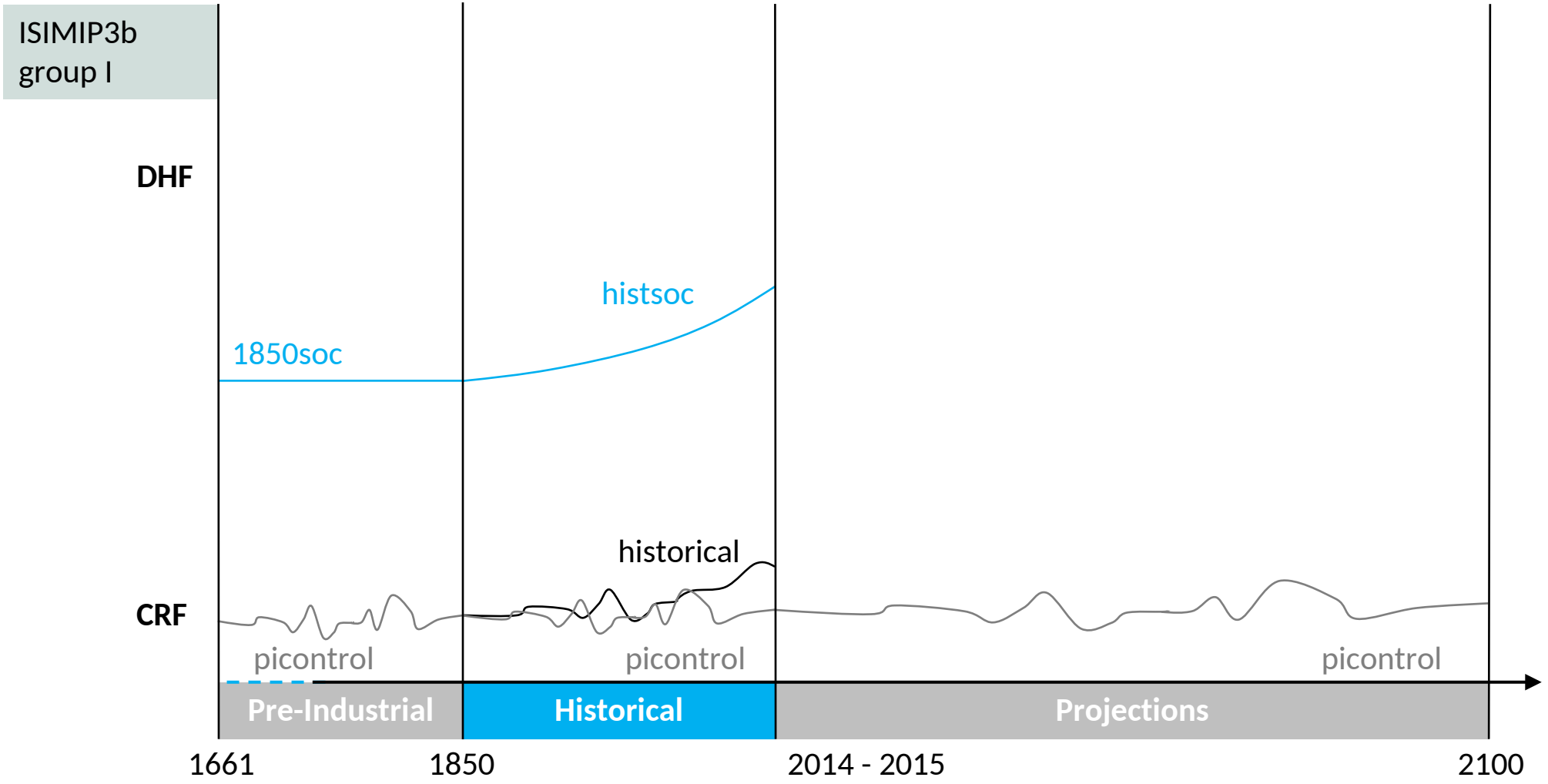
Update on ISIMIP3b future simulations and land use data

