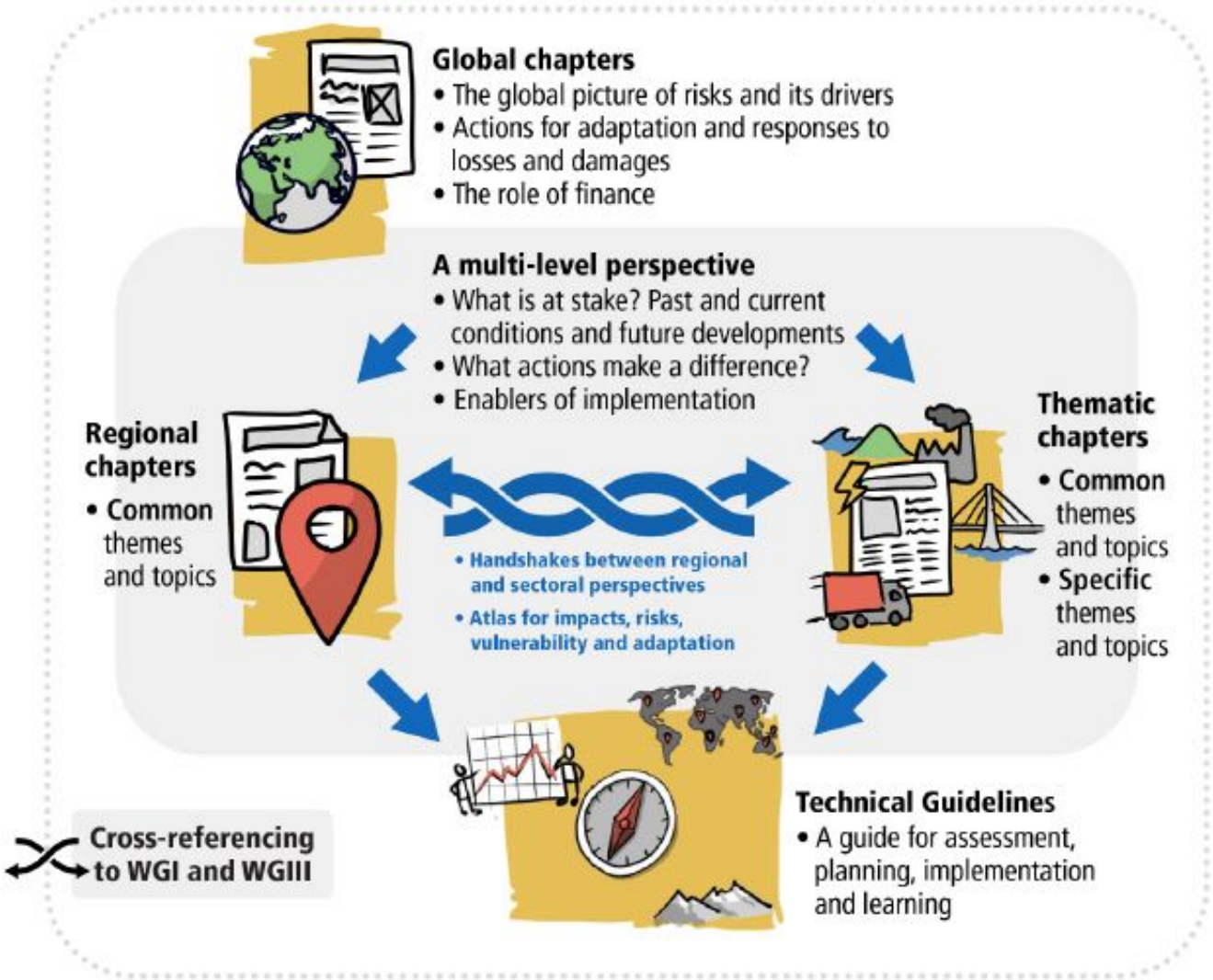
https://tinyurl.com/paperIdeasAR7

Towards the 7th Assessment Report of the IPCC

- Foster enhanced integration of impacts into scenarios (as done by ISIMIP) to support consistent assessment and the opportunity to address policy-relevant questions for example, the impacts of overshoot
  [Pirani et al., 2025]



