

15 Terrestrial biodiversity

The following protocol describes the contribution of global terrestrial biodiversity models to ISIMIP2b. Biodiversity is influenced by both climate and land-use change, as well as the biome changes resulting from these drivers. All of these drivers will be considered in biodiversity simulations.

Different model types may be used to simulate biodiversity, such as correlative species distribution models, macroecological species richness models, process-based biodiversity models, and others. There are no restrictions regarding the model type, as long as the methodology has been documented in previous peer-reviewed publications.

In its initial stage, this protocol focuses on correlative species distribution models; it will be amended with the needs and requirements of other model types as required.

Species distribution data, in combination with the observed climate dataset “EWEMBI” provided by ISIMIP, are used for the initial model construction (i.e. model calibration). Biodiversity projections are then calculated using the ISIMIP2b bias-corrected GCM data.

The effects of biome and land-use changes on biodiversity are currently assessed in postprocessing by simply overlaying the results from the climate-based species distribution models with layers of future land-use and biome change. In the future, biome and land-use changes may be directly used as predictor variables during model construction.

15.1 Scenarios

Climate scenarios	
picontrol	Pre-industrial climate (year specific for the entire period 1661-2299)
historical	Historical climate.
rcp26	Future climate from RCP2.6
rcp60	Future climate from RCP6.0
Human influences scenarios	
nosoc	No human influences considered.(The different land-use scenarios (see other Sectors) will be included in postprocessing and possibly in a more direct way in future model runs.)

Table 2* ISIMIP2b scenarios for global (and potentially regional) biodiversity simulations.

Experiment		Input	Pre-industrial 1660-1860	Historical 1861-2005 ¹	Future 2006-2099 ²	Extended future 2101-2299 ²
I	pre-industrial climate	Climate	picontrol	picontrol	picontrol	picontrol
	no other human influences	Human & LU	nosoc	nosoc	nosoc	nosoc
II	RCP2.6 climate	Climate	Experiment I	historical	rcp26	rcp26
	no other human influences	Human & LU		nosoc	nosoc	nosoc
III	RCP6.0 climate	Climate	Experiment I	Experiment II	rcp60	not simulated
	no other human influences	Human & LU			nosoc	

*for now, only correlative species distribution models are considered. Additional scenario combinations will be contributed from other model types in due time.

¹for the Terrestrial biodiversity sector, “historical” refers to a 30-year period of current conditions (e.g. 1970-1999)

5 ²within these long-term time periods, biodiversity models will be run for average conditions of selected 30-year periods

15.2 Output data

Table 4 Output variables¹ to be reported by biodiversity sector models.

Variable (long name)	Variable name	Resolution	Unit (NetCDF format)	Comments
Amphibian species probability of occurrence	amphibian_prob	30-year averages of selected time	Probability of occurrence per	Results from individual

Terrestrial mammal species probability of occurrence	mammal_prob	periods ² (0.5°x0.5°)	cell	SDMs
Terrestrial bird species probability of occurrence	bird_prob			
Amphibian species presence	amphibian_pres	30-year averages of selected time periods ² (0.5°x0.5°)	Presence per cell	Results from individual SDMs
Terrestrial mammal species presence	ter_mammal_pres			
Terrestrial bird species presence	ter_bird_pres			
Amphibian species richness	amphibian_sr	30-year averages of selected time periods ² (0.5°x0.5°)	Number of species per cell	Results from Stacked SDMs and Macro-ecological richness models
Terrestrial mammal species richness	ter_mammal_sr			
Terrestrial bird species richness	ter_bird_sr			
Richness of range-restricted (endemic) amphibian species	end_amphibian_sr			
Richness of range-restricted (endemic) terrestrial bird species	end_ter_bird_sr			
Richness of range-restricted (endemic) mammal species	end_ter_mammal_sr			
Richness of threatened amphibian species ¹	thr_amphibian_sr			
Richness of threatened terrestrial bird species ¹	thr_ter_bird_sr			