Christopher Reyer

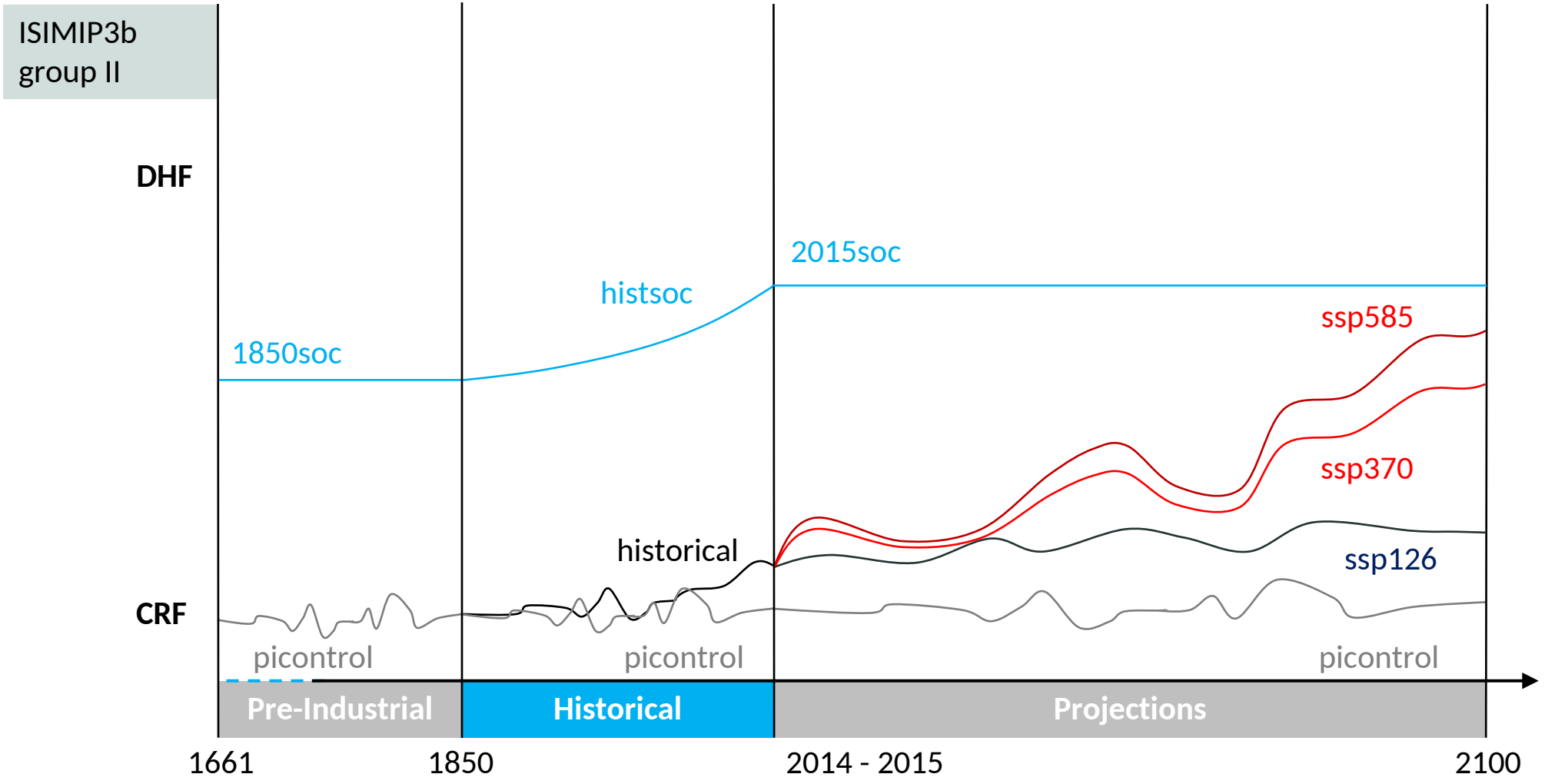
http://proclias.eu/
https://www.isimip.org/
reyer@pik-potsdam.de