Structure of working group II contribution



Technical Guidelines

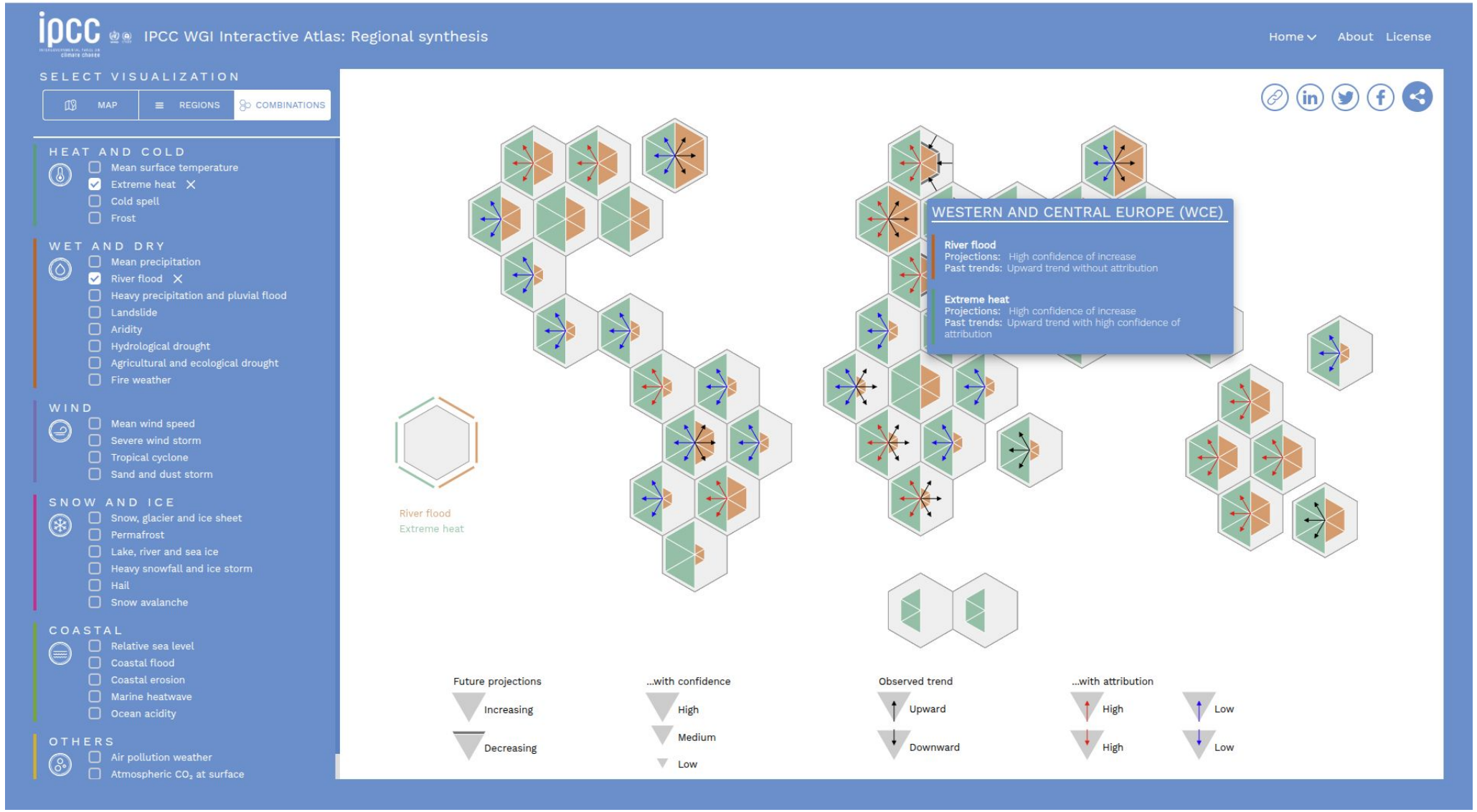
- Update IPCC Technical **Guidelines** on **Assessing Climate Change Impacts and Adaptation** (from 1994)
- **Interactive Atlas** on hazards, vulnerability, exposure, impacts, risks, adaptation, and responses to losses and damages

ISIMIP Inter-Sectoral Impact Model Intercomparison Project

OptimESM Optimal high resolution **Earth System Models** for exploring future climate change