Group-i – picontrol and historical GCM-driven runs



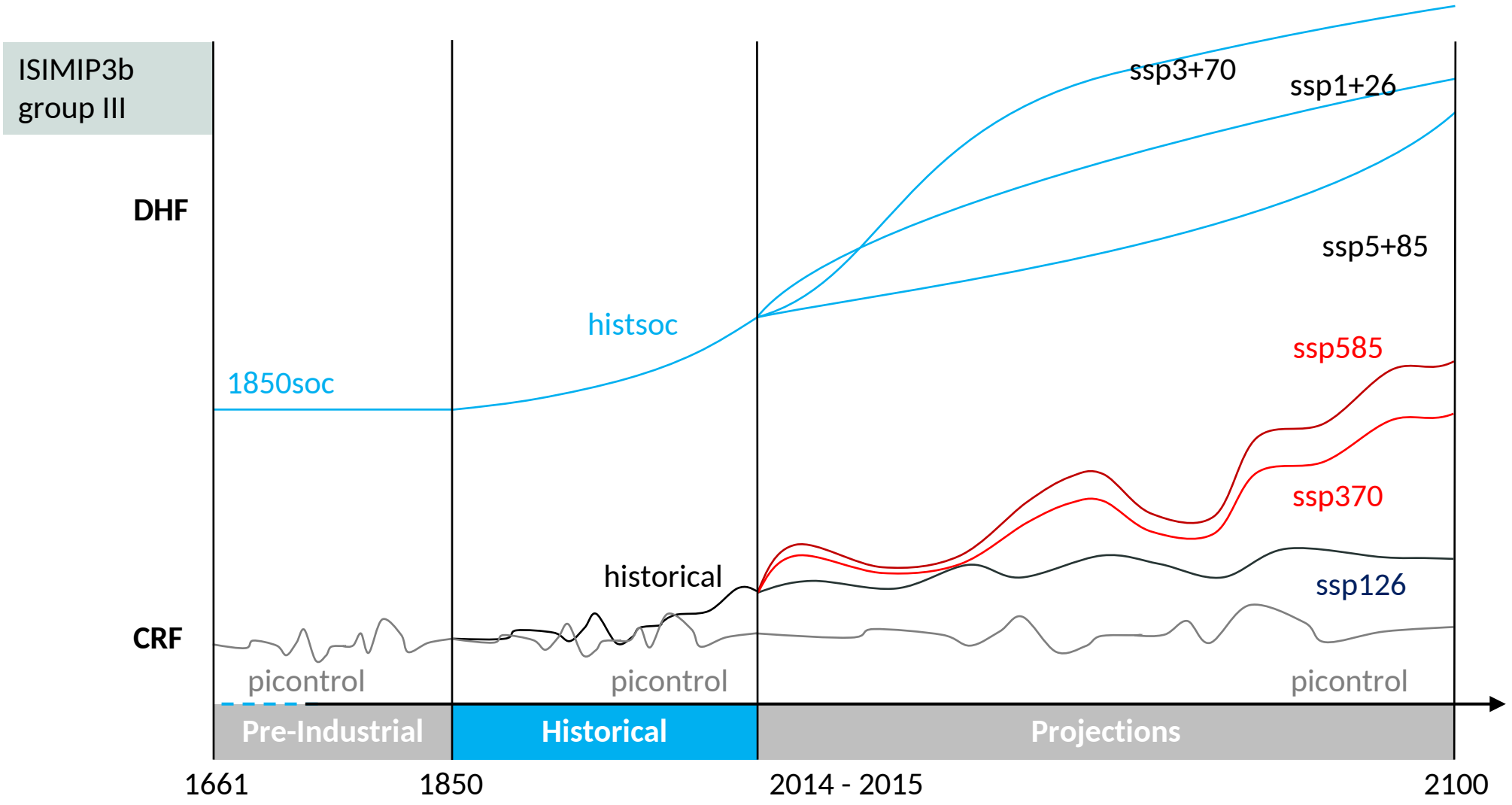
Frieler et al. In prep.

Group-ii – changing future Climate Related Forcing



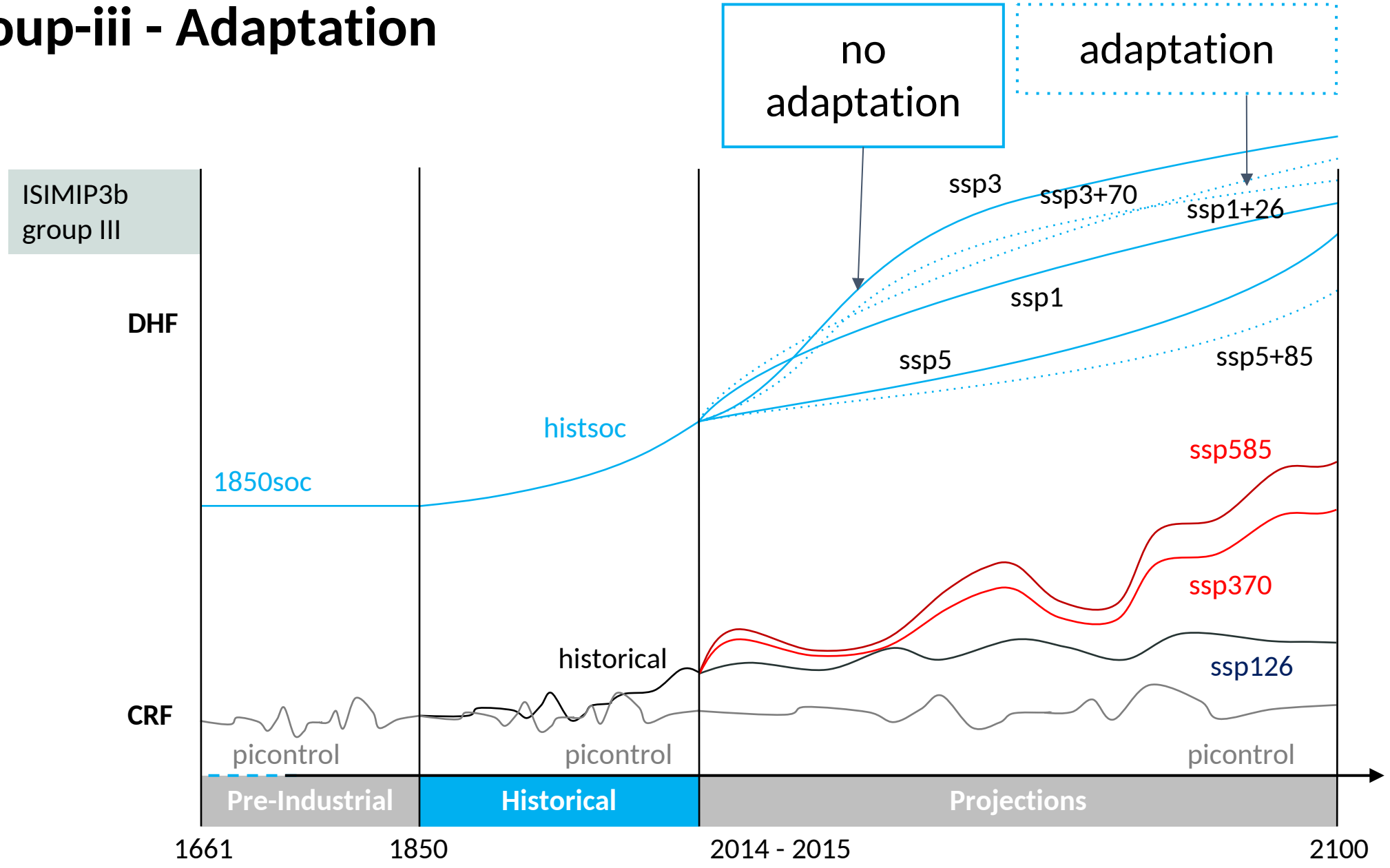
Frieler et al. In prep.

Group-iii – changing future Direct Human Forcing



Frieler et al. In prep.

Group-iii - Adaptation



Frieler et al. In prep.

Online protocol draft

Experiment	Period: Pre-industrial 1601-1849	Period: Historical 1850-2014	Period: Future 2015-2100
Pre-industrial control picontrol_1850soc_default picontrol_histsoc_default picontrol_2015soc-from-histsoc_default	picontrol	picontrol	picontrol
	....		
RCP2.6 2015soc-from-histsoc **1st priority** ISIMIP3b agriculture biodiversity biomes diarrhea fire health coastal labour lakes_global lakes_local marine-fishery_global marine-fishery_regional peat permafrost water_global water_regional	Identical to the similar **picontrol/1850soc** run above.	historical	ssp126
		histsoc	2015soc-from-histsoc
RCP2.6 2015soc **1st priority** ISIMIP3b agriculture biodiversity biomes coastal diarrhea fire health coastal labour lakes_global lakes_local peat permafrost water_global water_regional	Does not have to be simulated, spin-up should be based on the 2015 DHF (see note below the table).	historical	ssp126
		2015soc	2015soc
RCP2.6 1850soc **2nd priority** ISIMIP3b biomes lakes_global lakes_local peat permafrost water_global	Identical to the similar **picontrol/1850soc** run above.	historical	ssp126
		1850soc	1850soc
RCP2.6 nat **2nd priority** ISIMIP3b biomes peat marine-fishery_global marine-fishery_regional	Does not have to be simulated, spin-up should not use any DHF (see note below the table).	historical	ssp126
		nat	nat
RCP2.6 ssp126soc **1st priority** ISIMIP3b agriculture biodiversity biomes diarrhea fire health coastal labour lakes_global lakes_local marine-fishery_global marine-fishery_regional peat permafrost water_global water_regional	Identical to the similar **picontrol/1850soc** run above.	Identical to the similar **historical/histsoc** run above.	ssp126
			ssp126soc-noadapt
RCP2.6 ssp126soc-adapt **1st priority** ISIMIP3b agriculture biodiversity biomes diarrhea fire health coastal labour lakes_global lakes_local marine-fishery_global marine-fishery_regional peat permafrost water_global water_regional	Identical to the similar **picontrol/1850soc** run above.	Identical to the similar **historical/histsoc** run above.	ssp126
			ssp126soc-adapt