Funded by the European Union

The WG1 Atlas in AR6



Global Assessment Chapters

Intro

- Chapter 1: Point of departure, framing and key concepts

Global Assessment Chapters

- Chapter 2: Vulnerabilities, impacts and risks
- Chapter 3: Current adaptation progress, effectiveness and adequacy (-> “ex post”)
- Chapter 4: Adaptation options and conditions for accelerating action (-> “ex ante”)
- Chapter 5: Responses to losses and damages
- Chapter 6: Finance

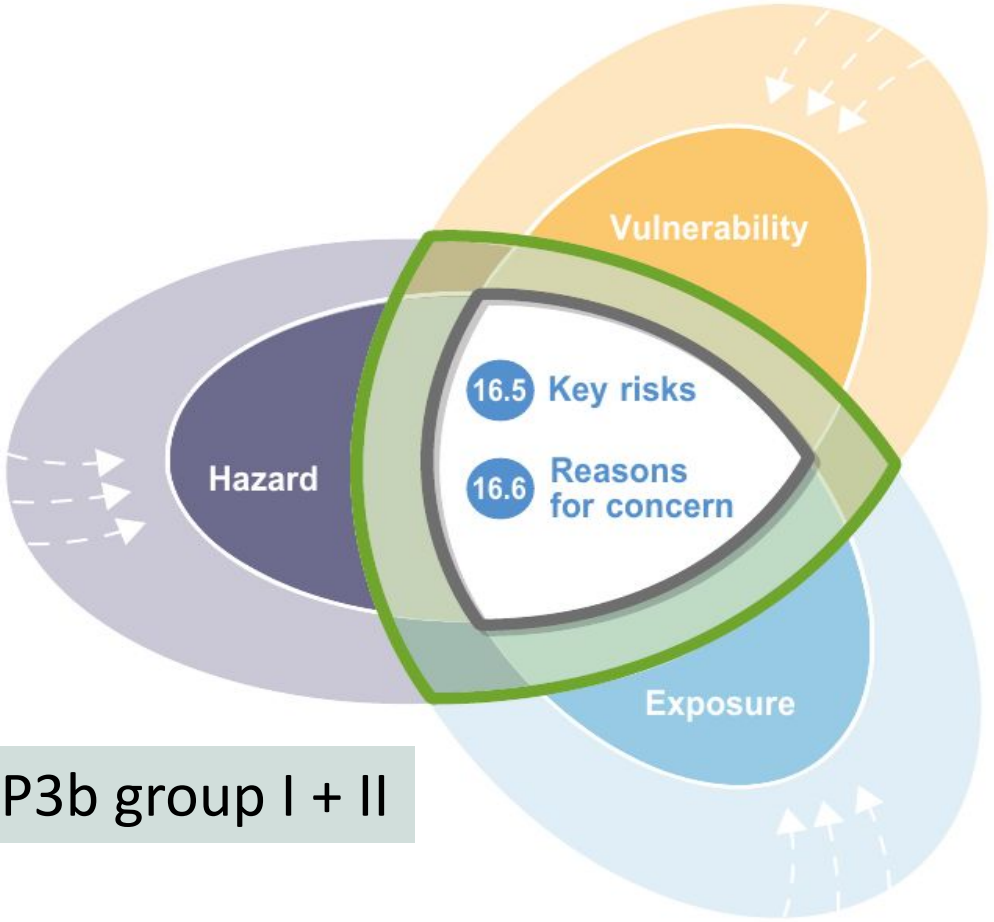
Chapter 2: Vulnerabilities, impacts and risks

- Multiple dimensions of vulnerability across temporal and spatial scales
- **Synthesis of observed and projected** reversible and irreversible **impacts**, building on both slow to rapid onset events and climate extremes, including quantification, **detection and attribution** as appropriate
- Assessment of methodologies and synthesis of **observed and projected economic and noneconomic losses and damages**
- **Key risks** including complex, compound, cascading, reversible, irreversible and residual risks under a range of **climate scenarios**, and different levels of global warming, **development, adaptation and other responses**
- **Risk assessments** across scales

Definition of Representative Key Risks (AR6 Ch. 16.5)

"**Representative key risks** are expected to increase in the coming decades and will **depend** strongly not only on how much **climate change** occurs, but also on how the **exposure and vulnerability of society changes**, as well as on the extent to which **adaptation efforts** will be effective enough to substantially reduce the magnitude of severe risks."