Group i and ii

- Picontrol
- SSP126, SSP370, SSP585 (4 GCMs)
- CO2 sensitivity experiment (ssp585)
- Lightening sensitivity experiment (UKESM)

Group iii

- 3 Land Use models (IMAGE, MAgPIE, GLOBIOM)
- adapt, no-adapt
- Core set of simulations to be discussed on Wednesday

DHF relevant for fire sector

	Level of harmonisation	no adaptation (SSP1, SSP3 SSP5)	adaptation (SSP126, SSP370, SSP585)
LU patterns	**mandatory with harmonization**	**yes**	**yes**
irrigation patterns	mandatory with harmonization	yes	yes
fertilizer input rates	mandatory with harmonization	yes	yes
growing seasons	mandatory with harmonization	fixed present day, no SSP dependence	yes
Peattypefrac: Percentage of grid cell covered by the natural, drained, restored or no peat type	Optional	Yes	–
Drainagedepth: Depth of drainage of artificial drainage network.	Optional	Yes	–
Drainagedensity: Density of drainage network as total length of drainage network per km²	Optional	Yes	–
hydropower dam locations	mandatory with harmonization	yes	yes
irrigation techniques shares	mandatory with harmonization	yes (assuming pre-industrial climate?)	yes
non-irrigation water use	mandatory with harmonization	yes	no
sea water desalination	mandatory with harmonization	yes	yes
inter-basin water transfer	mandatory with harmonization	yes	yes
population patterns	**mandatory with harmonization**	**yes**	**no**
GDP	mandatory with harmonization	yes	no
fishing intensities	mandatory with harmonization	?	yes

Group III (LUMs): LU and Management maps 2015-2100

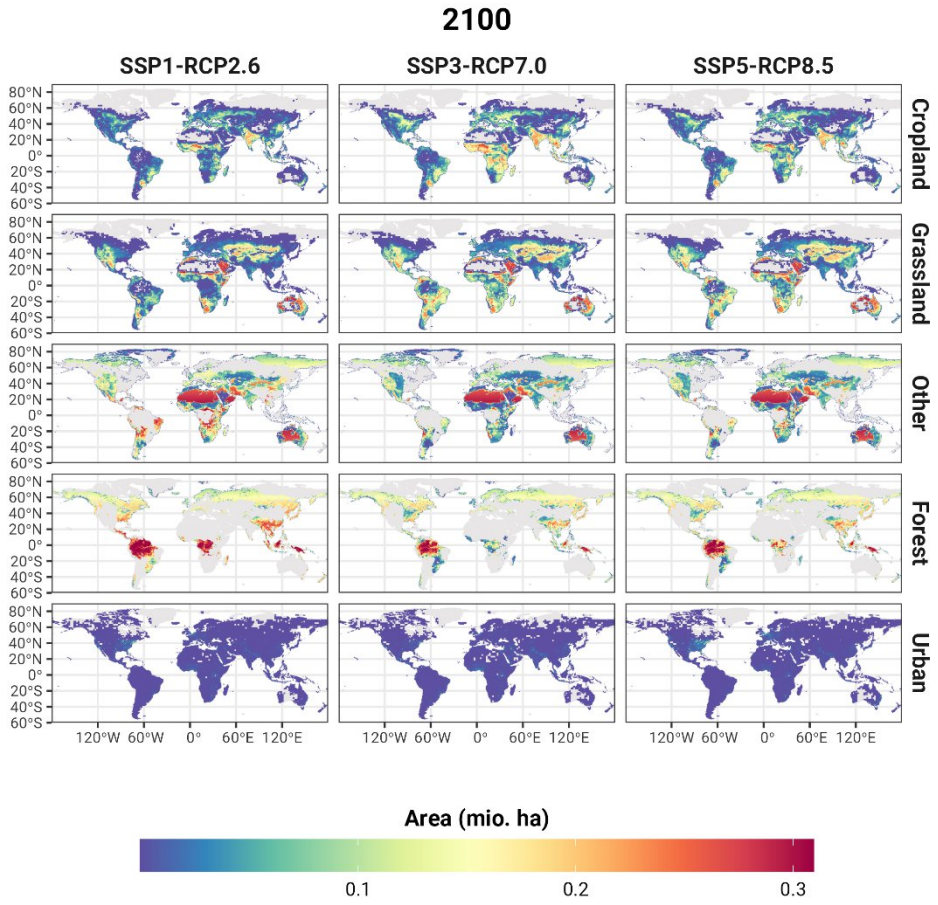
Harmonized (LUH2) land-use and agricultural management projections driven by global change **(0.25° x 0.25° resolution)**

Key outputs

- **LU projections** (Cropland, forest, pastures, urban land, natural vegetation, crop types)
- **Bioenergy crops**
- **Irrigated crop area**
- **Industrial N Fertilizer use**
- **Others**

Scenarios

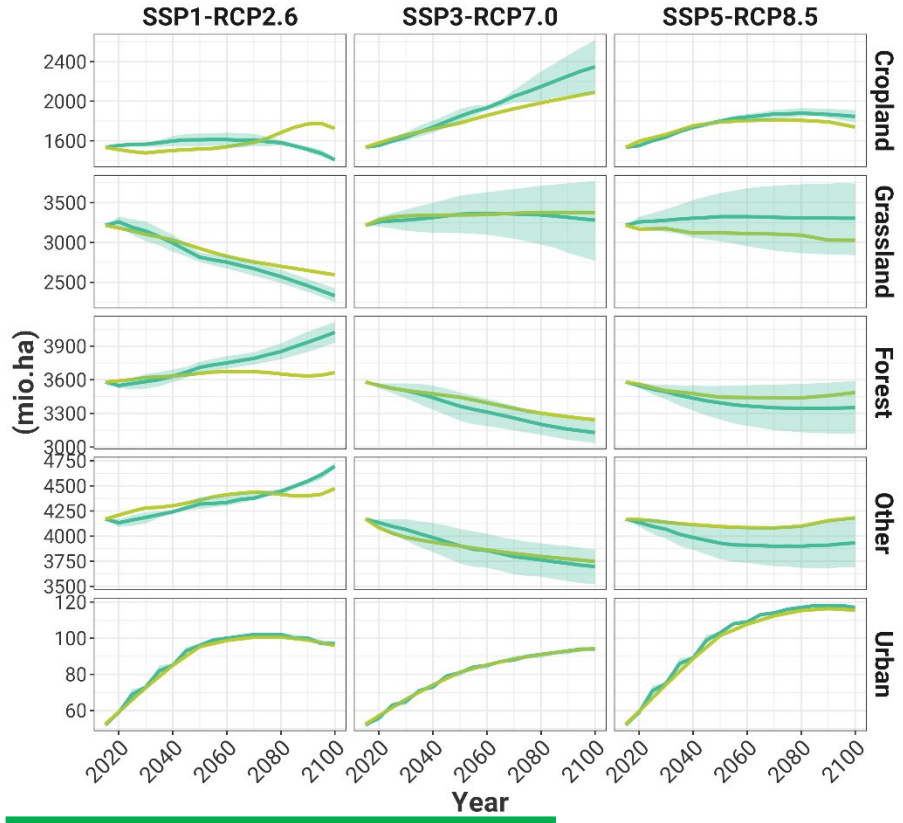
GCM/ESM	CO2 fert.	SSPs-RCPs	GGCMs-IAMs
IPSL-MC6A-LR	+		
MPI-ESM1-2-HR	+	SSP1-RCP2.6	EPIC-GLOBIOM-MESSAGE
UKESM1-0-LL	+	SSP3-RCP7.0	**LPJmL-IMAGE-MAGNET**
MRI-ESM2-0	+	SSP5-RCP8.5	**LPJmL-MAgPIE-REMIND**
GFDL-ESM4	+		
noadapt	Const	SSPx-NoCC	
GFDL-ESM4	-	SSP5-RCP8.5	