ISIMIP3b group III



ISIMIP3b group I + II

ISIMIP3b group III

Representative Key Risks (RKR)

Systems

- Risk to low-lying coastal socio-ecological systems
- Risk to terrestrial and ocean ecosystems

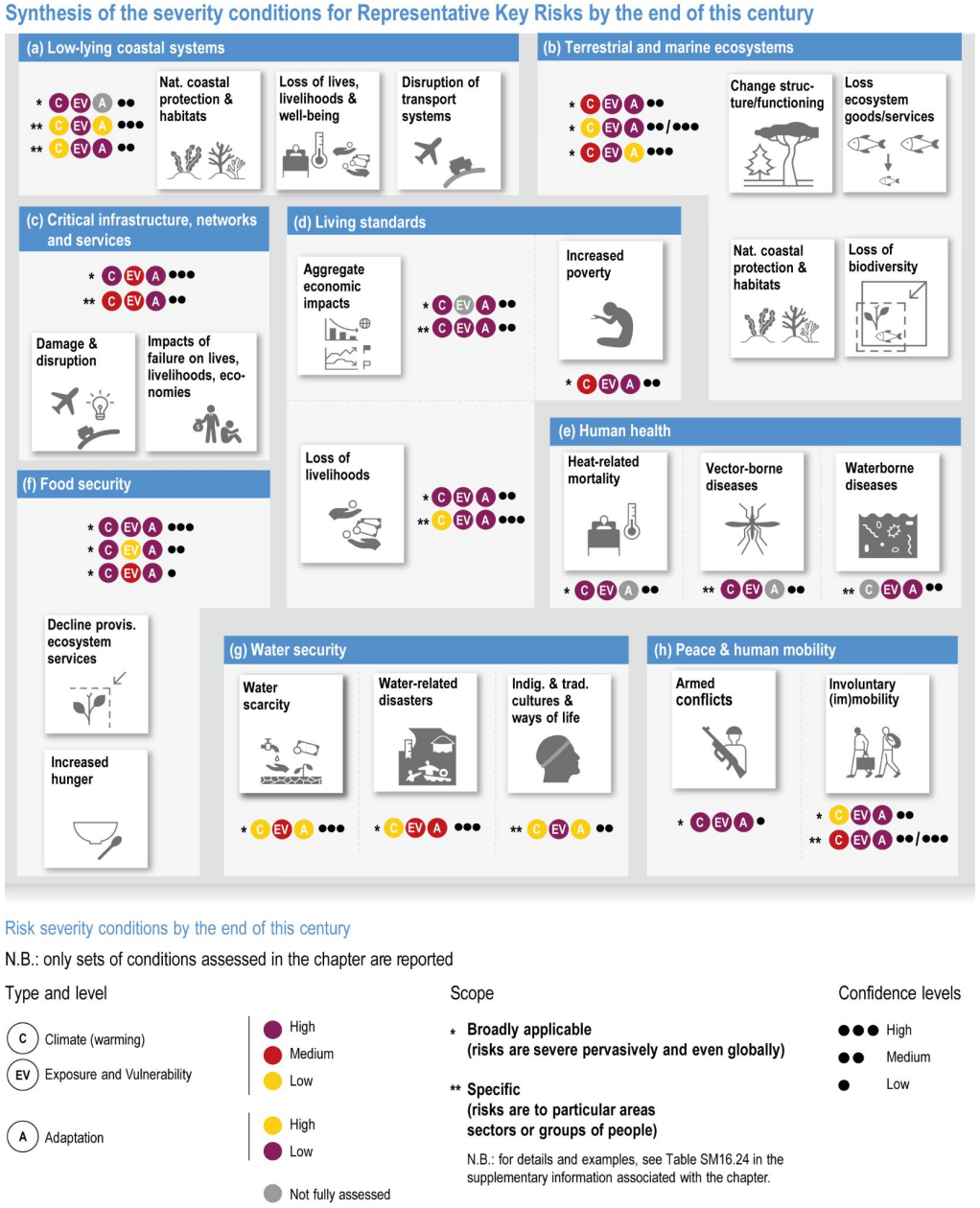
Sectors

- Risk to critical infrastructure
- Risk to living standards
- Risk to human health
- Risk to food security
- Risk to water security

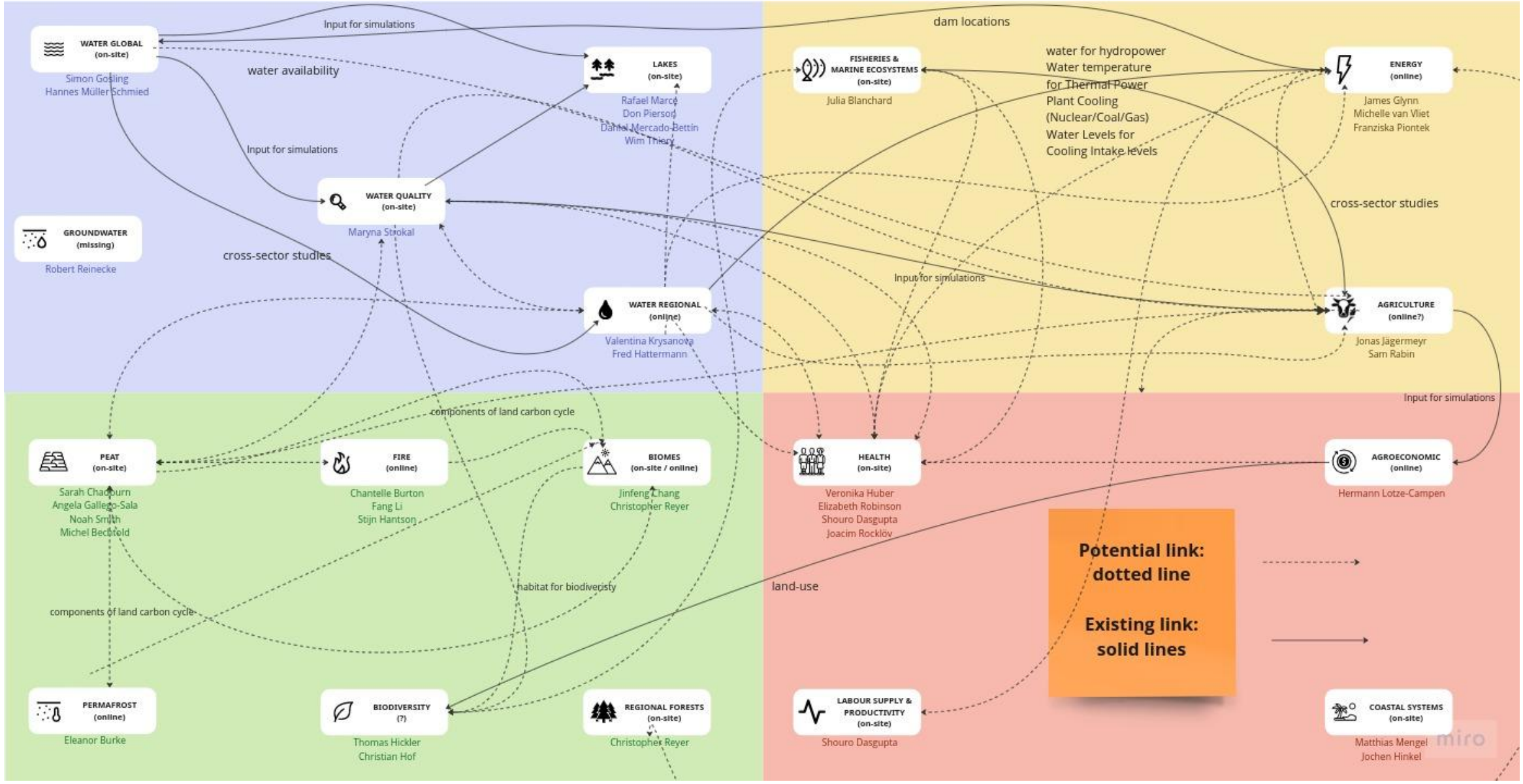
Topics

- Risk to peace and human mobility

Under which (future) climate and socioecon. conditions will these risks become severe?