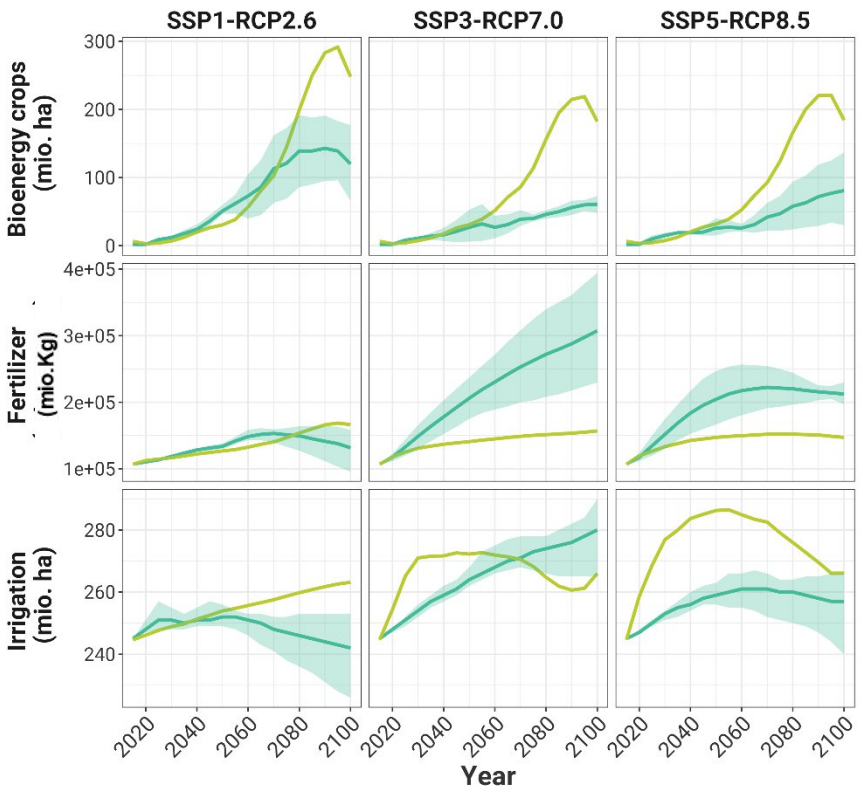
Molina Bacca et al. In prep. Ⓟsee full presentation on Wednesday

Grasslands trends for high emissions differ among the LUMs

Land use



Management



Also large differences in management trends for all scenarios

LUH2- 2017

- **SSP1-RCP2.6** – IMAGE
- **SSP3-RCP7.0** – AIM
- **SSP5-RCP8.5** – MAgPIE

For SSP1-2.6, larger growth of natural vegetation and reduction of grasslands and cropland compared to LUH2-2017

Molina Bacca et al. In prep. Ⓟsee full presentation on Wednesday

Paper Plans

- Many from you…
- Jacob Schewe/ Karim Zantout ⓅRecovery time between extreme impact events under global warming (ⓅBurned Area!)

key lists

Mailing lists:

- https://www.listserv.dfn.de/sympa/info/isimip-data_updates
- https://www.listserv.dfn.de/sympa/info/isimip-followers
- https://www.listserv.dfn.de/sympa/info/isimip-modelers
- https://www.listserv.dfn.de/sympa/info/proclias-all

Adaptation challenge: Other measures to take into account?