Sectoral interlinkages within ISIMIP relevant for RKR assessments (ISIMIP Workshop in Prague 2023)



Chapter 3 — 6 Adaptation, Loss & Damage, Finance

Chapter 3 Current adaptation progress, effectiveness and adequacy (-> “ex post”)

- Adaptation progress, gaps, **limits**
- Adaptation costs, **trade-offs**, benefits and co-benefits
- Evidence of **effectiveness**

Chapter 4: Adaptation options and conditions for accelerating action (-> “ex ante”)

- **Effectiveness** and feasibility of adaptation options considering current context, interdependencies, and a range of climate scenarios, development, and adaptation
- Approaches for monitoring and evaluation
- Drivers, enablers and conditions for accelerated adaptation action

Chapter 5: Responses to losses and damages

- Approaches of categorizations and metrics to assess losses and damages

Chapter 6: Finance

Regional Assessment Chapters 7-13

Regions

- Africa, Asia, Australasia, Central and Southern America, Europe, North America, Small Islands

Common bullet points across regional chapters and thematic chapters (selection)

- Multiple dimensions of **vulnerability and adaptive capacity** across temporal and spatial scales
- **Observed and projected impacts**, including economic and non-economic losses and damages
- **Key risks**
- **Adaptation progress**, options, solutions, gaps, limits and barriers
- **Range of adaptation options** and responses to losses and damages, means of implementation, costs, benefits, effectiveness and feasibility of different options
- **Distributional nature of effects**
- **Linkages of adaptation** with **sustainable development** and climate resilient development, including **co-benefits, synergies, trade-offs and opportunities** for innovation and transformation

Thematic Assessment Chapters

- **Chapter 14: Terrestrial, freshwater and cryospheric biodiversity, ecosystems and their services**
- **Chapter 15: Ocean, coastal and cryospheric biodiversity, ecosystems and their services**

  - **Vulnerability, resilience and climate change feedbacks** of biodiversity, ecosystem structure and functions
  - **Emerging threats, challenges** and management of risk to critical biodiversity, ecosystems, critical species and related cultural heritage

Thematic Assessment Chapters

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- **Chapter 15: Ocean, coastal and cryospheric biodiversity, ecosystems and their services**

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Thematic Assessment Chapters

Chapter 16: Water

- **Water security** addressing the issues of too little, too much, and polluted water in the context of climate change
- **Water scarcity** in arid and semi-arid regions
- **Water management** across scales including non-economic and cultural values of water

Chapter 17: Agriculture, food, forestry, fibre and fisheries

- **Adaptation options for agricultural production and food and nutritional security**, considering affordability, dietary diversity, accessibility, agency and sustainability
- **Synergies and trade-offs concerning land and ocean use**
- **Adaptation options for key vulnerable groups** such as smallholder farmers, women farmers, pastoralists, forestry, artisanal and traditional fishing dependent communities

Thematic Assessment Chapters

Chapter 18: Adaptation of human settlements, infrastructure and industry systems

- **Adapting infrastructure,** industry, energy systems and human settlements to reduce risk
- Developing and utilizing **climate resilient infrastructure**

Chapter 19: Health and well-being

- **Observed impacts and projected risks** from factors such as extreme weather, emerging pathogens, and infectious diseases to physical and mental health
- **Intersectionality** of **drivers of vulnerability and exposure to climate hazards** across populations and communities
- **Intersection between climate change, health and wellbeing, and non-climatic drivers** of health and other health determining factors

Thematic Assessment Chapters

Chapter 20: Poverty, livelihoods, mobility and fragility

- **Interaction of climate change and development with poverty**, vulnerability and livelihoods
- **Human mobility**, including transhumance in the context of climate change
- **Risks and adaptation** in fragile contexts, and in contexts of **social unrest and conflict**
- **Integrating adaptation and resilience** into efforts towards **poverty eradication**, livelihood enhancement, formal and informal social protection mechanisms

Annex I: Atlas

- Inter- and intra-regional mapping of hazards, vulnerability, exposure, impacts, risks, adaptation, and responses to losses and damages

Paper ideas — Global Assessment Chapters

Chapter 2: Vulnerabilities, impacts and risks

Key risks

1. Different futures are possible: scenario outcomes for the world

- Original idea: Brian O'Neill
- Outcome-focused scenario paper - what do different scenarios mean in terms of
  - socioeconomic development -> SSPs
  - climate change impacts (human and ecosystem) -> ISIMIP (+ other?) - input from all sectors needed!
  - mitigation risks -> IAM modeling
  - adaptation challenges -> ?
- Synthesis around the total risks (related to representative key risks)
  - Outcomes for wellbeing and development, in particular risks under a high warming scenario
  - Benefits and risks of mitigation
  - Residual risks under mitigation – need for adaptation
- Quantitative and qualitative elements – modeling, literature, story-telling
- set of 3-4 scenarios spanning the range

2. Agri-food systems labour force under overshoot scenarios

- Potential amplification of adverse effects on labour force in the agri-food systems under various scenarios, focusing on long-term distributional implications
- Understanding these dynamics is crucial for assessing path dependencies in labour markets that persist beyond temperature stabilisation periods
- Higher temperatures and increased frequency of heatwaves
- Thereby have an impact on the labour force which would lead to wage losses and shifts of labour between sectors
- A key issue is whether the difference in labour impact between the overshoot and non-overshoot scenario is substantial enough to derive a difference to inform policy decisions
- Integrate empirical damage-functions in MAgPIE, IMACLIM-R, and IMAGE to quantify the interplay between climate mitigation pathways and labour force adaptation
- As such allowing multi-model intercomparison framework consistent with ISIMIP protocols

2. Agri-food systems labour force under overshoot scenarios

- Drawing on spatially resolved temperature emulations for these pathways, we will compare labour losses under various scenarios from ScenarioMIP that could include overshoot
  - Is the difference in labour impacts and distributional implications between overshoot and non-overshoot scenarios significant enough to inform policy decisions?
- Development of resilient net zero pathways requires explicit integration of climate adaptation strategies with mitigation objectives
- Particularly in agri-food systems where labour dynamics and ecosystem services intersect.
- Building on ISIMIP4's cross-sectoral modelling capabilities, our enhanced framework addresses three critical dimensions of this integration
  - Evaluate economics of adaptation
  - Identify heat stress thresholds that trigger irreversible labour force disruptions
  - Evaluate cost-benefit of pre-emptive adaptation versus reactive strategies

Paper ideas — Global Assessment Chapters

Chapter 2: Vulnerabilities, impacts and risks

Key risks

3. Project direct economic damage of tropical cyclones, fluvial floods, and droughts under climate and socioeconomic change (Otto et al.). Needs: 3b group III global water model runs

Discussion — Key Risks

Paper ideas — Global Assessment Chapters

Chapter 2: Vulnerabilities, impacts and risks

Attribution

1. Attributing changes in TC-induced surge areas (Mengel et al.)
2. Landfalling Tropical Cyclones: Investigating Rainfall Trends under Climate Change (Hamester et al.)
3. Attributing river flood damage to climate and socioeconomic drivers, globally (Sauer et al.)
4. Attributing changes in global soil moisture drought characteristics (Koutroulis et al.)
5. Attributing tropical cyclone damage (in the U.S. and globally) (Hassel et al.)
6. Attributing changes in labour force and food insecurity (Dasgupta et al. and Robinson et al.)

Chapter 3: Current adaptation progress, effectiveness and adequacy (-> “ex post”)

Chapter 4: Adaptation options and conditions for accelerating action (-> “ex ante”)

Chapter 5: Responses to losses and damages

Chapter 6: Finance

Discussion — Attribution

Paper ideas — Regional Assessment Chapters 7-13

Regions

- Africa, Asia, Australasia, Central and Southern America, Europe, North America, Small Islands

Europe

1. The Social Costs of River Floods in Europe (Hassel et al.) Needs: 3b group III global water model runs

Asia

2. Tropical cyclone-induced societal tipping dynamics.
    - Can the intensification of tropical cyclones under global warming trigger societal tipping points in tropical cyclone-prone developing countries (Sauer et al., ISIMIP3b group II)

Small Islands

3. Construct a climate vulnerability index for SIDS using ISIMIP3b Group II projections (exposure; temp, runoff +...), combined with socioeconomic data to cover adaptive capacity (e.g. GDP, access to electricity, education) and sensitivity (e.g. pop density, agri dependence) (Gosling et al.).