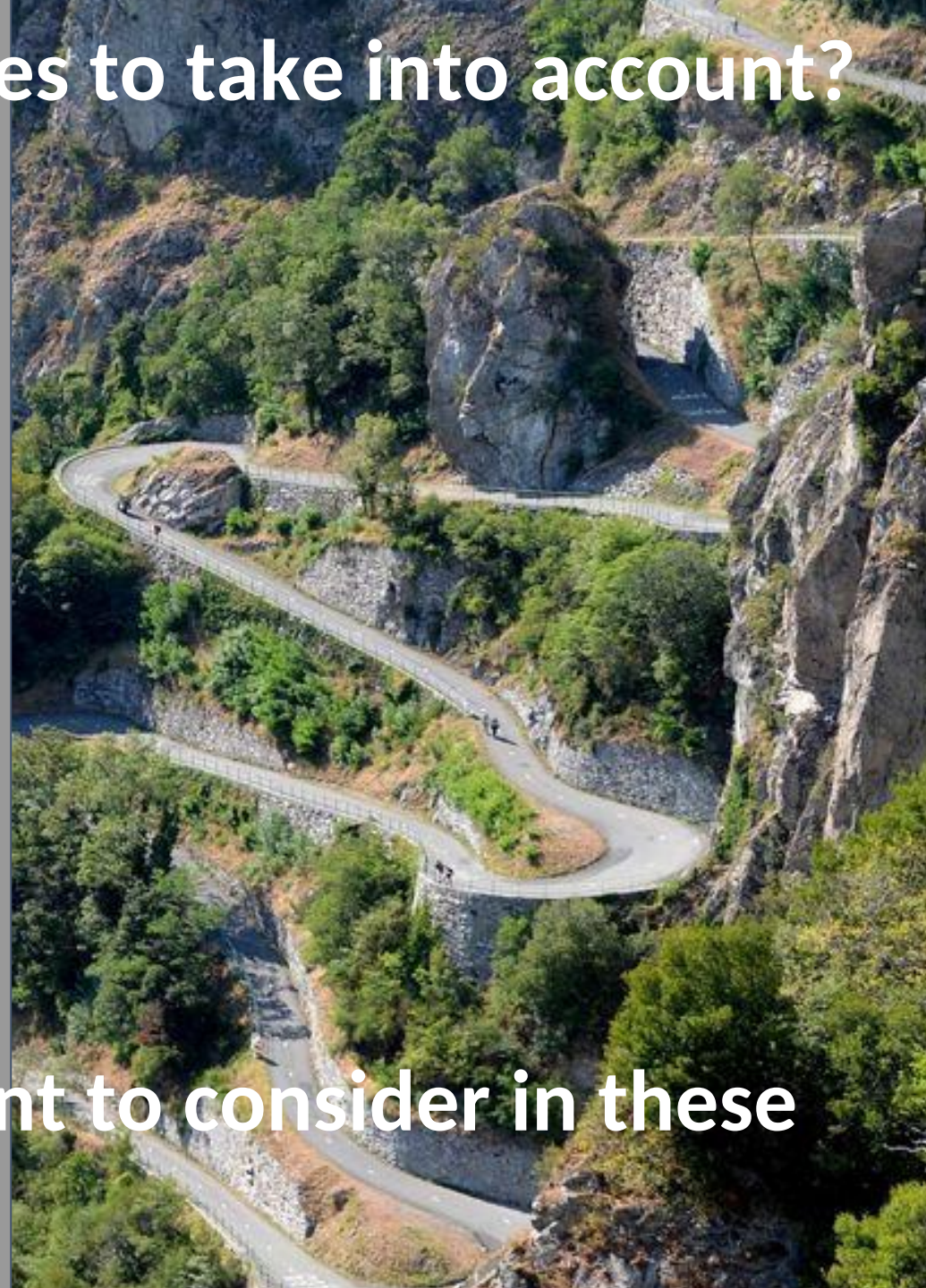
... by additional / more detailed data sets on DHF:

- drainage of wetlands (peat)
- more detailed specification of land use (biodiversity)

... in a more rule-based approach:

- Changes in fire management (fire, biomes)
- changes in agricultural practices (agriculture)
- dam operations (global / regional water)
- flood protection levels (water / coastal systems)
- forest management (biomes / regional forest)

What level of adaptation do we want to consider in these additional measures?



	no adaptation	adaptation	To do
LU patterns	SSP1/ SSP3/ SSP5	SSP126/ SSP370/ SSP585	harmonization of GLOBIOM, IMAGE patterns
irrigation patterns	SSP1/ SSP3/ SSP5	SSP126/ SSP370/ SSP585	harmonization of GLOBIOM, IMAGE patterns, quality check
fertilizer input rates	SSP1/ SSP3/ SSP5	SSP126/ SSP370/ SSP585	bias adjustment of LUM national rates to LUH2 rates, addition of manure
growing seasons	fixed present day	SSP126/ SSP370/ SSP585	ready
hydropower dam locations	SSP1/ SSP3/ SSP5	SSP126/ SSP370/ SSP585	map to 0.5 degree grid, add upstream areas for inclusion into models
irrigation techniques shares	SSP1/SSP3/SSP5	SSP126/ SSP370/ SSP585	can be provided but needs clarification how to apply in models
non-irrigation water use	SSP1/SSP3/SSP5	-	under development (electricity inputs ready)

	no adaptation	adaptation	To do
sea water desalination	SSP1/SSP3/SSP5	SSP126/ SSP370/ SSP585	ready
inter-basin water transfer	existing/under construction	existing/under construction/planned	ready
population patterns	SSP1/ SSP3/ SSP5	-	harmonization of gridded data to national totals
GDP	SSP1/ SSP3/ SSP5	-	harmonization of gridded data to national totals
fishing intensities	SSP1/ SSP3/ SSP5	SSP126/ SSP370/ SSP585	under development (see presentation by Olivier Maury)
heat-related mortality	?	?	under development
labour productivity	?	?	under development