Discussion — Regional

Paper ideas — Thematic Assessment Chapters

Chapter 14: Terrestrial, freshwater and cryospheric biodiversity, ecosystems and their services

1. Future biosphere functioning ==> Focusses on biosphere integrity (using established biosphere integrity/stability metrics) under different climate and land-use scenarios (Stenzel et al., ISIMIP3b group III)
2. Considers the role of N-cycling for the land carbon sink, only uses ISIMIP biomes models that include a fully coupled nitrogen cycle and sensitivity experiments of switching the Nitrogen cycle on and off (S. Kou-Giesbrecht et al.)
3. Focusses on the GHG balance of Mongolian/Asian rangelands under extant and future climate change (N. Banzragch et al.).
4. Uses fire and permafrost simulations from 3b group-ii to include impacts on burned area and permafrost emissions in a climate emulator (B. Zhu et al.)
5. Link vegetation productivity changes under climate change into the global IAM GCAM (M Luo et al. 2025)
6. Link forest productivitiy changes under climate change into the global forest economics model GTM and dynamic optimization (J. Kim et al.)
7. A third of land vertebrates geographic range exposed to multiple extreme events by 2085 (Heinicke et al. submitted)

Paper ideas — Thematic Assessment Chapters

Chapter 15: Ocean, coastal and cryospheric biodiversity, ecosystems and their services

1. Sudden and gradual climate impacts threaten global food systems in a world connected by trade (FishMIP & AgMIP 3b data – led by Aurore Maureaud; in review at Nature Food)
2. Climate change risks to feeding our food (FishMIP and AgMIP 3b data – led by Julia Blanchard; in prep.)

Discussion — Ecosystems

Paper ideas — Thematic Assessment Chapters

Chapter 16: Water

1. Global-scale analysis of flood risk under climate change and socio-economic change scenarios, using ISIMIP3b Group II simulations; Gosling et al..
2. Global projections of changes in mean and extreme river discharge derived from routing both CMIP6 and ISIMIP3b runoff (Seubert, …, Gudmundsson et al.)
3. Effects of global land use transformation on hydrological resources and risks.
    - Compare a) no-adaptation and b) adaptation runs to group II runs, for:
        - Mean and seasonal discharge
        - Low flow frequency
        - Flood risk (use either CaMa-Flood or just extreme discharge)
4. Hydropower expansion and hydrological risks under climate change: Synergies or tradeoffs?
    - Compare a) no-adaptation and b) adaptation runs including future dam locations to group II runs

Discussion — Water

Paper ideas — Thematic Assessment Chapters

Chapter 17: Agriculture, food, forestry, fibre and fisheries

1. Food security risks under climate and socioeconomic change
    - Does top-down food-system adaptation reduce local risk of crop failure? Compare a) no-adaptation and b) adaptation runs to group II runs.
    - How could shifting production patterns and technological change (e.g., irrigation and fertilizer) change the risk of severe world market price spikes of main food staples and associated regional consumption losses? (Kuhla et al.) Needs: ISIMIP3b group III crop model runs

Chapter 18: Adaptation of human settlements, infrastructure and industry systems

Paper ideas — Thematic Assessment Chapters

Chapter 19: Health and well-being

Chapter 20: Poverty, livelihoods, mobility and fragility

1. Forecasting cooling poverty: a gridded model of AC penetration and power demand under climate and socioeconomic change (Colelli et al.) Needs: ISIMIP3b group III runs of AC penetration and cooling demand
2. Future projections of human displacement risk due to floods, accounting for changes in land use (Schewe et al.). Does land use adaptation mitigate or exacerbate displacement risk? (SDG tradeoff/synergy analysis…)

Discussion — Agriculture, Health, Wellbeing

Discussion on further paper ideas and critical gaps we should address

https://tinyurl.com/paperIdeasAR7

Let’s collect paper ideas for how we could contribute to AR7

https://tinyurl.com/paperIdeasAR7

Aims & Outline

see collection here:
https://docs.google.com/document/d/1eDL7fntRWUAMd5uCB_-o8u9BlEmjCLJQXCi_IjYX1EI/edit?tab=t.0#heading=h.nk1oj5yh0yqt

have a 15 min slot for people to pin ideas on flip charts according to IPCC chapters